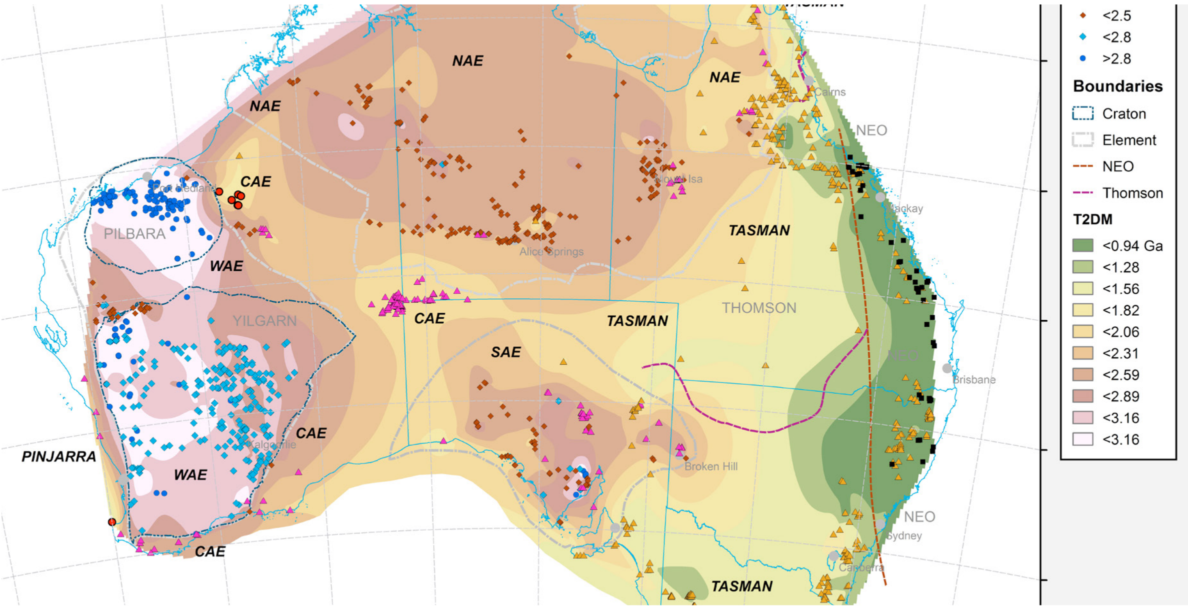
Australian Government
Geoscience Australia



Record 2013/44 | **GeoCat** 77772

Neodymium depleted mantle model age map of Australia

Explanatory notes and user guide

David Champion

Neodymium depleted mantle model age map of Australia

Explanatory notes and user guide

GEOSCIENCE AUSTRALIA
RECORD 2013/44

David Champion

Australian Government
Geoscience Australia

Department of Industry

Minister for Industry: The Hon Ian Macfarlane MP
Parliamentary Secretary: The Hon Bob Baldwin MP
Secretary: Ms Glenys Beauchamp PSM

Geoscience Australia
Chief Executive Officer: Dr Chris Pigram
This paper is published with the permission of the CEO, Geoscience Australia

ISSN 2201-702X (PDF)

ISBN 978-1-922201-79-9 (PDF)

GeoCat 77772

Bibliographic reference: Champion, D.C. 2013. *Neodymium depleted mantle model age map of Australia: explanatory notes and user guide*. Record 2013/44. Geoscience Australia: Canberra. http://dx.doi.org/10.11636/Record.2013.044

Version: 1310

Contents

Executive Summary

As recognised by the Academy of Science's UNCOVER group in their 'Searching the Deep Earth' document, a goal for geoscientific advancement in Australia is a 'holistic understanding of our continent so that we might better predict the location of large-scale mineral systems'. This view included the investigation of Australia's lithospheric architecture to establish a whole-of-lithosphere architectural framework as a priority.

An important component of the Earth's lithosphere is the crust, most of which is clearly inaccessible. Just as the study of basaltic rocks has provided insight into the earth's mantle, granites provide a (not always wholly transparent) window into the middle and lower continental crust. Studies of these rocks are enhanced by isotopic tracers, such as samarium-neodymium (Sm-Nd), which can affectively 'see through' the granite to provide constraints on crustal formation, and enable us to map the Australian crust. This approach and the application of Sm-Nd isotope data were used by Geoscience Australia for the Archean Yilgarn Craton of Western Australia. Studies in that region showed that regional scale Sm-Nd signatures in felsic igneous rocks (tonalite to granite and volcanic equivalents) were not only able to map crustal architecture but that this architecture had unexpected correlations with mineralisation. The successful results in the Yilgarn Craton, coupled with the UNCOVER focus, warranted that this approach be extended to the whole of the continent to test its general applicability for crustal mapping and predicting mineralisation.

A database of Sm-Nd isotopic data, and associated metadata, for >2650 samples of Australian rocks was compiled from published and unpublished sources. This included location, unit, geochronology and bibliographic data and metadata for all data points; this dataset is available for download at www.ga.gov.au. Data were compiled for a range of lithologies, including felsic and mafic igneous rocks, sedimentary rocks, as well as some mineral data. Just over 1630 of these data points were from felsic igneous rocks which had reliable locational details and a reasonable estimated or known magmatic age. A comparison of the magmatic ages from these samples with compilations of Australian igneous rock ages showed a generally good agreement confirming the representative nature of the compiled Nd data set.

Isotopic data were standardised and used to calculate epsilon Nd (ε_{Nd}) and two-stage depleted mantle model ages (T_{2DM}). Values of the latter from just over 1490 of the data points (samples from S-type magmatism were excluded) were used to generate (in ArcMap®) a gridded T_{2DM} map of Australia. Subsets of the data were also used to generate T_{2DM} maps of northern, western, southern and eastern Australia, basically covering the six crustal elements (West Australian, North Australian, Central Australian, South Australian, Pinjarra and Tasman elements; see Blewett et al., 2012) and their constituent crustal blocks (e.g., cratons, orogens, geological terranes, geological provinces and subprovinces). These maps, plus ε_{Nd}-time and T_{2DM}-time plots were used, along with known geological and geophysical data and interpretations, to analyse the isotopic signatures of the crustal elements and their major crustal blocks, and place constraints on their possible nature and crustal evolution.

Calculated model ages (T_{2DM}) for Australian felsic magmatism range from ~4.0 Ga in the Yilgarn and Pilbara cratons of the West Australian Element, to ca. 0.3 Ga in the New England Orogen of the Tasman Element in eastern Australia. Importantly, and despite the possible complexities of the Nd signal in granites, there is a generally well correlated distribution of model ages with the known geology of Australia and these crustal elements (with significant changes in model ages across, or close to, element boundaries). Overall there is a broad eastward trend in decreasing model ages across the Australian continent, punctuated by the Central Australian Element with younger model ages separating the North, South and West Australian elements. The majority of Australian model ages are Proterozoic in age, in agreement with the known geology. Archean model ages are best expressed in the Archean Pilbara and Yilgarn cratons of the West Australian Element, but also occur in both the North and South Australian elements. Youngest model ages are restricted to the Tasman Element, chiefly within the New England Orogen.

Within all elements there is obvious internal isotopic zonation. Of most importance are regions characterised by either major and/or sharp changes over narrow zones or more diffuse general gradients. Many of these breaks and gradients correspond to known crustal boundaries or changes in geology, suggesting that Sm-Nd whole rock signatures can be used to identify crustal changes. Such breaks are often best delineated using widespread broadly contemporaneous magmatism, e.g., late granites in the Pilbara Craton, Kennedy Igneous Association magmatism in north Queensland. Transects of Sm-Nd isotopic signatures across crustal elements provide useful information, good examples being both north-south and east-west changes across the North Australian Element which appear to match well with inferred geological boundaries and interpreted geodynamic processes. The strongly increasing juvenile isotopic signature in the southern half of the Northern Territory, for example, is suggestive of an accretionary margin, similar to that observed in the Tasman Orogen.

A major part of this study was to document and discuss the general applicability (or otherwise) of the Sm-Nd isotopic system for such studies. As outlined above, there are many cases where (for a variety of reasons) the isotopic data are mapping crustal changes or responses to geodynamic environments. There are areas, however, where this does not appear to be the case. These include regions where the signature is noisy (often areas of either wide age ranges or lower data density), or regions where apparent crustal changes are not mirrored in the Sm-Nd data (such as in Tasmania). The greatest difficulty with interpretation arises from the involvement of sedimentary components, particularly where the sedimentary component may not be locally derived. For this reason Sm-Nd data from S-type granites were not used in the present work. In regions with widespread thick metasedimentary sequences, such as in the Tasman Element, or where S-type granites are present, Sm-Nd data should be interpreted with caution. This illustrates the potential importance and value of using other isotope systems (e.g., oxygen isotopes) in conjunction with Sm-Nd data. It is evident even in the Tasman Element, however, that changes in Nd (and hafnium (Hf)) isotopic signatures are present, can be mapped at a regional scale, and have geological and geodynamic implications.

Despite these potential difficulties, demonstrable empirical relationships between the regional isotopic pictures (as depicted on gridded T_{2DM} maps) and a number of mineralisation styles, e.g., komatiite-hosted nickel sulphides, Archean VHMS, iron-oxide copper gold deposits and intrusion-related copper-gold deposits exist. These relationships, although not completely understood, appear to be related to aspects of the crustal architecture, geodynamic environment, and/or ground preparation. In at least one case (Archean VHMS deposits) there is a very good relationship between mineral fertility and isotopic signature that can be used as a predictive tool for metallogenic analysis. The same is probably true for intrusion-related copper-gold deposits.

The Sm-Nd data were also used to calculate a crustal growth curve for Australia, updating the earlier crustal growth curve of McCulloch (1987). The new curve shows a more even growth-rate for the continent, suggesting 20% of the Australian continent had formed 3 billion years ago, 40% by 2.5

billion, 60% by 2 billion and ~75% by 1.5 billion years ago. Both growth curves show a peak around 2.6–2.3 Ga which corresponds to ~21% of the Australia crustal growth (compared with the background rate of ~10% per 300 Ma period). Consideration of secular changes in Australian granite geochemistry, and data from other isotopic studies, suggest that the calculated growth curve should be adjusted, particularly to account for high degrees of crustal reworking in the late Archean to Mesoproterozoic. This has the effect of increasing growth rates in the Archean, and indicates that ~40–70% of the Australian crust was in place by the end of the Archean, and ~70–85% by the end of the Mesoproterozoic. These results lend credence to the overall general picture of the Australian crust based on Sm-Nd data and, in combination with geological data, allow broad basement ages to be inferred for regions of Australia and the construction of a basement age map of Australia. Although clearly speculative, this preliminary map provides a working hypothesis that is directly amenable to comparison (and testing) with geological, geophysical and other data sets. This map and the T_{2DM} maps not only highlight areas with interesting isotopic zonation, e.g., in the Tanami region of the North Australian Element, but also areas (not all undercover) with little or no data, e.g., Lachlan Orogen in Victoria, which would benefit from additional data.

1. Introduction

As recognised by the Academy of Science's 2010 Theo Murphy High Fliers Think Tank on 'Searching the Deep Earth: The Future of Australian Resource Discovery and Utilisation' and the subsequent 'Searching the Deep Earth' document (released by the UNCOVER group), an important goal for geoscientific advancement in Australia is a 'holistic understanding of our continent so that we might better predict the location of large-scale mineral systems'. This view identified the need for continuing and further investigation of Australia's lithospheric architecture, i.e., an increased understanding of the deep crust and upper mantle, to establish a whole-of-lithosphere architectural framework as a priority. It also specifically identified the collection and use of radiogenic isotope data as one approach to increasing our understanding of the evolution of the crust.

Such an approach was successfully used by Geoscience Australia and partner organisations for the Archean Yilgarn Craton of Western Australia. That work showed (e.g., Champion and Cassidy, 2007, 2008) that regional scale samarium-neodymium (Sm-Nd) isotopic signatures in felsic igneous rocks (tonalite to granite and volcanic equivalents) were not only able to map crustal architecture but that this architecture had unexpected correlations with mineralisation (Cassidy et al., 2005; Huston et al., 2005, 2013). The successful results in the Yilgarn Craton, coupled with the 'Searching the Deep Earth' focus, warranted that this approach be extended to the whole of the continent to test its general applicability for crustal mapping and predicting mineralisation on a national scale. This Record, therefore, contains the results of a project to develop a preliminary neodymium (Nd) model age map of Australia. The aims of the project were to:

- Capture, as much as possible, published and Geoscience Australia unpublished Sm-Nd isotopic data in Australia, concentrating on felsic igneous units, and related rocks. This included capturing (where possible), for each sample, analytical results for International Standards, to allow normalisation of data, prior to calculation of epsilon Nd (ε_{Nd}), one- and two-stage depleted mantle model ages (T_{DM} and T_{2DM}), and residence ages (T_{Res}) from the isotopic data.
- Capture, as much as possible, associated metadata for analysed units. This included unit details (e.g., lithology, unit name), location (estimated where no precise location available), geochronology (age, error, age source), and geological province details (including geological element, e.g., Shaw et al., 1995), as well as all reference details.
- Produce database-ready spread sheets of primary and secondary isotopic, location, unit, geochronology and reference data and metadata for all data points, freely available for all to use; this data set is available for download at www.ga.gov.au.
- Produce gridded images (maps) for Australia and regional parts of Australia, illustrating gridded Nd model ages, based on the compiled data set for felsic igneous rocks. Gridded images are available for download at www.ga.gov.au.
- Use these maps, in conjunction with isotopic and other geological data, to test the validity of using such maps to aid recognition and/or definition of crustal blocks at the continental and regional scale.
- Produce a new crustal growth curve for Australia based on the new continent-wide data set, and investigate implications for crustal growth of Australia to help constrain timing of crustal growth

in Australia. Use the latter results, with other geoscientific data sets to produce a preliminary basement age map of Australia.

- Explore the use of such maps for metallogenic analysis, particularly potential relationships between delineated crustal blocks and metallogeny.

This Record documents the compiled Sm-Nd isotopic database, and resultant isotopic maps of Australia compiled from that data. It discusses the implications of these data and maps for the recognition and/or definition of crustal blocks in Australia, as well as implications for crustal growth of the Australian continent and implications for metallogeny. This Record also provides a general review of Sm-Nd isotope systematics, including comments on the applicability (strengths and weaknesses) of using whole-rock Sm-Nd data from felsic magmatic rocks for the purposes outlined herein.

2. Isotopic tracers and Samarium-Neodymium

2.1. Introduction

One fundamental use of isotopic parent-daughter systems in geology is their use as tracers to provide information on components and processes in the formation of a rock. These have long been used in geological studies to provide constraints on geological processes and source components for a wide variety of geological processes (e.g., magmatism, mineral deposits). Individual isotope systems (e.g., U-Pb, Sm-Nd, Rb-Sr), provide different constraints that are largely a function of the physio-chemical behaviour of the parent-daughter isotopes in question, their half-life, and the geological environment.

One important parent-daughter isotopic tracer commonly used in the studies of granites, and related rocks, is samarium-neodymium (Sm-Nd), where the mass 147 samarium isotope (^{147}Sm) breaks down to the radiogenic mass 144 neodymium isotope (^{144}Nd) with a very long half-life of ~106 billion years. Sm and Nd are members of the rare earth series of elements (REE) and as such generally exhibit very similar chemical properties. This means they generally behave similarly, and predictably, in many geological processes. This is especially the case for processes responsible for, and occurring during, the formation of felsic igneous rocks such as granites. As documented by DePaolo (1988), this similar behaviour means that the Sm-Nd system (hereafter Sm-Nd), can be used to effectively 'see' through many crustal processes and provide information on the nature of the source of the rocks in question (see section 2.3). For voluminous rocks such as granites, which often have a significant crustal component, this provides a potentially powerful proxy in constraining the nature and potential 'age' of the crustal block the granites occur within, i.e., in effect broadly mapping crustal growth as demonstrated by Bennett and DePaolo (1987). This approach is even more powerful when combined with granite geochemistry and geochronology (including that for inherited components).

This methodology has been used successfully in parts of Australia, most particularly the Yilgarn Craton in Western Australia (Fletcher et al., 1994; Champion and Sheraton, 1997; Champion and Cassidy, 2008). For the Yilgarn Craton, the Nd isotopic data not only delineated crustal domains, but also highlighted unexpected relationships between these domains and mineralisation (e.g., Cassidy et al., 2005; Huston et al., 2005, 2013). The significant implications of the Yilgarn data for mapping crustal domains and potential metallogenic domains prompted expansion of this approach to a continental scale.

2.2. Sm-Nd isotopes: a review

Samarium (Sm) has a number of isotopes, including the isotope ^{147}Sm, which radioactively decays to the radiogenic ^{143}Nd isotope, emitting an alpha particle:

$$^{147}\text{Sm} \rightarrow {}^{143}\text{Nd} + \alpha$$

The half-life (the time taken for half of a given mass of ^{147}Sm to decay to ^{144}Nd) of this decay is 106 billion years. Like many isotopic systems analytical results are reported relative to a stable (non-radiogenic) isotope, which for Sm-Nd is ^{144}Nd, i.e., ^{147}Sm/^{144}Nd, ^{143}Nd/^{144}Nd. The evolution of these ratios through time (in a closed system) is as follows:

$$({}^{143}Nd/{}^{144}Nd)_{(T)} = ({}^{143}Nd/{}^{144}Nd)_{(0)} - ({}^{147}Sm/{}^{144}Nd)_{(0)} * e^{\lambda t} - 1$$

where λ = the decay constant (6.54×10^{-12}), (0) = ratios as measured at time 0 (typically present day) and (T) = the value at Time T (in million years) in the past (T is typically magmatic age; Figure 2.1).

The long half-life of ^{147}Sm means deviations in $^{143}Nd/^{144}Nd$ are small, typical in the 4th and 5th decimal places (Figure 2.1). Accordingly, $^{143}Nd/^{144}Nd$ values are commonly reported as epsilon (ε) units (DePaolo and Wasserburg, 1976; Figure 2.1, Figure 2.2), which are deviations in part per ten thousand from a chondritic earth reference model (CHUR = Chondritic Uniform Reservoir), as follows:

$$\varepsilon_{Nd} = 10000 * [({}^{143}Nd/{}^{144}Nd)_{Sample(T)} - ({}^{143}Nd/{}^{144}Nd)_{CHUR(T)}] / ({}^{143}Nd/{}^{144}Nd)_{CHUR(T)}$$

Sm-Nd data are typically displayed using ε_{Nd}-time plots (Figure 2.2).

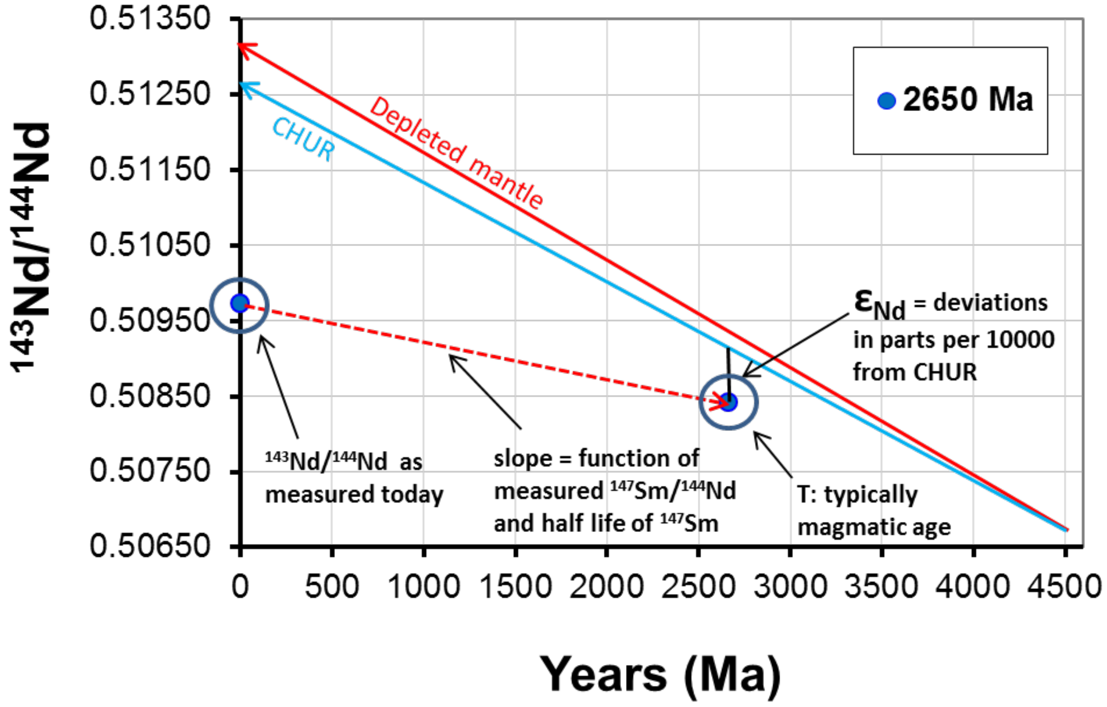


Figure 2.1 Evolution of $^{143}Nd/^{144}Nd$ through time. The change in $^{143}Nd/^{144}Nd$ back through time is a function of the $^{147}Sm/^{144}Nd$ ratio. Variations of $^{143}Nd/^{144}Nd$ are small and so are typically reported as ε_{Nd} values (deviations from CHUR = blue line) using the formula given in the text. Depleted mantle (DM) and Chondritic mantle (CHUR) evolution curves are shown as red and blue lines, respectively.

2.3. Sm-Nd behaviour

Samarium and Nd are both members of the lanthanides—also known as the rare earth elements (REE)—a series of elements with very similar properties. As such they exhibit similar geochemical behaviour for most geological processes, and there is consequently only minor fractionation between the two elements, i.e., Sm/Nd ratios do not greatly vary in common crustal rocks (Table 2.1). The REE can be further subdivided into light and heavy REE (LREE, HREE, respectively), on the basis of atomic weight, with both Sm and Nd belonging to the LREE. This subdivision is based on another characteristic of the REEs, namely lanthanide contraction, whereby successively heavier lanthanides (higher atomic number) have increasingly smaller atomic radii. This means that lighter REE, such as Nd, behave (albeit only slightly) more incompatibly than heavier REE, such as Sm. As a result, common igneous processes, such as partial melting and fractional crystallisation, almost always result in not just higher LREE concentrations but also lower Sm/Nd ratios in the more siliceous end-members (see modelling in DePaolo, 1988). A clear result of the effect of lanthanide contraction on incompatibility can be seen in the zonation of the earth's composition (Table 2.1). The earth's crust is not only more enriched in the lighter REE such as Nd and Sm, but also has correspondingly lower Sm/Nd ratios than the complementary depleted mantle reservoir. As pointed out by many workers (e.g., DePaolo and Wasserburg, 1976; Bennett and DePaolo, 1987; see discussion in DePaolo, 1988), the differing Sm/Nd ratios of mantle and crustal reservoirs (Table 2.1) result in markedly different time integrated behaviour through time (readily evident on ε_{Nd}–time plots; Figure 2.3).

Table 2.1 Average Nd and Sm concentrations and Sm/Nd ratios of mantle and crustal reservoirs. Sources: crust – Rudnick and Gao (2004); mantle (except depleted mantle) – Sun and McDonough (1989); Depleted mantle – Salters and Stracke (2004). Nd and Sm are in parts per million.

	Nd	Sm	Sm/Nd
upper crust	27	4.7	0.17
middle crust	25	4.6	0.18
lower crust	11	2.8	0.26
bulk crust	20	3.9	0.20
OIB	38.5	10.0	0.26
E-MORB	9.0	2.6	0.29
N-MORB	7.3	2.63	0.36
depleted mantle	0.71	0.27	0.38
primitive Mantle	1.354	0.444	0.33
Chondrite	0.467	0.153	0.33

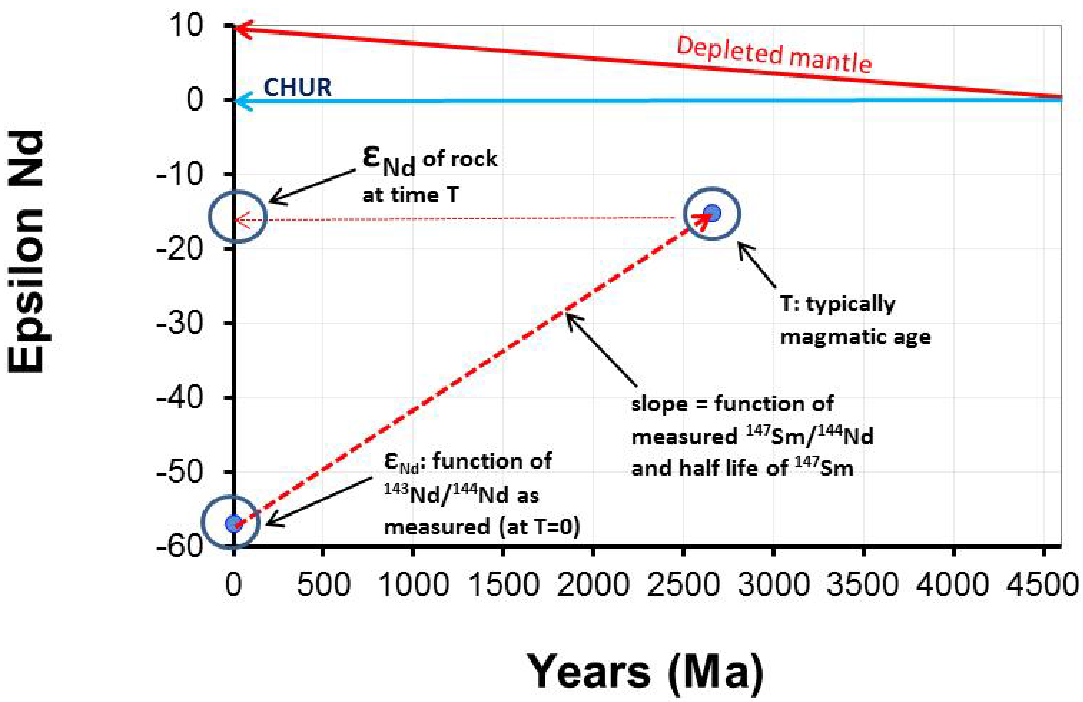


Figure 2.2 ε_{Nd} versus time. The ε_{Nd} value of a rock at time (T), typically the crystallisation age for a magmatic rock, requires present-day (T = 0) $^{143}Nd/^{144}Nd$ and $^{147}Sm/^{144}Nd$ values for the rock in question, a measure or estimate of T, and present day values of $^{147}Sm/^{144}Nd$ and $^{143}Nd/^{144}Nd$ for CHUR – here 0.1967 and 0.51265, respectively. CHUR values will vary between laboratories but calculated ε_{Nd} values should be similar. The line connecting ε_{Nd} at time T and time = 0, tracks the ε_{Nd} evolution of the sample through time, and is useful in comparing samples of different ages.

2.4. Model Ages

Isotopic systems have long been used to calculate model ages, i.e., the age when the isotope characteristics of the rock in question matched those of some modelled reservoir. The well understood behaviour of Sm and Nd, in combination with the observation for distinctly different time integrated behaviour of Nd isotopic signatures between mantle and crustal reservoirs (Figure 2.3), led to the early recognition of the usefulness of Sm-Nd data for providing model age estimates for the age of continental crust in a region (e.g., McCulloch and Wasserburg, 1978; DePaolo, 1981; Farmer and DePaolo, 1983, 1984; Liew and McCulloch, 1985; Bennett and DePaolo, 1987; McCulloch, 1987; Figure 2.4). Calculated Nd model ages effectively provide a simplistic estimate of the time a sample (= proxy for the crust in a region) has been separated from its (modelled) mantle source, typically depleted mantle. This approach is most useful for magmatic rocks, especially felsic magmatic rocks, but has been used for all rock types (McCulloch and Wasserburg, 1978). Such model age calculations contain a number of assumptions:

- mantle source characteristics are known and correct, i.e., the modelled mantle is correct;
- the growth of the crust represents one event;
- magmatic components are understood. For model ages calculated from granites this typically reduces to assuming a uniform infracrustal protolith (an assumption that may not be valid) and
- the behaviour of Sm/Nd in crustal growth processes and subsequent reworking are understood and approximate the Sm/Nd ratios used in the model.

Although early model ages were calculated assuming a chondritic mantle (T_{CHUR}), most are now calculated assuming depleted mantle (T_{DM}; DePaolo, 1981), with supra-chondritic Sm/Nd ratios (see discussion in Liew and McCulloch, 1985). A variety of models are used for depleted mantle. These include the DePaolo (1981) model which assumes an increasingly depleted mantle (calculated by $\varepsilon_{Nd}(T) = 0.25.T2 – 3T + 8.5$); and the linear depletion model (the one used here) which assumes linear depletion from $\varepsilon_{Nd} = 0$ at ~4.56 Ga to +10 today (Figure 2.4). McCulloch (1987), in his study of Australia, also assumed a linear model but assumed depletion commenced at 2.75 Ga. The linear depletion model gives slightly older model ages than the others. Model ages can also be calculated assuming single stage or multi-stage (typically two-stage) models. Single stage models (Figure 2.4) assume that the dominant fractionation (i.e., change) of Sm/Nd occurred as a result of the mantle extraction event, i.e., crustal processes have not significantly modified this ratio. Although mostly not realistic (as shown by the changes in average Sm/Nd in crustal reservoirs; Table 2.1), it is evident that they can provide useful results (e.g., Bennett and DePaolo, 1987). One consideration with single stage models is that model ages are increasingly unreliable with increasing Sm/Nd ratios (as sample evolution curves become more sub-parallel with mantle evolution curves) and such model ages should not be calculated for $^{147}Sm/^{144}Nd$ ratios over 1.4–1.5. Most felsic igneous rocks have $^{147}Sm/^{144}Nd$ ratios between 0.09 and 0.12 (e.g., Sun et al., 1995).

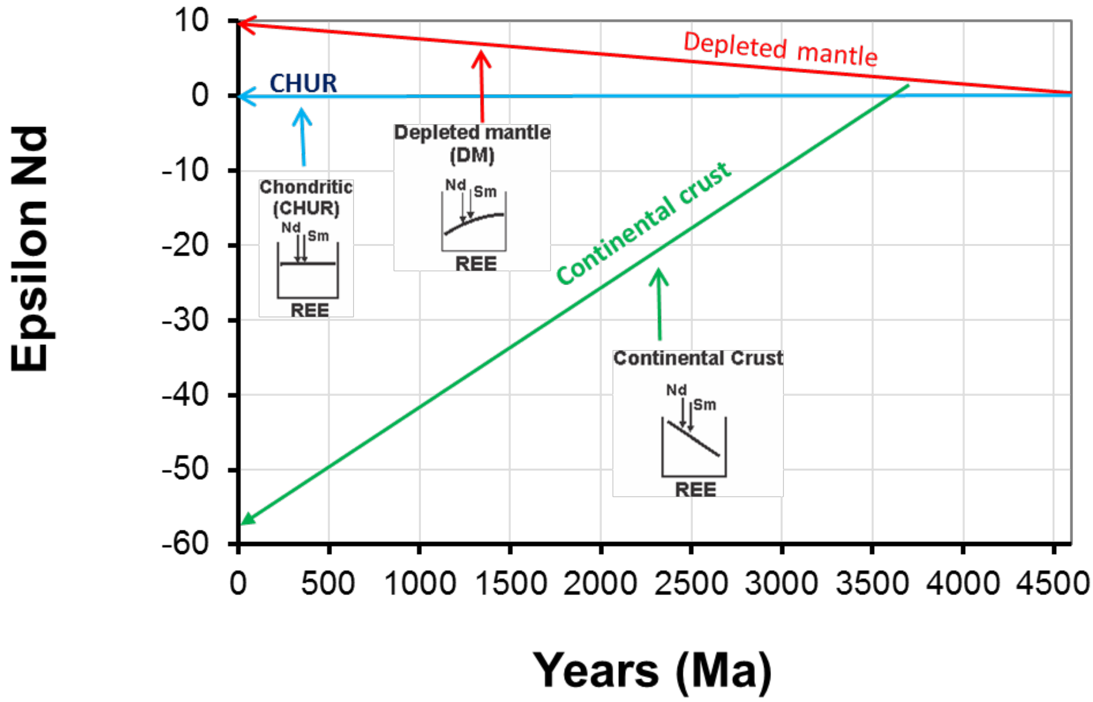


Figure 2.3 Time integrated behaviour of ε_{Nd} in continental crustal reservoirs versus the complementary depleted mantle reservoir. Small REE plots illustrate the change in Sm/Nd ratio (normalised to Chondrite) between the reservoirs.

Two-stage model ages (T_{2DM}) are increasingly being used for felsic igneous rocks in particular (e.g., Liew and McCulloch, 1985) to correct for changes in Sm/Nd ratios, produced by processes such as partial melting, fractional crystallisation, magma mixing, alteration, etc. Such models are typically calculated using the measured $^{147}Sm/^{144}Nd$ ratio back to the magmatic age of the rock and an assumed (not the measured) $^{147}Sm/^{144}Nd$ ratio for calculating the sample evolution curve prior to the crystallisation age (see Figure 2.4). In this work an assumed $^{147}Sm/^{144}Nd$ ratio of 0.11 has been used, equivalent to the average upper continental crust value using Sm and Nd values from Rudnick and Gao (2003). Liew and McCulloch (1985), for example, used a value of 0.12. Two stage depleted mantle model ages may be younger or older than single stage ages, depending on the measured and assumed $^{147}Sm/^{144}Nd$ ratios used. Empirical evidence suggests two stage model ages give more consistent model ages on a regional basis (Champion and Cassidy, 2008). They also allow model ages to be calculated for samples with high measured $^{147}Sm/^{144}Nd$ ratios. Notably, the methodology for two stage Nd depleted mantle model ages as outlined here is essentially identical to the approach used for calculating hafnium (Hf) model ages from Hf in zircon analysis, where Lu/Hf ratios of the parent magma have to be assumed (e.g., Kemp et al., 2009).

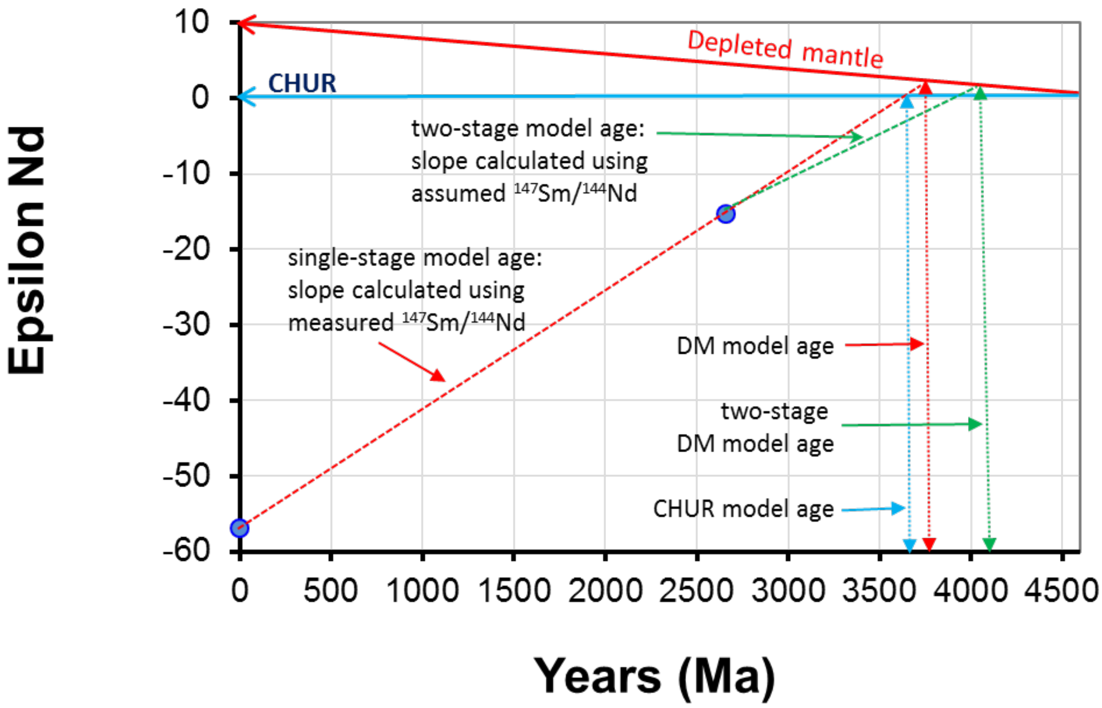


Figure 2.4 Nd model ages. Single stage Nd model ages (T_{CHUR}, T_{DM}) assume no fractionation of Sm/Nd (=measured ratio). The intersection of the sample evolution curve with the mantle evolution curve (CHUR or depleted mantle (DM)), defines the model age. Two-stage model ages (T_{2DM}) assume a change in Sm/Nd at some point in the crustal history of the protolith. For felsic magmatic rocks this is typically the magmatic age. Prior to this (i.e., for ages older than the magmatic age) a model $^{147}Sm/^{144}Nd$ ratio is used, typically that of average continental crust. As for calculating ε_{Nd}, values of $^{147}Sm/^{144}Nd$ and $^{143}Nd/^{144}Nd$ have to be assigned for the DM and CHUR reservoirs. DM values used here are 0.2136 and 0.513163.

2.5. What do model ages actually represent?

As outlined earlier, there are a number of assumptions involved with model ages and their interpretation. Taking model ages at face value implies that the crustal protolith for the sample in question was largely homogeneous (one source component) and essentially formed in a single event. Neither of these will be universally (and probably only rarely) true, and even when these criteria are met the model age is still only an approximation, given the uncertainty over the isotopic signature of the mantle source. There is abundant evidence that crustal protoliths can be complex (as readily evidenced by the geological record in many regions), as well as much literature on the demonstrated role of crustal, juvenile and assimilated components in felsic magmatism. With regards to complex crustal protoliths, the calculated model ages are best thought of as average ages. The situation can be clarified to some extent by the use of complementary data, such as magmatic ages, inherited zircon ages, other isotopic systems especially in-situ analysis of magmatic and xenocrystic minerals (e.g., Lu-Hf and oxygen isotope analysis of zircons), as well as use of geological ages from regional geology (e.g., Bennett and DePaolo, 1987; Liew and McCulloch, 1985). The variability in model ages in regions where multiple samples exist can also be used to help constrain and interpret regional model age data (e.g., Champion and Cassidy, 2008).

With regards to possible multiple components involved in the formation of a felsic magmatic rock the interpretation of the model age will depend on the nature of the individual components, as outlined in Table 2.2. This latter table shows that model ages for much felsic magmatism is still useful though again are, at best, thought of as average crustal ages and, for most, as minimum ages for the pre-existing crustal component (due to addition of juvenile material). Difficulty with interpretation arises from the involvement of sedimentary components – one reason data from S-type granites has not been used in the present work. It also means Nd data should be interpreted with caution in regions with widespread metasedimentary rocks, such as in the Tasman Element, or where S-type granites are present. Most information regarding Nd model ages will come from looking at regional or secular changes, i.e., relative changes are more important than absolute values.

Table 2.2 Interpretations of model ages for felsic magmatism based on possible source components. End-members and potential mixes of such end-members are shown in Figure 2.5.

	Components	Model age interpretation
Crust (solely crustal-derived)	I-type (some A-types)	average age of source protolith
	S-type	Average age of the provenance of the metasedimentary protolith. Provides constraints on the provenance so can still be useful.
Mantle (solely mantle-derived)	fractionated	Isotopic signature of mantle (mantle wedge, asthenosphere, lithosphere).
Crust-mantle mixtures	I-type (1 or more) crustal source and mantle	Model age is effectively a minimum age for the crustal component (a mix between juvenile crust and pre-existing older crust). Because of the commonly (much) higher Sm and Nd in the crustal component the model age is weighted towards the crustal component.
	S-type crustal source and mantle	Model age is effectively a minimum age for the average age of the provenance of the metasediment component. As for I-type-mantle mixes, the model age is weighted to the crustal component.
	I-type source, S-type source (including assimilated sediments) and mantle	Difficult to interpret model ages (without additional information).
Mantle-'crust'	Mantle with 'crustal' signature, i.e., evidence for a possible crustal component	Model age is effectively a minimum age for the average age of the crustal or metasedimentary component, though again weighted towards the crustal component. Difficulties can arise if the 'crustal' signature derives from the mantle (e.g., metasomatised mantle, enriched mantle), or is related to sediment input.

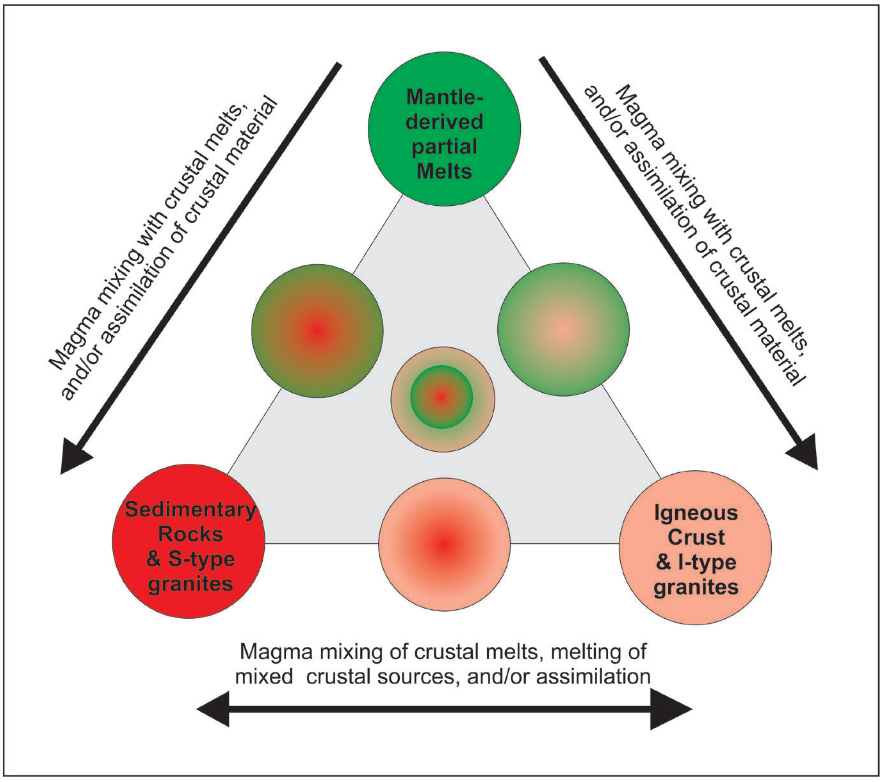


Figure 2.5 Possible components within felsic magmatism that contribute to the isotopic signature. The three dominant end-members involved include igneous and sedimentary crustal components (I- and S-type felsic igneous melts and/or assimilated material) and mantle-derived melt material. Note that each end-member may in itself be heterogeneous. Isotopic data used within this record is concentrated on material from the bottom right corner (i.e., granites derived from igneous crust), though in reality will include units with sedimentary and mantle components.

2.6. Secular and geographic changes in isotopic signatures

One important way to help decipher what the (geological and) isotopic data for magmatic rocks may be showing is by looking at both secular and geographic changes of isotopic signatures, i.e., changes in signatures/model ages through time and space (the reason the Australia-wide compilation was produced). This approach recognises that absolute model ages are much less important (or significant) than geographical and/or secular changes in such ages. This is particularly informative in regions with multiple episodes of magmatism, e.g., the Pilbara (van Kranendonk et al., 2007) and the Tasman Orogen of eastern Australia (Kemp et al., 2007; Champion et al., 2010). Although there are a variety of secular changes, there are three general end-members that warrant further comment. These can be defined on the behaviour of model ages, and ε_{Nd}), through time and/or space (see Table 2.3). Many regions show a mixture of all these trends through their history. Perhaps the most distinctive and most straight forward to interpret is the case for constant model ages (Type 1 in Table 2.3). Many early workers documented such patterns, e.g., Bennett and DePaolo (1987) and interpreted them to demonstrate crustal reworking, with minimal involvement of juvenile material. One of the better Australian examples is for the East Pilbara, where ca. 2.93–2.85 Ga (and older) felsic magmatism is reworking older (ca. 3.6–3.5 Ga Pilbara crust). These rocks show generally similar T_{2DM} but increasingly negative ε_{Nd} (Figure 2.6), both consistent with reworking. This is also evident geographically where older model ages are largely confined to the East Pilbara (Figure 2.7).

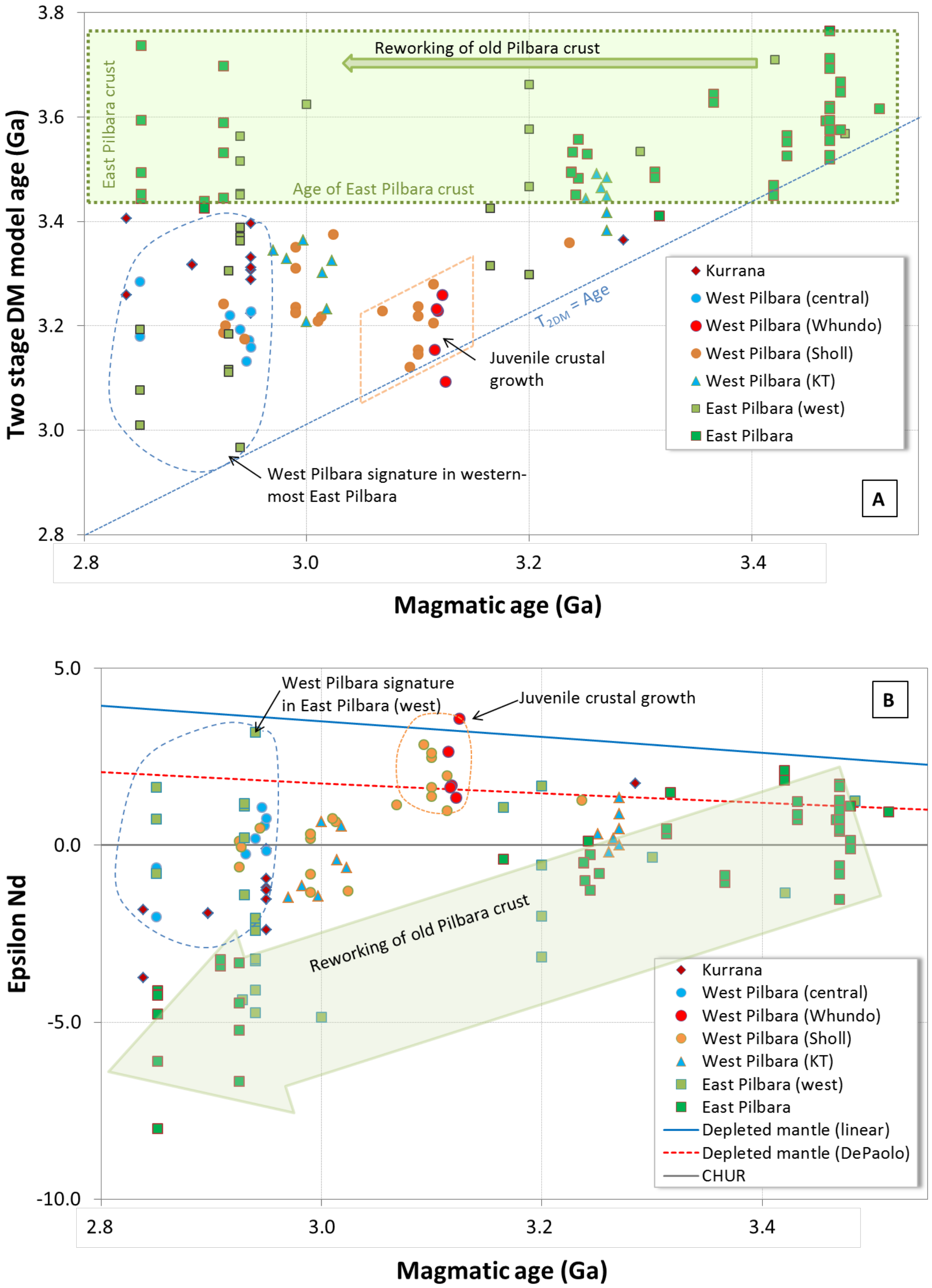


Figure 2.6 Two stage depleted mantle model ages (A) and ε_{Nd} (B) versus magmatic ages for the Pilbara Craton, Western Australia. The East Pilbara Terrane (EP) largely shows decreasing ε_{Nd} and approximately constant T_{2DM} with decreasing magmatic age (Type 1 behaviour; Table 2.3), consistent with reworking of old crust with minimal juvenile involvement. The exceptions to this are 2.95–2.85 Ga magmatism in the western part of the EP which include a more significant juvenile component (younger T_{2DM}, more positive ε_{Nd}), probably related to growth of the West Pilbara Superterrane (e.g., Champion and Smithies, 2000).

Table 2.3 Variations in T_{2DM} and ε_{Nd} with time and space and possible interpretations. Type 4 is for isotopic variation of contemporaneous rocks within a more localised region. Large local variations in ε_{Nd} and T_{2DM} are the best indicators for multiple age sources and/or components.

Type	Variations with decreasing age	Interpretation	Examples
1	T_{2DM} approximately constant (especially maximum values) ε_{Nd} increasing	Largely reworking of pre-existing crust. Any juvenile input is cryptic.	East Pilbara
2	T_{2DM} decreasing ε_{Nd} ~constant	Involvement of both pre-existing crust and juvenile material (either reworking of young crust and/or direct mantle input).	Pine Creek-Tennant Creek-Tanami-Aileron
3	T_{2DM} decreasing (markedly) ε_{Nd} decreasing	Significant juvenile input (often related to orogenic accretionary margins). Pre-existing older crust thinned or largely absent.	Tasman, especially transition to New England Orogen
4	Range of T_{2DM} and ε_{Nd} for rocks of similar age in one region	Contribution from multiple sources and/or components. May indicate crust of multiple ages and/or indirect (rapid reworking of new crust) or direct juvenile input (mixing).	Present in most orogens

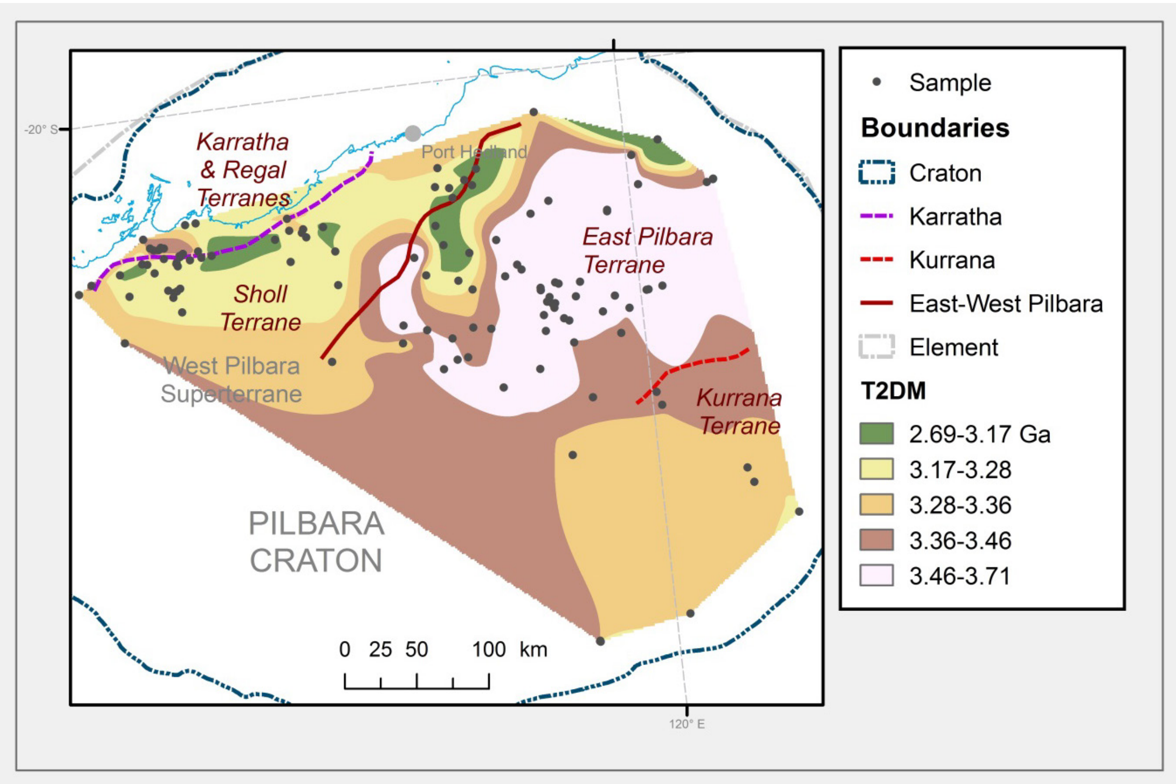


Figure 2.7 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for the Pilbara Craton, Western Australia. Isotopic data used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap® (see main text). Also shown are the boundary between the Karratha and Regal terranes and the Sholl Terrane (all three comprise the West Pilbara Superterrane), the boundary between the West Pilbara Superterrane and East Pilbara Terrane, and the boundary between the East Pilbara Terrane and the Kurrana Terrane (nomenclature follows van Kranendonk et al., 2007). Grid colours in areas with no samples, are purely based on interpolation and may have no relationship with underlying deeper crust.

Figure 2.7 also illustrates another use of geographic interpretation of isotopic data. The figure clearly shows an obvious broad zonation in model ages across the craton with a significant jump in model ages across a zone that approximates the boundary between the East Pilbara Terrane (EPT) and the West Pilbara Superterrane (WPS). Consideration of T_{2DM} and ε_{Nd} data across this zone shows both markedly decrease from east to west (Figure 2.6). The simplest, though not the only, interpretation is that the basement to the WPS is geologically younger than that which underlies most of the EPT, and Van Kranendonk et al. (2007) interpreted the EPT as a cratonic nucleus upon which components of the WPS were added or grew. It is notable that there is not a one-to-one relationship between the isotopic break and the EPT-WPS boundary. Younger model ages in the EPT are confined to younger magmatism (ca. 2.95–2.85 Ga) in the western part of the EPT (Figure 2.6), which were attributed by Champion and Smithies (2000) to WPS geological events affecting that part of the EPT. There is additional support for this in the belt of unusual high-Mg dioritic magmatism that runs along and outboard of the western margin of the EPT (e.g., Smithies and Champion, 2000). Figure 2.6 also highlights the primitive isotopic signature of the rocks in the western part of the Sholl Terrane of the WPS, which Smithies et al. (2005) have interpreted as a juvenile arc. It should be noted that there are other possible interpretations for the change in isotopic signature across the East Pilbara Terrane/West Pilbara Superterrane boundary. For example, the change may simply reflect much greater juvenile input in the West Pilbara Superterrane at or prior to ca. 2.95–2.85 Ga. In this scenario this is no requirement for a change in basement across this margin, but rather a significant change in the proportion of juvenile versus East Pilbara-style crust. This is a consistent difficulty when interpreting regional changes in Nd model ages. It shows that, like much geological data, there are a variety of ways to interpret Nd model ages, and other supporting geological evidence should always be included where possible. For the Pilbara example, the consistent lack of older model ages in the west, and the geological evidence for continental margin-style magmatism (e.g., Smithies et al., 2005) support the terrane boundary theory.

3. T_{2DM} Maps of Australia

3.1. Introduction

3.1.1. Nd isotopic data

Samarium-neodymium isotopic data were compiled from both published and unpublished datasets. Published data (including that in State and Territory Survey publications) was collected based on prior knowledge and searches of bibliographic databases, though data searches were not exhaustive. Unpublished data was sourced from that undertaken by Geoscience Australia (alone or in collaboration with State and Territory Surveys) and from data collected by the Northern Territory Geological Survey. All effort was made to ascertain whether these data had been previously published and if so attributed accordingly. The database may, however, contain data shown as unpublished that has actually been published. Descriptions of the data collected and accompanying metadata are given in Appendix A.

The Sm-Nd isotope database compiled for Australia contains just over 2650 samples—including those for mafic rocks and sedimentary rocks, as well as some mineral data (data in Appendix B). Of these, just under 1690 meet the requirements of suitable rock type—felsic intrusive and extrusive igneous rocks—and are from units for which a reasonable estimated or known age has been determined. A comparison of the magmatic ages from these samples with Australian igneous rocks (Figure 3.1) shows a generally good agreement confirming the representative nature of the compiled Nd data set. The majority of the felsic igneous rock samples (~1631) have known or reasonably well estimated locations. Just over 1490 (S-type magmatism was excluded) samples were used to generate the gridded images used in this Record. These located samples were imported into ArcMap™ and gridded for two-stage depleted mantle model ages (T_{2DM}) (as well as for residence ages (T_{2DM} minus magmatic age; T_{Res})). Gridding performed in ArcMap™ was undertaken using Natural Neighbour Interpolation with intervals based on Natural Breaks (Jenks), i.e., intervals were determined by the software (the reason for the non-linear intervals in the resultant images, e.g., Figure 3.2). One final point is that the gridding/contouring process somewhat simplifies the isotopic signatures of regions. This has the added benefit (and disadvantage) that the dominant signature for each region is portrayed, with outliers and anomalies largely ignored, except where data density is low. Subtle changes through time or within tectonic cycles, as, for example, documented by Kemp et al. (2009) in the Tasman Element, will not be obvious within the gridded data. For this reason, ε_{Nd}-time and T_{2DM}-time plots are also used to fully explore the variations of isotopic signatures and complexities within each crustal block.

3.1.2. Crustal Elements, geological provinces and geological regions

Any discussion of gridded Nd isotopic maps, and isotopic and geological data in general, needs to take into account the range of different crustal blocks that comprise the Australian continent. At the broadest scale the continent can be subdivided into a small number of crustal elements (or building blocks). We follow the nomenclature of Blewett et al. (2012; see Appendix D) and Huston et al. (2012), which synthesise much previous work, particularly Shaw et al. (1995), Myers et al. (1996) and Glen

(2005). These workers invoke six crustal elements, namely the West, North and South Australian elements (WAE, NAE and SAE, respectively; cratons of Myers et al.(1996), i.e., WAC, NAC and SAC), the Central Australian Element (CAE, essentially Paterson, Albany-Fraser and Musgraves regions; the central Australia and Albany-Fraser Orogens of Myers et al., 1996), the Tasman Element (also called the Tasman Orogen, e.g., Cawood, 2005), and the Pinjarra Element (Orogen of Myers et al., 1996). The locations and distribution of elements are shown on Figure 3.2 (and subsequent figures). Geological descriptions of these elements and the provinces within them, and various tectonic reconstructions regarding these elements, are described in Myers et al. (1996), Glen (2005), Cawood (2005), Cawood and Korsch (2008) and Huston et al. (2012), and references therein. Each element contains a variety of geological subdivisions (cratons; geological provinces, terranes, superterranes and domains; geological regions), based on a range of geological, geophysical and geographic criteria. These are described below in discussions of each element. Further discussions are provided in Appendix D, along with a detailed listing of the sub-divisions used for each element in Appendix Table D.1. Although each geological element is discussed below it is not an exhaustive coverage. Emphasis for each element is largely based on one or two geological or isotopic features that provide constraints on the interpretation of the entire Sm-Nd data set.

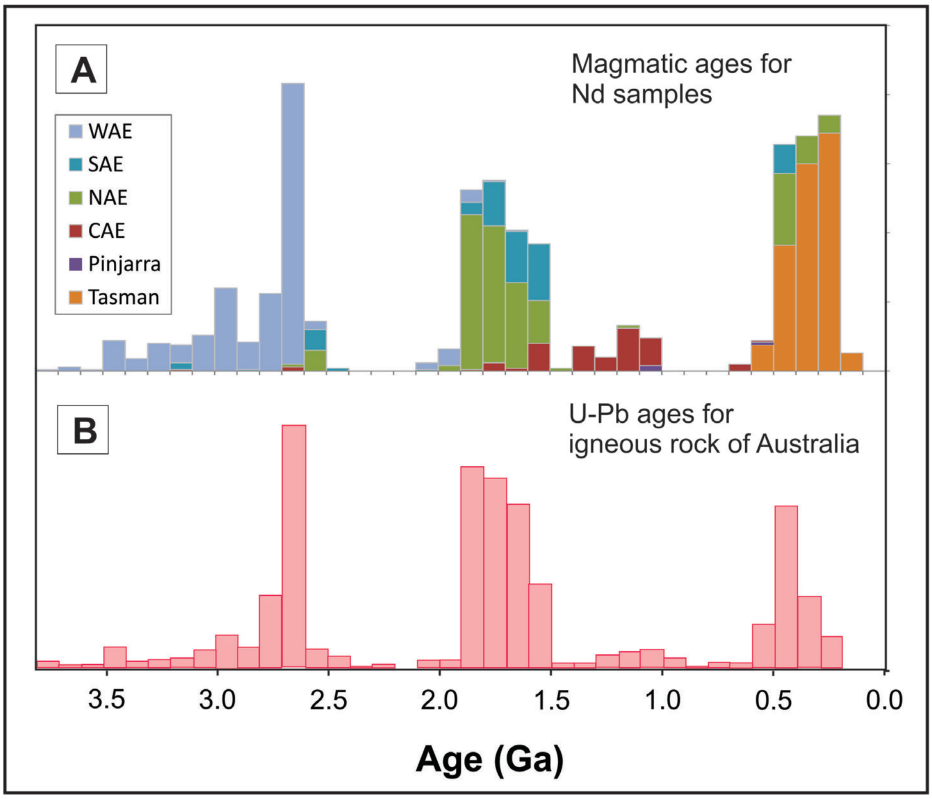


Figure 3.1 A. Histogram of magmatic ages of felsic igneous rock samples with Nd isotopic data (from 1615 samples compiled in this report (see Appendix B). Colour coding refers to the geological element the sample is from. WAE, SAE, NAE and CAE = West, South, North, and Central Australia Elements, respectively. B. Histogram of magmatic U-Pb ages of Australian igneous rocks based on probability distribution plot of U-Pb ages of igneous rocks in Australia (from K. Sircombe, written Communication, 2011), the peaks of which correspond reasonably well with those of the samples analysed for Nd (in A).

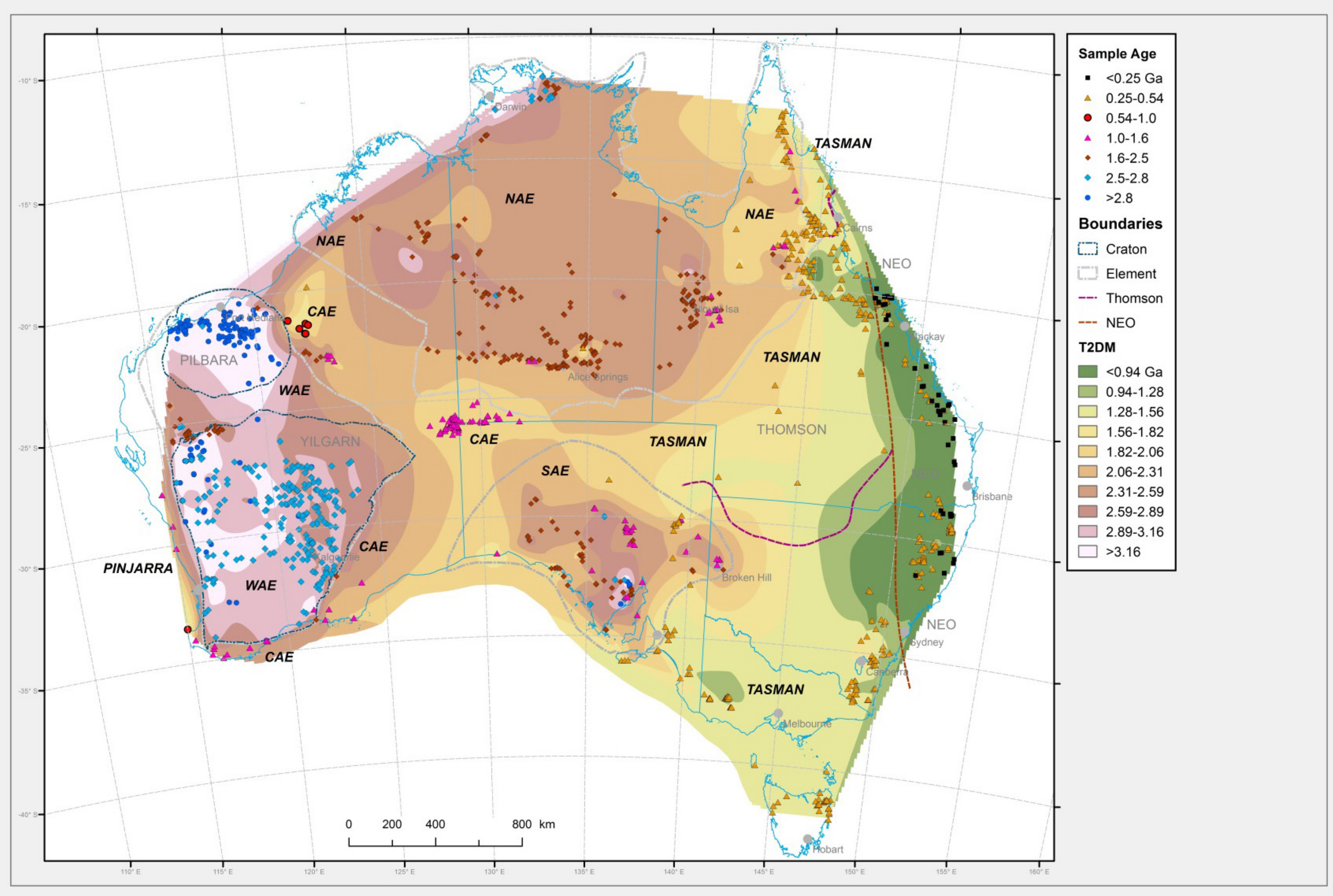


Figure 3.2 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for Australia. Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap®; see main text. Also shown are North, West, South and Central Australian elements (NAE, WAE, SAE and CAE), the Pinjarra, and Tasman elements, the Archean Pilbara and Yilgarn cratons (both WAE) and Phanerozoic Thomson and New England (NEO) orogens (both in the Tasman Element). Grid constructed from 1493 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. The boundary between the CAE and Tasman elements is uncertain and not shown.

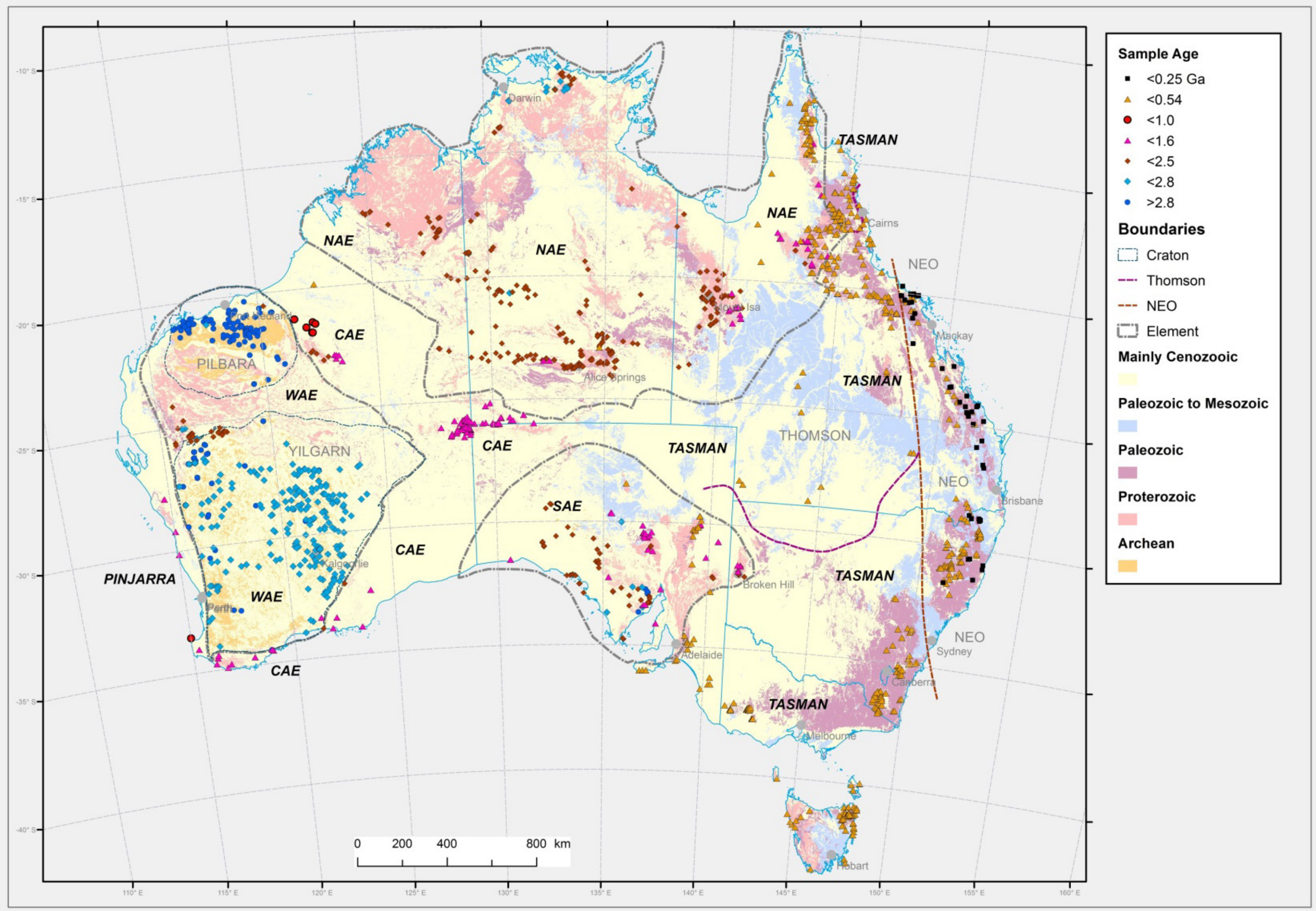


Figure 3.3 Surface geology map for Australia, coloured by age. Isotopic data (colour coded by magmatic age) are also shown (Data from Geoscience Australia's Surface Geology of Australia 1:1 million scale dataset 2012 edition (Raymond et al., 2012)). Also shown are the North, West, South and Central Australian elements (NAE, WAE, SAE and CAE), the Pinjarra, and Tasman elements, the Archean Pilbara and Yilgarn cratons (both WAE) and Phanerozoic Thomson and New England (NEO) orogens (both in the Tasman Element). The boundary between the CAE and Tasman Element is uncertain and is not shown.

3.2. General picture

Given the large age range in felsic igneous material in Australia—from Paleoarchean to Cenozoic (Figure 3.1)—there is a corresponding large range in isotopic signature. Model ages (depleted mantle two-stage model ages (T_{2DM}) unless stated otherwise) range from 3.0 Ga and over (up to ~4.0 Ga) in the Yilgarn and Pilbara Cratons of the West Australian Element (WAE), to ca. 0.3 Ga in the New England Orogen of the Tasman Element in eastern Australia (Figure 3.2). Importantly, and despite the possible complexities of Nd signatures in granites (e.g., Champion and Cassidy, 2008; Chapter 2), there is a generally well correlated distribution of model ages with the known geology of Australia (Figure 3.3) and, importantly, with the six geological elements. This is readily evident in Figure 3.2 with significant changes in model ages across (or close to) element boundaries. This is best observed by the change to younger model ages crossing from the WAE and the North Australian Element (NAE) into the Central Australia Element (CAE).

There is a broad eastward trend in decreasing model ages across the Australian continent (Figure 3.4), punctuated by the CAE with younger model ages separating the NAE and South Australia Element (SAE) from each other and from the West Australia Element (WAE). The majority of model ages are Proterozoic in age, again in agreement with the known geology. Archean model ages are largely confined to known Archean rocks in the Pilbara and Yilgarn cratons of the WAE, but also occur in the NAE and SAE (Figure 3.4), largely but not exclusively confined to regions of known or assumed Archean geology (e.g., Pine Creek (Hollis et al., 2009c), Tanami (Page et al., 1995), Mount Isa (McDonald et al., 1997) and the Gawler (Swain et al., 2005; Fraser et al., 2010)). The youngest model ages are restricted to the Tasman Element, chiefly within the New England Orogen (e.g., Kemp et al., 2009). The latter highlights a major point regarding Figure 3.2, i.e., that all elements (with the exception of the Pinjarra for which there are little available data) contain obvious internal isotopic zonation. This is explored in detail in the following section.

3.3. Crustal Elements

3.3.1. Introduction

Crustal elements (Figure 3.2, Figure 3.3) are discussed in order of generally decreasing age, i.e., from west to east. The western two-thirds of Australia is dominated by the West, North and South Australian elements (WAE, NAE and SAE) which contain Paleoproterozoic and Mesoproterozoic terranes, with Archean remnants of various sizes (e.g., Myers et al., 1996; Cawood and Korsch, 2008; Huston et al., 2012). These are separated from each other by the three-pronged Meso- and Neoproterozoic rocks comprising the Musgrave, Paterson and Albany-Fraser orogens—together comprising the Central Australian Element (CAE; Figure 3.2; Figure 3.3). These elements are bordered in the east by the extensive, largely Phanerozoic, Tasman Element (e.g., Cawood, 2005; Glen, 2005), and in the west by the small, largely undercover and poorly known, Proterozoic to Paleozoic Pinjarra Element (Myers et al., 1996; Wilde and Nelson, 2001).

One of the chief concerns regarding the crustal development of Australia (and particularly of the three older elements, the WAE, SAE and NAE), concerns the nature and timing of crustal growth. To begin to fully understand this requires more robust constraints on not just the age of the crust (e.g., the relative extents of Archean versus Proterozoic basement in the WAE, SAE and NAE) but also constraints on its possible crustal evolution. For example, although Archean fragments are present within the WAE, NAE and SAE, there has been considerable debate over the actual extent of Archean versus Proterozoic basement, as well as the related question regarding the nature of crustal growth in these elements and the relative roles of vertical versus horizontal tectonics (Etheridge et al., 1987; McCulloch, 1987; Wyborn et al., 1987; Myers et al., 1996; Giles et al., 2002; Betts et al., 2002; Cawood and Tyler, 2004; Betts et al., 2009; Johnson et al., 2011; Huston et al. 2012; see general summaries in Fraser et al., 2007; Cawood and Korsch, 2008; Korsch et al., 2011).

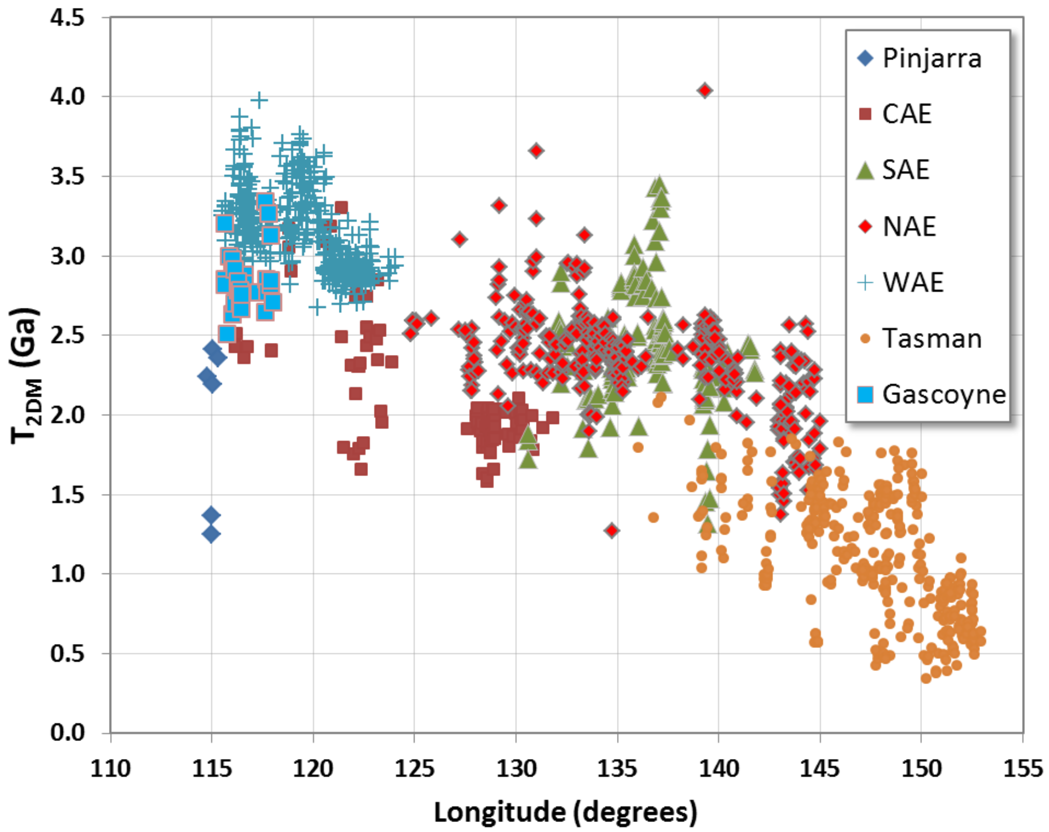


Figure 3.4 Two stage depleted mantle model ages (T_{2DM}) versus longitude. Isotopic data for Australian felsic igneous rocks show a broad regional negative correlation with longitude. The majority of model ages are Proterozoic in age; Archean model ages are largely confined to the WAE, Phanerozoic model ages to the Tasman Element. The Gascoyne region samples (WAE) are shown separately. Data and data sources are listed in Appendix B and Appendix C.

In the following sections, emphasis is placed on the four largest elements (WAE, NAE, SAE and Tasman) with examples of how Sm-Nd isotopic data can be used to constrain their crustal evolution. The Central Australian and Pinjarra elements are discussed with their neighbouring elements, largely with respect to the nature and style of the boundaries between them. Examples of ambiguous (and even misleading) signals from the Sm-Nd isotopic data, and reasons for this ambiguity, are also discussed.

3.3.2. West Australian Element and bordering provinces

The West Australian Element (WAE; Myers et al., 1996; Cawood and Korsch, 2008) is comprised of the Archean Pilbara and Yilgarn cratons and the intervening (Archean to) Paleoproterozoic rocks of the Capricorn Orogen (Cawood and Tyler, 2004; Sheppard et al., 2010a,b; Figure 3.5), including the Gascoyne Province and its basement Glenburgh Terrane (Sheppard et al., 2010a,b). Numerous Sm-Nd isotopic data are available for the Pilbara and Yilgarn cratons (Bickle et al., 1989, 1993, Brauhart and Morant, 2000; McCulloch, 1987; Smith et al., 1998; Tyler et al., 1992; Barley et al., 2003; Smithies et al., 2007; Champion and Sheraton, 1997; GSWA-GA unpublished; Nutman et al., 1993; de Laeter et al., 1985; Fletcher and McNaughton, 2002b; Fletcher et al., 1983a, 1983b, 1984, 1985, 1994; McCulloch and Compston, 1981; McCulloch et al., 1983a, 1983b; Watkins and Hickman, 1990; Sheppard et al., 2003). Less data are available for the Capricorn Orogen, with all data from the Gascoyne Province from Fletcher et al. (1983a) and Sheppard et al. (2003, 2004).

The WAE is bordered in the northeast, east and south by Proterozoic geological provinces of the Central Australian Element (CAE), specifically rocks of the (Late Archean–) Paleoproterozoic and Mesoproterozoic Albany-Fraser Orogen (e.g., Nelson et al., 1995) and the Paleoproterozoic to Neoproterozoic Paterson Orogen (e.g., Czarnota et al., 2009; Figure 3.5). Large parts of the CAE in these areas are either under cover or poorly exposed and even where exposed the isotopic data is limited. Available isotopic data for the Paterson Orogen is from McCulloch (1987) and Geoscience Australia (unpublished), and for the Albany-Fraser Orogen from Fletcher et al. (1983b), Nelson et al. (1995) and Geoscience Australia (unpublished). The western margin of the WAE is bordered by the Pinjarra Element (also called Darling Mobile Belt, e.g., Wilde and Nelson, 2001). Most of the element is unexposed, under the Perth and Southern Carnarvon basins, with outcrop confined to a number of basement high complexes. Geology is not well understood and a range of Paleoproterozoic to Neoproterozoic and younger ages has been recorded (see summary in Wilde and Nelson, 2001). A small number of isotopic data are available, from both exposed rocks and drill core which has intercepted basement, chiefly from Fletcher et al. (1985), but also from McCulloch (1987).

The WAE and surrounding elements provide information on the isotopic character of Archean cratons and changes across their edges from Archean to Proterozoic and Phanerozoic rocks. Data for the WAE are largely dominated by Archean samples from the Yilgarn and Pilbara cratons with only minimal data for the rocks between and around these cratons. As such, the gridded image is dominated by the Archean signal and other complexities are largely not evident. The sparse data do highlight the edges of the two cratons, mirroring results, for example by Fletcher and co-workers on isotopic changes across the margins of the Yilgarn (Fletcher et al., 1983a,b). These workers documented marked changes in isotopic signal (towards much less evolved with younger model ages) on transects away from the Yilgarn Craton. A similar change appears to be evident in crossing from the Pilbara into the CAE region.

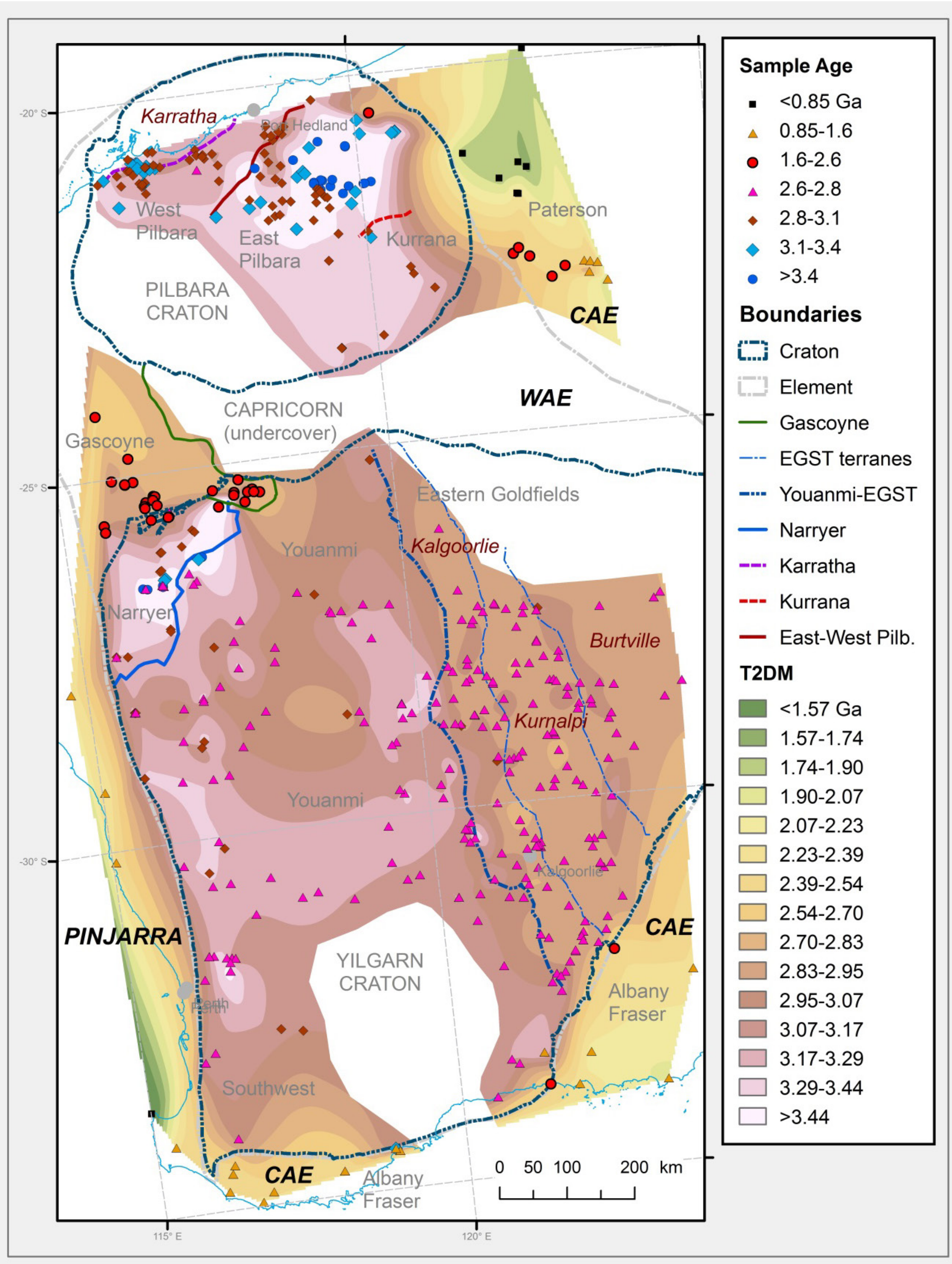


Figure 3.5 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for the West Australian Element (WAE) and surrounding Pinjarra and Central Australia (CAE) elements. Isotopic data (coloured by magmatic age) used to create the grid are also shown (data and data sources are in Appendix B and Appendix C). Grid created in ArcMap® (see text), from 514 data points. Also shown are West Pilbara, East Pilbara and Kurrana terranes (Pilbara Craton), Narryer, Youanmi, Southwest (no border shown), Kalgoorlie, Burtville and Kurnalpi terranes (Yilgarn Craton), the Gascoyne region—all in the WAE—as well as the Albany-Fraser and Paterson regions (CAE). Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust; these areas have been partially masked. Kalgoorlie, Burtville and Kurnalpi terranes belong to the Eastern Goldfields Superterrane (EGST), boundaries follow Cassidy et al. (2006) and Stewart et al. (in prep).

3.3.2.1. Archean Pilbara and Yilgarn cratons

Regional isotopic variation is well documented for both the Pilbara Craton (Van Kranendonk et al., 2004, 2007) and the Yilgarn Craton (Nutman et al., 1993; Fletcher et al., 1994; Champion and Sheraton, 1997; Champion and Cassidy, 2008), and matches reasonably well with known geology and geological terranes. Both cratons have older 'nucleii'—the ca. 3.7–3.6 Ga East Pilbara Terrane and the mostly 3.3–3.0 Ga Youanmi Terrane—bound by mostly younger crustal domains—the West Pilbara Superterrane and Kurrana Terrane in the Pilbara (see section 2.6) and the Eastern Goldfields Superterrane in the Yilgarn (Figure 3.5). As highlighted by Champion and Cassidy (2008), the boundary between the Youanmi Terrane and the bounding Eastern Goldfields Superterrane is pronounced and readily visible in the gridded data. Similarly, as discussed in section 2.6, the boundary between the older East Pilbara Terrane and the West Pilbara Superterrane is well marked. In the Pilbara, oldest model ages (ca. 3.7 Ga) are almost exclusively confined to the East Pilbara Terrane. In the Yilgarn Craton, although older model ages occur in the Youanmi Terrane, the oldest model ages are confined to the Narryer Terrane (Figure 3.5), interpreted by Nutman et al. (1993) to be an exotic accreted block. Youngest model ages in both cratons occur within the marginal terranes.

Both the Pilbara and Yilgarn cratons highlight the potential ambiguity of isotopic signatures, particularly when applied to tectonic interpretation. The marginal terranes in both cratons have been interpreted in terms of accretionary tectonic processes (e.g., Barley et al., 1989, 2008; Smithies et al., 2005; Champion and Cassidy, 2008), and the isotopic data are consistent with this. The data are also consistent with other processes, however. For example, the zonation within the Eastern Goldfields Superterrane has been attributed, wholly or in part, to intracontinental and/or back-arc rifting (e.g., Groves and Batt, 1984; Czarnota et al., 2010), and the isotopic data are also consistent with those interpretations. Similarly, the more homogeneous and evolved isotopic signatures of the 'nucleii' in both cratons—Youanmi Terrane (Yilgarn) and East Pilbara Terrane (Pilbara)—have been interpreted as the old crustal blocks possibly derived from oceanic plateau-like precursors (e.g., Van Kranendonk et al., 2007). These interpretations are also not without controversy, though it is noted that the East Pilbara Terrane, in particular, has many geological features consistent with such an interpretation (see e.g., Van Kranendonk et al., 2007; Champion and Smithies, 2007).

One feature of the isotopic zonation in the Yilgarn Craton, particularly within the Eastern Goldfields Superterrane, was the recognition of apparent relationships between isotopic signatures and gold, base metal and nickel mineralisation (Cassidy et al., 2005; Huston et al., 2005, 2013). In the case of base metal mineralisation, Huston et al. (2013) showed that this relationship can be extended to Archean terranes in general. These topics are discussed in more detail in section 5.2.

3.3.2.2. Gascoyne Province (WAE) and bordering elements

The Pilbara and Yilgarn cratons in the WAE are separated by the younger late Archean and Proterozoic rocks of the Capricorn Orogen (Myers et al., 1994; Sheppard et al., 2010a,b). Detailed geological mapping, geochemistry and geochronology (e.g., Sheppard et al., 2003, 2004, 2010a,b; Johnson et al., 2011, and references therein) highlight the initial accretionary/collisional nature of this orogen in the Paleoproterozoic (pre-1950 Ma, in two events) that were responsible for amalgamation and formation of the WAE, probably with the involvement of a Late Archean-early Paleoproterozoic block called the Glenburgh Terrane. As highlighted by Sheppard et al. (2010b), subsequent younger (post-1950 Ma) magmatic and thermal events are related to intracontinental reworking, though Sheppard et al. (2004) indicated even the older events involved significant crustal recycling. The isotopic data are consistent with these interpretations. Model ages for samples from the Capricorn

Orogen (Figure 3.4 to Figure 3.6) range from ~2.5 Ga to much older, requiring not just rocks of similar isotopic signature to the Yilgarn Craton (or another unexposed Archean block) but also the involvement of younger material (i.e., younger model ages) not present in the Pilbara or Yilgarn cratons (Figure 3.6). This is consistent with Late Archean–Early Paleoproterozoic basement for this part of the Capricorn Orogen, being reworked with new crustal growth in the Paleoproterozoic (e.g., Sheppard et al., 2004; Johnson et al., 2011).

Provinces in the surrounding Central Australian Element (CAE) that abut the WAE, specifically the Paterson and Albany-Fraser orogens, show similar isotopic signatures to the Gascoyne Province (Figure 3.5, Figure 3.6), but extend to younger T_{2DM} with decreasing magmatic age. The latter trends are most consistent with a number of crustal growth events. The isotopic zonation in the Paterson with markedly younger T_{2DM} to the north (Figure 3.5) is consistent with distinct geological provinces, with the older T_{2DM} confined to the Rudall Province in the south. Youngest model ages occur in intrusions in the Yeneena Basin—these T_{2DM} may be recording juvenile input at the time of their formation and/or relate to slightly older crustal growth at ca. 830 Ma as recorded by mafic and other intrusions related to basin formation (e.g., Czarnota et al., 2009; Figure 3.6).

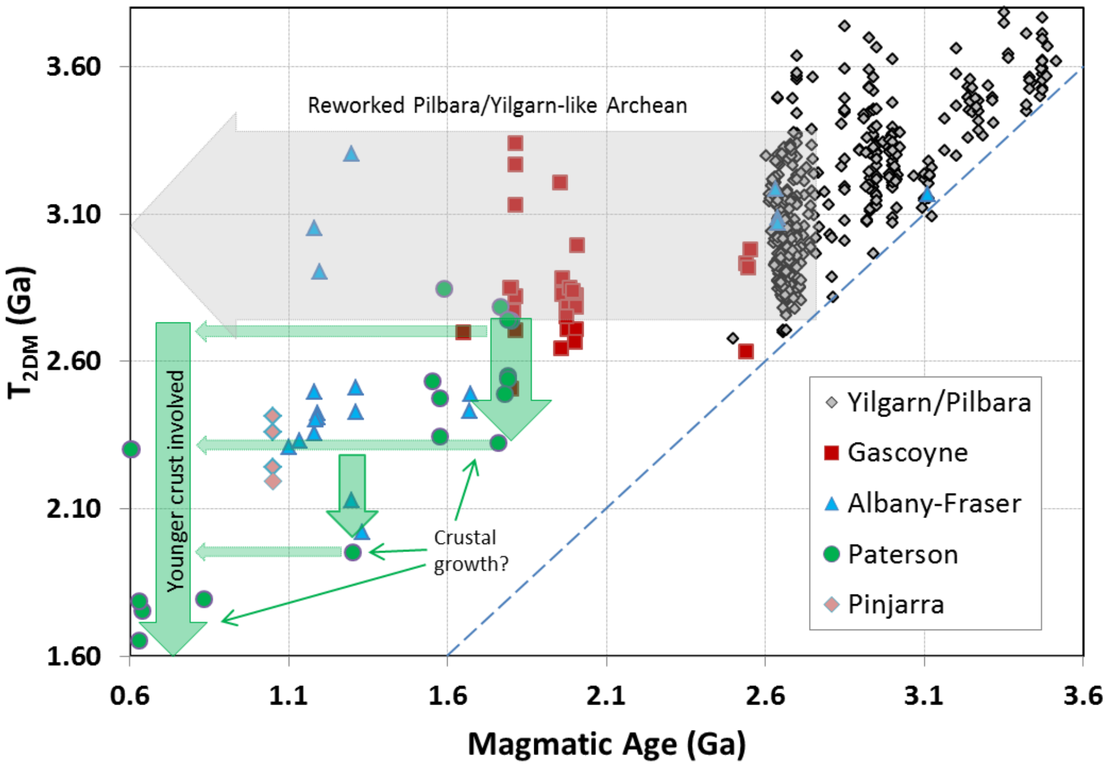


Figure 3.6 Magmatic age versus two stage depleted mantle model ages (T_{2DM}) for rocks of the West Australian (Yilgarn, Pilbara and Gascoyne) and neighbouring Central Australia (Paterson, Albany-Fraser) and Pinjarra elements. With the exception of the Pinjarra Element all other (late Archean-) Proterozoic provinces have T_{2DM} ages which require both Archean and younger 'crustal' components. The isotopic data from both the Paterson and Albany-Fraser orogens indicate significant post-Archean crustal growth.

The small amount of data available for the Pinjarra Element is largely non-definitive. As noted by earlier studies (e.g., Fletcher et al., 1985), the data are broadly similar to that in the Albany-Fraser Orogen bordering the southern and eastern margins of the Yilgarn Craton, and at best demonstrates the involvement of younger (post-Yilgarn Craton) crust. The lack of old T_{2DM} may be indicative of no Yilgarn Craton involvement at all, but may just as readily reflect a more cryptic Archean signature.

3.3.3. North Australian Element

The North Australian Element (NAE; Myers et al., 1995; Cawood and Korsch, 2008; Huston et al., 2012) is dominated by Paleoproterozoic to Mesoproterozoic geology of the age period ca. 1920–1550 Ma, best documented in the Kimberley (Halls Creek and King Leopold orogens), Pine Creek, Tanami, Tennant Creek, Arunta, Mount Isa and Georgetown regions (see Figure 3.7, Figure 3.8). Definitive Neoarchean (to early Paleoproterozoic) rocks are largely confined to parts of the Pine Creek Orogen (e.g., Hollis et al., 2009c) but also occur as complexes in the Tanami region (Page et al., 1995). McDonald et al. (1997) also reported evidence for suspected Archean basement in the Mount Isa region. Phanerozoic, mostly Paleozoic, rocks related to the Tasman Orogen and the Alice Springs Orogeny occur along the eastern and southern margins of the NAE (e.g., Hand et al., 1999), but are most abundant in the Georgetown region (Withnall et al., 1997). Much of the NAE is obscured by Proterozoic and younger basins and the distribution of Sm-Nd samples largely reflects the location of basement outcrop (Figure 3.8).

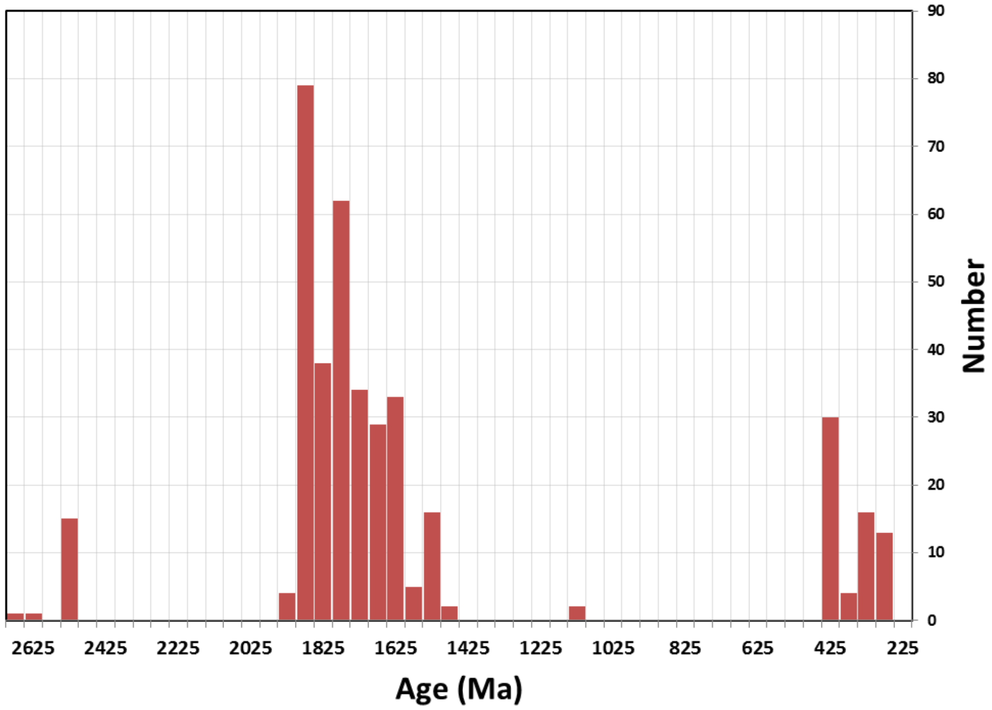


Figure 3.7 Histogram of ages of felsic igneous Sm-Nd samples from the North Australian Element. Total number of samples is 384, of which 17 are Archean, 304 Proterozoic and 63 Paleozoic.

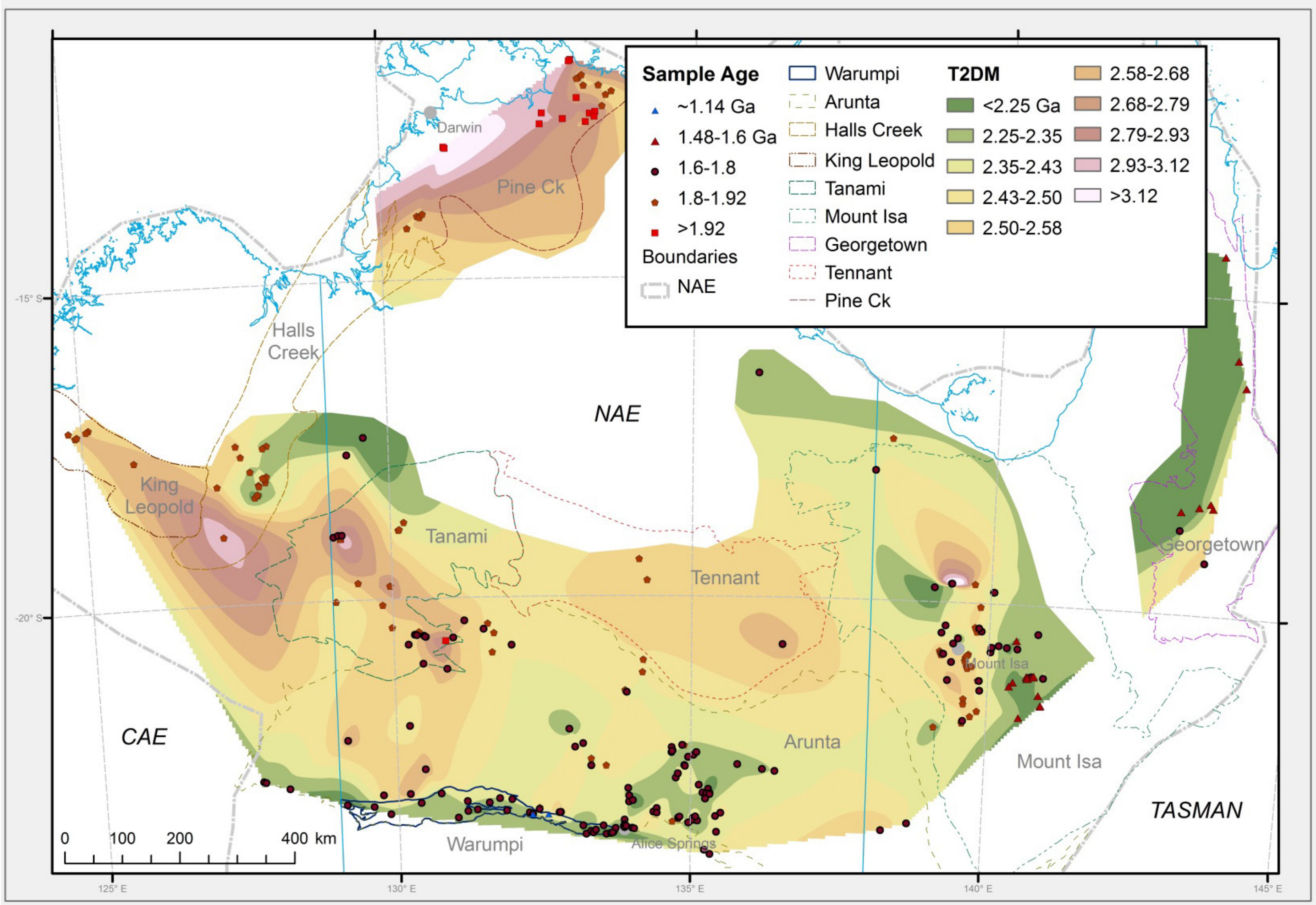


Figure 3.8 Gridded two-stage depleted mantle model ages (T_{2DM}) for the North Australian Element (NAE). Only Proterozoic aged samples have been used. NAE orogen and province boundaries after (Stewart et al., in prep), except Warumpi which is from the NTGS. Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap®–see main text. Also shown are the Central Australian (CAE) and Tasman elements. The grid was constructed from 321 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. These areas have been partially masked.

Numerous Sm-Nd isotopic data are available for igneous rocks of the Arunta, Isa and Georgetown regions (e.g., Black and Shaw, 1992; Black and McCulloch, 1984, 1990; Windrim and McCulloch, 1986; McCulloch, 1987; Page and Sun, 1988; Wyborn et al., 1988, 1998; Champion, 1991; Foden et al., 1995; Sun et al., 1995; Zhao and McCulloch, 1995; Knutson and Sun (in Blewett et al., 1997); McDonald et al., 1997; Mark, 2001; Smith, 2001; Bierlein and Betts, 2004; Scrimgeour et al., 2005a; Wade et al., 2008; Bierlein et al., 2011; Lambeck et al., 2012; GA unpublished; NTGS unpublished). Fewer data are available for the Pine Creek and Tanami regions (McCulloch, 1987; Smith, 2001; Bagas et al., 2010; GA unpublished; NTGS unpublished). Only limited data are available for both the Tennant Creek and Kimberley regions (McCulloch, 1987; Griffin et al., 2000; GA unpublished; NTGS unpublished). Available isotopic samples span the age range evident in the geology (ca 2670 Ma to 280 Ma) and, like the geology, are dominated by late Paleoproterozoic to early Mesoproterozoic ages (Figure 3.7).

The gridded T_{2DM} image for the NAE (Figure 3.8) is not simple and lacks the obvious correlations with the geological regions seen in the WAE image. Nonetheless, a number of observations can be made regarding the possible ages of basement rocks, isotopic variations within geological provinces and possible crustal breaks between geological provinces in the NAE:

- T_{2DM} ages in the NAE are dominated by Proterozoic ages (see section 4.1), with the peak between 2.5 Ga and 2.2 Ga (Figure 4.2).
- Samples with Archean model ages, although not uncommon, are patchy, suggesting either Archean basement is not widespread or that model ages largely represent mixes between Archean and Proterozoic crust.
- All regions show a broad range in T_{2DM} and ε_{Nd} (Figure 3.9), consistent with a range of crustal ages and/or components (e.g., crust and mantle) involved in the genesis of these rocks. In fact there is more variation within NAE provinces than between them.
- T_{2DM} ages for the Proterozoic magmatism are almost exclusively 400–800 Ma greater than magmatic ages (Figure 3.10), irrespective of model age, i.e., the average age of the crust in the NAE is decreasing with decreasing age, implying episodic (ongoing) crustal growth.
- For the Northern Territory portion of the NAE, there is a pronounced decrease in (minimum and maximum) model ages southward with increasing latitude (Figure 3.11).
- There are marked changes and gradients in isotopic data in an east-west direction across the NAE (Figure 3.12) that suggest possible crustal breaks (suture zones) and accretionary tectonics.

3.3.3.1. Pine Creek Orogen: Archean basement signatures

The best evidence for Archean basement is in the Pine Creek and Tanami orogens. The Pine Creek Orogen (PCO) with its known Archean basement and Paleoproterozoic cover sequences, coupled with available Nd and Hf isotopic data (McCulloch 1987; Glass et al., 2010; Hollis et al., 2011) serves as a potential model to understand Nd signatures within the NAE and in other Australian Proterozoic terranes for which evidence on the basement rocks are either missing or poorly understood. The PCO comprises Paleoproterozoic sedimentary and volcanic rocks, overlying Neoarchean (ca. 2670–2500 Ma) granites and gneisses (Needham et al., 1980, 1988). Current geological syntheses of the PCO show it can be subdivided into three domains—the Litchfield Province (west), the Central Domain, and the Nimbuwah Domain (east). Each domain is characterised by distinctive geology, structural history and metamorphism, and periods of magmatism (Carson et al., 2008; Glass et al., 2010). Neoarchean (ca. 2670 to 2500 Ma) felsic magmatism has been identified in the Central Domain (ca. 2674 Ma

Woolner Granite (Glass et al., 2010) and ca. 2545–2520 Ma units of the Rum Jungle Complex (Cross et al., 2005), and Nimbuwah Domain (the ca. 2671 and ca. 2640 Ma Arrarra Gneiss (Hollis et al., 2009a,c), units of the Nanambu Complex (ca. 2520 Ma; Hollis et al., 2009a,c) and the Kukalak Gneiss (ca. 2527–2510 Ma; Hollis et al., 2009a,c)), but not in the Litchfield Province (Carson et al., 2008). Paleoproterozoic magmatism occurs within all three domains. This includes: ca. 1867–1860 Ma granites of the Nimbuwah Complex in the Nimbuwah Domain (Hollis et al., 2009b); slightly younger (ca. 1855 Ma) mafic and felsic magmatism in the Litchfield Province (Carson et al., 2008); and younger I-type magmatism (ca. 1835–1820 Ma) in the Central Domain (Hollis et al., 2011).

Glass et al. (2010) summarised the Nd isotopic signatures of the Central and Nimbuwah domains, utilising new data as well as that of McCulloch (1987). They found a wide range of Archean model (T_{DM}) ages from ca. 2600 Ma to as old as ca. 3110 Ma. Data (recalculated) from McCulloch (1987) expands this range in both directions, with T_{2DM} ages from ca. 2490 to ca. 3650 Ma. No data are available for the Litchfield Province. Model ages, especially those reported by Glass et al. (2010), broadly match, though are older than the known Archean basement geology in the PCO (with ages of 2680–2520 Ma).

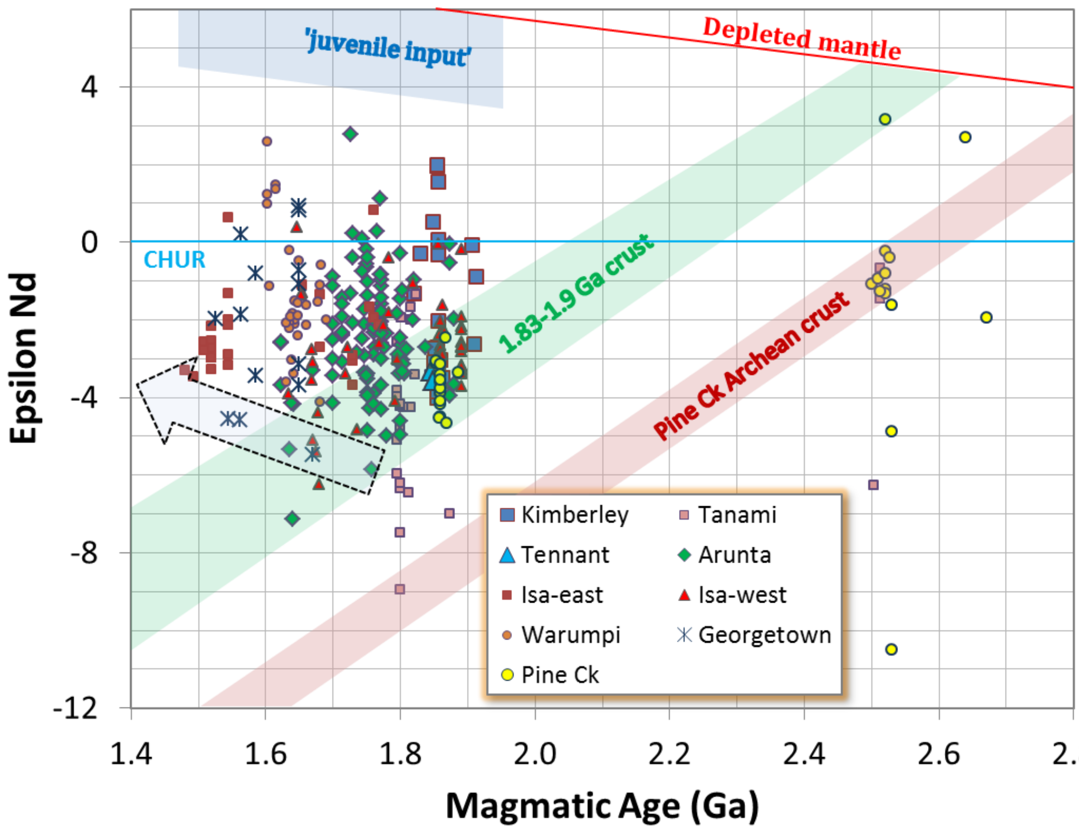


Figure 3.9 Magmatic age versus epsilon Nd (ε_{Nd}) for felsic magmatism of the North Australian Element (NAE). Data and data sources are listed in Appendix B and Appendix C). Note the spread in ε_{Nd} for all geological regions, as well as a trend to decreasing minimum eNd with decreasing magmatic age (highlighted by the arrow). Oblique pink and green shaded zones represent project evolutionary trajectories for Pine Creek Archean crust and Pine Creek 1.9–1.83 Ga crust, respectively. Blue shaded area labelled 'juvenile input' represents expected range of isotopic signatures for mantle material emplaced during 1.93–1.5 Ga. The large arrow highlights the decreasing minimum ε_{Nd} with increasing age.

The older model ages are certainly realistic. As pointed out by Glass et al. (2010), many of the Archean felsic intrusives have evolved ε_{Nd} (mostly <0) requiring some crustal recycling. There is also evidence of older crustal material within the ca. 2010 Ma Woodcutters Supergroup. As discussed by Hollis et al. (2011), this formation not only contains zircons as old as 3670–3555 Ma but includes a dominant population of ca. 3120 Ma zircons. Hollis et al. (2011) also found inherited zircons in the ca. 2600 Ma to 3535 Ma age range for the Rum Jungle Complex—a spread that matches the range in model ages for this unit (e.g., McCulloch, 1987). There is no definitive indication of the actual age of the older parts of the PCO basement, nor is there any strong evidence regarding the abundance of this older material, or whether or not the crust is zoned in this region. The detrital zircon populations in post Archean sedimentary sequences in the PCO largely fall in the age range 2670–2500 Ma (Hollis et al., 2011), matching known ages of the exposed basement.

Nd model ages (T_{DM}) for the younger ca. 1867–1860 Ma granites of the Nimbuwah Complex give model ages of ca. 2600 Ma (Glass et al., 2010). Importantly, although these ages match those of the dominant zircon population they do not match the isotopic signature of the Archean rocks (Figure 3.9), requiring the involvement of some juvenile input. The age of the latter is largely unconstrained and may be anywhere between late Archean and ca. 1867–1860 Ma, i.e., syn-magmatic. The most interesting observation is that in an area where Archean basement is clearly present, calculated T_{2DM} ages for the Proterozoic magmatism are Paleoproterozoic to latest Archean, i.e., lack of Archean model ages signatures does not negate the possibility of Archean basement.

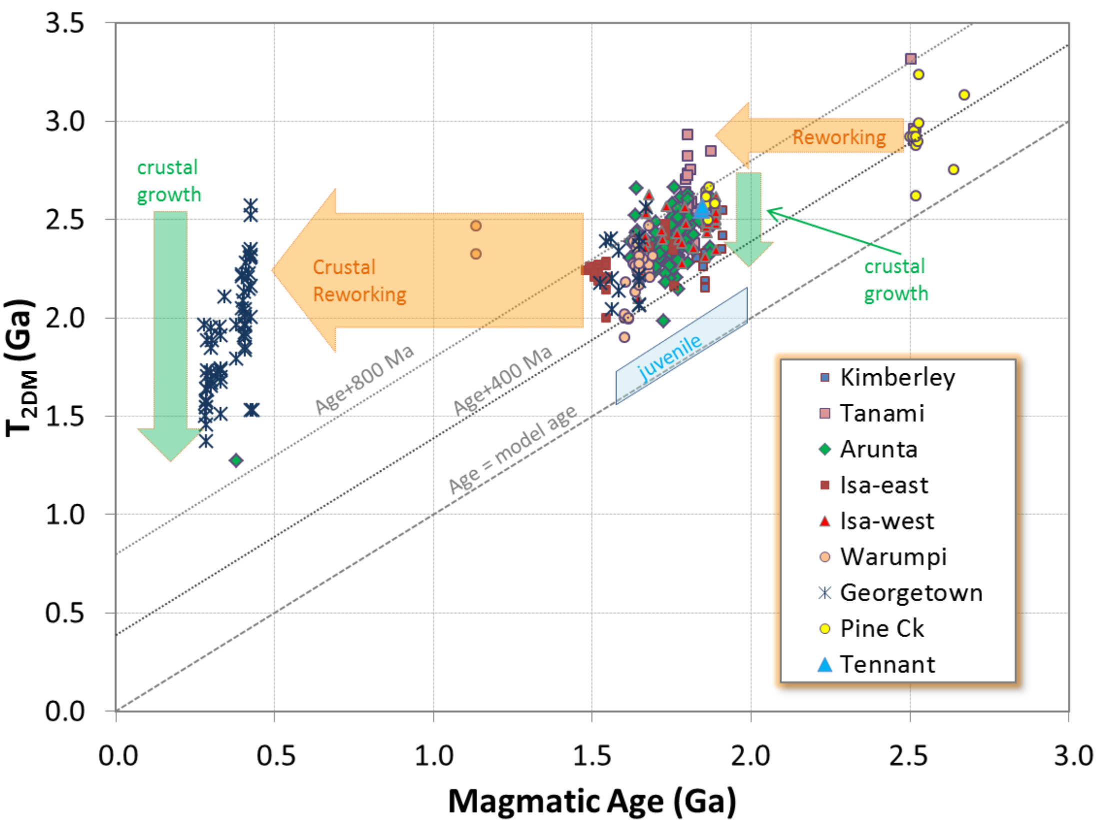


Figure 3.10 Magmatic age versus model age (T_{2DM}) for felsic magmatism of the North Australian Element (NAE). Data and data sources are listed in Appendix B and Appendix C. Note the spread in T_{2DM} for all geological regions, as well as a trend to decreasing T_{2DM} with decreasing magmatic age. T_{2DM} for most Proterozoic samples are 400 Ma to 800 Ma older than the magmatic age, irrespective of age.

3.3.3.2. Basement rocks of the NAE—Archean or not

As pointed out by Glass et al. (2010), there is a similarity of isotopic signature between the Nimbuwah Complex rocks in the PCO and contemporaneous rocks of the Kalkadoon Granodiorite (McDonald et al., 1997) in the Mount Isa region. The ca. 1850 Ma granites in the Tennant Creek region also have T_{2DM} ages of ca. 2550 Ma (McCulloch, 1987). This is not surprising as McCulloch (1987) showed that most of his samples from the NAE had very similar model ages. His reported model ages of ca. 2100 to 2300 Ma, are slightly younger than those reported here, because of the different depleted mantle growth curve (depleted mantle beginning at 2750 Ma not 4500 Ma) used. McCulloch's (1987) values of T_{DM} increase to ca. 2500 and older when more conventional growth curves are used. The general similarity of the isotopic signature of rocks of the NAE is illustrated in Figure 3.9 which shows that rocks of the Kimberley region, Tanami Orogen, Tennant region (Warramunga and Davenport provinces), Arunta Orogen and the Mount Isa Orogen (especially the western half), all have evolved end-members with isotopic signatures similar to those of the ca. 1860–1850 Ma PCO granites. The simplest interpretation is that many of these provinces are underlain by basement similar to that being sampled by the ca. 1860 Ma PCO granites, i.e., Archean basement modified by one or more subsequent crustal growth events (including juvenile mantle material at the time of magmatism). Wyborn et al. (1987) reached a similar conclusion in their synthesis of Australian Proterozoic magmatism, though suggested that the Proterozoic terranes developed on, but not necessarily from, Archean crust. The observation that T_{2DM} in the Proterozoic samples are 400-800 Ma older than the magmatic age, irrespective of the magmatic age (Figure 3.10), implies there has been ongoing crustal growth through the 400 Ma time span of Proterozoic magmatism. This is consistent with Wyborn et al. (1987) who suggested that these crustal growth events were probably related to rifting and extensional events associated with, and prior to, development of the Proterozoic sequences. They also advocated a major role for vertical redistribution and not horizontal crustal growth, i.e., most of the present extent of the NAE was present early. The patchy distribution of model ages (Figure 3.8) in nearly all of the geological provinces lends some support to this model. Consideration of the relationship between T_{2DM} and geography (next section), however, offers one possible alternative interpretation.

3.3.3.3. Geographic changes in model ages

3.3.3.3.1. North-South variations in isotopic signature

Figure 3.11 shows that there is a reasonable correlation between minimum and maximum T_{2DM} and latitude for the Northern Territory portion of the NAE. This is particularly the case south of 22 degrees latitude, i.e., for the Aileron and Warumpi provinces of the Arunta Orogen. The Warumpi Province in particular is one of the few in the NAE that has a relatively homogeneous isotopic signature. This trend also continues further south to the Musgrave Province in the neighbouring Central Australian Element (Figure 3.11). Although this trend could be interpreted as rifting/extension, presumably between a joined NAE and the South Australian Element (e.g., see model B in Fraser et al., 2007, and references therein), it is perhaps more consistent with arc-related crustal growth along the southern margin of the NAE. The trends in isotopic signature (ε_{Nd}, T_{2DM}) in the southern NAE are very similar to (though not as extreme as) that seen in the accretionary Phanerozoic Tasman Element of eastern Australia (e.g., Kemp et al., 2009; Champion et al., 2010; see Figure 3.20), i.e., suggesting that the southern half (at least) of the NAE was formed in an accretionary environment. The isotopic signature of the southern NAE is particularly akin to the northern part of the Tasman Element where lateral growth is not as extensive as in the southern Tasman (Champion et al., 2010; see section 3.3.5). The isotopic trend is also consistent with previous geological and tectonic interpretations of both the Aileron (Foden et al., 1988; Zhao and McCulloch, 1995) and Warumpi (Scrimgeour et al., 2005a,b) provinces, based on magmatic, sedimentary, metamorphic/deformation and isotopic data (see Huston et al. (2012) for a possible tectonic model). For example, Zhao and McCulloch (1995) subdivided the Arunta region granites into three main groups, one of which—their calc-alkaline–trondhjemitic group (CAT group)—is confined to the southern margin of the Aileron Province was interpreted to have arc-like geochemical features. Korsch et al. (2011) suggested, based on seismic reflection data, that there is an ancient crustal suture (expressed at the surface by the Atuckera Fault) between the Aileron Province and the Davenport Province to the north. They linked this suture to a similar break observed between the Tanami region and the Aileron Province to the northwest documented by Goleby et al. (2009). Bagas et al. (2008) proposed a collisional event between the Tanami and Arunta region occurring ca. 1850 Ma. Korsch et al. (2011) suggested a similar scenario, and speculated it may relate to deformation at ca. 1850 Ma in the Tennant region. Notably there is also an apparent (northeast-southwest trending) gradient in the isotopic data for the Tanami region (Figure 3.8), also possibly recording accretion to the southwest. There is also a suggestion of younger crust to the northeast but there are too few data points to verify (or otherwise) this change.

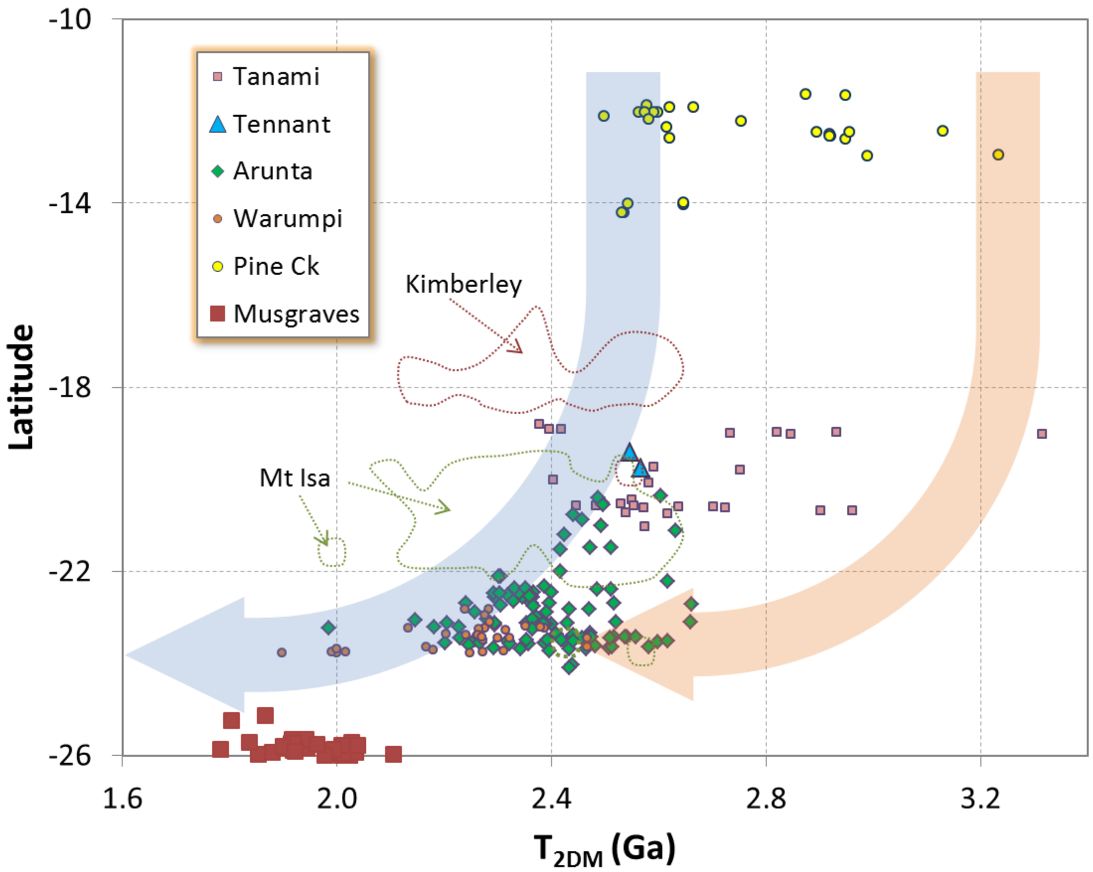


Figure 3.11 Two-stage Depleted mantle model (T_{2DM}) ages versus latitude for felsic igneous rocks of northern Territory. Note the general decrease in minimum and max T_{2DM} with decreasing latitude, highlighted by the blue and orange arrows, respectively. Fields for rocks of the Kimberley (denoted by pink dotted lines) and Mt Isa (green dotted lines) regions do not follow this trend.

A somewhat similar scenario has been invoked for the Warumpi Province, which has a geological history (pre-1640 Ma) distinct from that of the now-neighbouring Aileron Province (Close et al., 2003, 2004; Scrimgeour et al., 2005b). This led to the suggestion (e.g., Close et al., 2003) that the Warumpi

Province was separate from the Aileron Province up until the Leibig Orogeny (ca. 1640–1630 Ma) which appears to be the first common geological event shared by both provinces. Scrimgeour et al. (2005b) interpreted the orogeny to reflect continental collision between the Warumpi and Aileron provinces, most likely related to a south-dipping subduction zone (based on the concentration of pre- and syn-orogeny magmatism in the Warumpi Province). The two provinces are separated by what Close et al. (2004) called the Central Australian Suture—a series of faults and shear zones, including the Redbank Thrust.

The interpreted sutures are supported by the isotopic data—certainly there is an apparent jump in model ages and ε_{Nd} values south of latitude 22 degrees, and a trend to strongly decreasing T_{2DM} further south. There are also some slight inconsistencies, however. Firstly, the most evolved samples in the Arunta Orogen have T_{2DM} of 2.5 Ga and over (up to 2.4 Ga and over in Warumpi Province samples) suggesting that they have sampled (in part) an Archean component. Secondly, there is an overlap between the isotopic signatures of felsic magmatism in the Warumpi and Aileron provinces (Figure 3.11) perhaps suggesting some commonality.

3.3.3.3.2. East-West variations in isotopic signature

Similar regional isotopic variations can be seen taking an approximate broad east-west transect across the central part of the NAE, from the King Leopold and Halls Creek orogens in the west, through the Tanami and Tennant regions, and the northern Arunta (north of 22 degrees), into Mount Isa and across to the Georgetown region (Figure 3.12). Although the number of data points are quite limited for some regions (Kimberley, Tennant), there are a number of east-west changes (jumps, gradients) in isotopic signature that are suggestive of either crustal breaks (i.e., possible sutures) or continental margin processes. These include:

- A gradient to more significantly primitive isotopic signatures in the eastern part of the Halls Creek Orogen;
- A marked change from the Halls Creek Orogen to the Tanami Orogen;
- A pronounced gradient (or break) from the western to eastern Mount Isa Orogen; and
- A marked change from western Mount Isa to the Georgetown region.

Many of these correlate reasonably well with geological interpretations for the NAE. Detailed geological studies in the Halls Creek Orogen (Kimberley region) (e.g., Griffin et al., 2000; Sheppard et al., 1999, 2001) have identified three geological terranes (Western, Central and Eastern zones) each with distinct early geological histories, and distinctive sodic and potassic granites groups specific to individual zones. The identified geological zones were interpreted by Sheppard et al. (1999, 2001) to record the amalgamation of the Kimberley Craton with the NAE (see Korsch et al. (2011) and Huston et al. (2012) for recent overviews). In this interpretation the three zones represent, from west to east, the Kimberley Craton, an accreted island arc, and the western margin of the NAE. Nearly all the available isotopic data are from the Western and Central zones, so the isotopic zonation in Figure 3.12 (data from McCulloch (1987); Griffin et al. (2000); Geoscience Australia unpublished) is recording the change from older continental crust in the west to the accreted island arc terrane in the Central Zone. This tectonic interpretation is also consistent with the change in isotopic signal from the Halls Creek Orogen to the Tanami Orogen.

Bierlein et al. (2011) have recently suggested, primarily based on Sm-Nd data but also on geochemistry, geochronology, and Lu-Hf isotopic data, that the eastern part of the Mount Isa Orogen (Eastern Fold Belt) has a distinct geological history (pre 1.86 Ga) to the western part (Western Fold

Belt and Kalkadoon-Leichhardt Belt). They suggested the Eastern Fold Belt was accreted to the rest of the Mount Isa block at, or before, ca. 1.86 Ga. The break shown on Figure 3.12 at 140 degrees longitude closely approximates the location of the boundary between the Kalkadoon-Leichhardt Belt and the Eastern Fold Belt. The expanded data set used here clearly lends support to the suggestions of Bierlein et al. (2011).

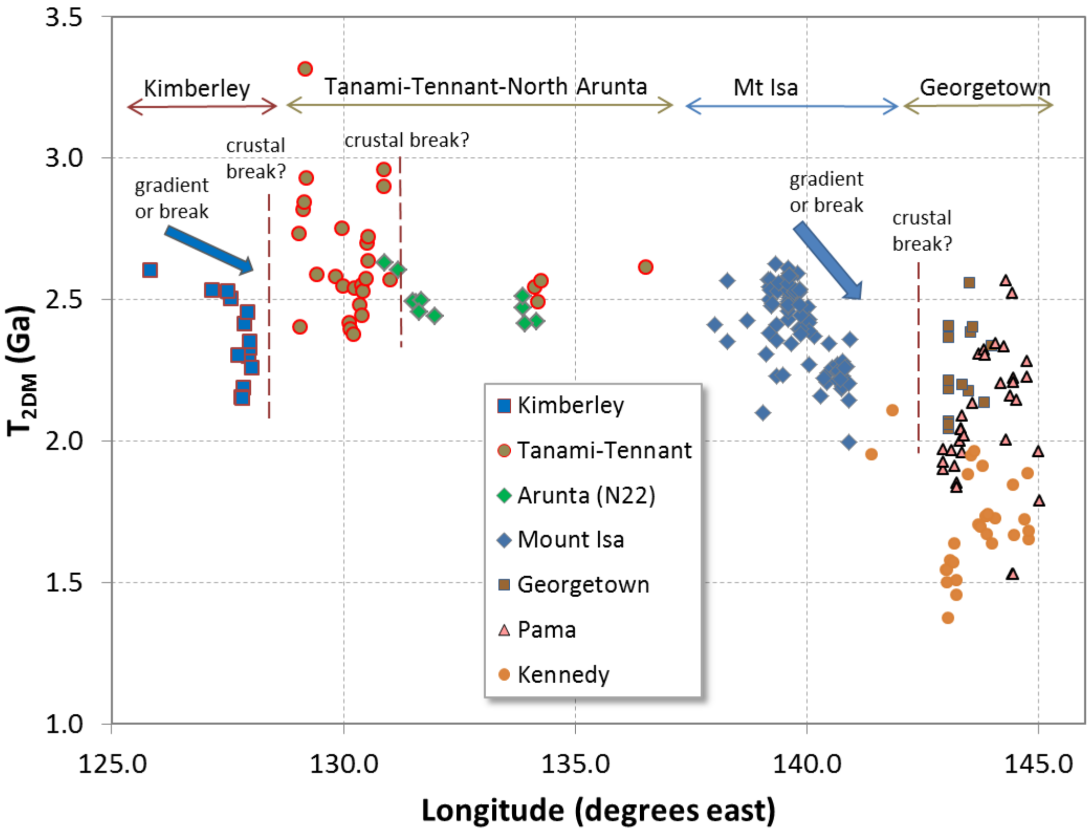


Figure 3.12 Two stage Depleted mantle model ages (T_{2DM}) versus longitude for Proterozoic rocks of the Kimberley region (King Leopold and Halls Creek orogens), Tanami Orogen, Tennant Creek region (Warramunga and Davenport provinces), Arunta Orogen (north of 22 degrees = N22), Mount Isa Orogen, and the Georgetown region (Etheridge, Croydon and Savannah provinces). Phanerozoic rocks of the Pama and Kennedy Igneous provinces (Georgetown region) are also shown. A number of possible isotopic gradients and or crustal breaks are also shown. Data and data sources are given in Appendix B and Appendix C.

Bierlein et al. (2011) also speculated (their Figure 21) that the Mount Isa Orogen was accreted to the rest of the NAE in a similar time frame. The isotopic data (Figure 3.12) provide no support for this suggestion (though on their own do not refute it either). There are other possible interpretations of the Mount Isa isotopic data. For example, when magmatic age (and not just location) is taken into account, it is apparent that most of the more primitive isotopic signatures are associated with post 1600 Ma magmatism which is (largely) confined to the Eastern Fold Belt (e.g., Wyborn et al., 1988). It may well be that the east-west change in isotopic signature simply reflects a greater amount of younger crustal growth in the Eastern Fold Belt, which may or may not necessarily be related to convergent margin processes. For example, Gibson et al. (2012) suggest formation of a rifted margin (ca. 1800–1600 Ma) on the eastern side of the Mount Isa Orogen which would alter the isotopic signature. The isotopic data do show, however, that regardless of age, the most evolved signatures (largest T_{2DM}) are in the western Isa region, lending support to Bierlein et al. (2011).

Figure 3.12 also shows a change in isotopic signature going from the Mount Isa Orogen into the Georgetown region, where Proterozoic magmatism records T_{2DM} ages similar to those in the western part of Mount Isa. Interpretations of reflection seismic data that transect these provinces show two possible sutures, one on the eastern margin of the Mount Isa Orogen (the Gidyea Suture Zone of Korsch et al., 2012), and another west of Georgetown (the Rowe Fossil Subduction Zone of Korsch et al., 2012). The isotopic data is consistent with one or both of these sutures. Korsch et al. (2012) also identified a crustal block, which they called the Numil Seismic Province, between the two suggested suture zones. The paucity of isotopic data between the Mount Isa and Georgetown regions, however, means it is not possible to make any inferences about the age of the basement in that area.

3.3.3.3.3. Younger events along the margins of the NAE

Younger events are recorded along the eastern and southern margins of the NAE, in the Neoproterozoic to Cambrian Irindina Province (Hand et al., 1999, Maidment, 2005) within the Aileron Province (Arunta Orogen), in the dominantly Mesoproterozoic Musgrave Province (Central Australia Element; Smithies et al., 2010; Edgoose et al., 2004), and in the Georgetown region (related to the Tasman Orogen; Withnall et al., 1997). Few isotopic data are available for the Irindina Province and it is not discussed further. Trends in the Georgetown region are discussed in the Tasman Element though it is evident from the isotopic data that Paleozoic magmatism in that region (Figure 3.10, Figure 3.12) is derived from a mixture of reworked (Archean? and) Proterozoic basement and Phanerozoic crustal growth (as signified by the large range in T_{2DM}).

The Musgrave Province is dominated by ca. 1345–1290 Ma, ca. 1200–1160 Ma and ca. 1080–1030 Ma magmatism (e.g., Edgoose et al., 2004; Smithies et al., 2010). Isotopic signatures of this magmatism (Smithies et al., 2010; Wade et al., 2006) are very similar across the province. Similarly, as shown by Smithies et al. (2010), there is very little variation in model ages with decreasing age, at least prior to the ca. 1080 Ma Giles event (Smithies et al., in prep). The isotopic data fall into a small range of T_{2DM} (2110–1840 Ma), which slightly overlap with but are mostly more primitive than found in the Warumpi Province (Figure 3.11). This continues the southward trend from more evolved signatures within the Aileron Province (and Tanami and Tennant regions), to least evolved in the Musgrave Province (as noted by Wade et al. (2006) and Smithies et al. (2010)), through to the intermediate values found in the Warumpi Province. Wade et al. (2006) suggested, on the basis of the geochemistry and (relatively) primitive Nd signatures, and assumed ages of ca. 1.59–1.55 Ga, that the Musgrave Province formed in the early Mesoproterozoic within an island arc environment between the North and South Australian elements. Smithies et al. (2010), although questioning the classification and age assignment of many of the gneisses used in the Wade et al. study, agreed with the overall conclusions of Wade et al. (2006). The spread in isotopic data do suggest, however, as acknowledged by Smithies et al. (2010), the involvement of an older component. This may indicate older crust but possibly could reflect input of sediments, such as craton-derived sediments overlying the subducting slab (Wade et al., 2006; Smithies et al., 2010). The absence of older (pre ca. 1650 Ma) zircons in the igneous rocks of the Musgrave Province (e.g., Wade et al., 2006; Smithies et al., 2010) is the best evidence for its primitive nature and short pre-history.

3.3.4. South Australian Element

The South Australian Element (SAE; Myers et al., 1996; Cawood and Korsch, 2008; Huston et al., 2012) is comprised of the Archean to Mesoproterozoic Gawler Craton (e.g., Hand et al., 2007; Reid and Hand, 2012), the Paleo- to Mesoproterozoic Curnamona Craton (Conor and Preiss, 2008) as well as the Coompana Block (west of the Gawler Craton; Figure 3.13, Figure 3.14). Both the Gawler and Curnamona cratons have been subdivided into a number of geological domains (e.g., Ferris et al. 2002; Conor and Preiss, 2008; Figure 3.14). Large parts of both cratons underlie younger sedimentary basins. This includes the contact between the two cratons which are separated by the intervening (Neoproterozoic to Cambrian) supracrustal sequences of the Adelaide Geosyncline (Preiss, 2000; also called Adelaide Fold Belt) that relate to Rodinia break-up and subsequent orogenic events of the Tasman Orogen (e.g., Cawood, 2005). Numerous Sm-Nd isotopic data are available for the Gawler and Curnamona cratons, including Cowley and Fanning (1992), Turner et al. (1993a), Johnson and McCulloch (1995), Elburg et al. (2003, 2012), Swain et al. (2005, 2008); Budd and Skirrow (2007), Skirrow et al. (2007), Wade et al. (2007), Raveggi et al. (2008), Fraser et al. (2010), Payne et al. (2010), Szpunar and Fraser (2010), Howard et al. (2011), Wade et al. (2012) and Geoscience Australia unpublished (see Appendix B, Appendix C).

The SAE is bordered in the north and west by Proterozoic geological provinces of the Central Australian Element (CAE), specifically rocks of the (Late Archean-) Paleoproterozoic and Mesoproterozoic Albany-Fraser Orogen (e.g., Nelson et al., 1995) and the Mesoproterozoic Musgrave Province (e.g., Smithies et al., 2010; Figure 3.2). Large parts of the CAE and the SAE in these areas are under cover so it is difficult to make any supportable conclusions from the isotopic data on the nature of these boundaries and, as such, they are not discussed further. In contrast, the eastern and north-eastern part of the SAE not only abuts outcropping elements of the Tasman Element, but the SAE itself is overlain by components of the Tasman Element, particularly parts of the Adelaide Rift system related to Rodinia break-up (e.g., Priess, 2000). The SAE and Adelaide rift sequences were subsequently deformed by Delamerian events, and intruded by Delamerian and younger magmatism, related to the Tasman Element. Examples of the latter include Paleozoic magmatism within the Mount Painter Province, Curnamona Craton (e.g., Elburg et al., 2003, 2012). Paleozoic magmatism, with available isotopic data (Foden et al., 2002; Turner et al., 1993a; Hergt et al., 2007; Whelan et al., 2007) also occurs within the Tasman Element provinces close to the margin of the SAE (Figure 3.14), allowing the investigation of the SAE-Tasman Element boundary. Interestingly, osmium isotope data from mantle xenoliths in eastern South Australia and western Victoria (Handler et al., 1997), suggest that early Proterozoic basement extends some 400 km eastward from known outcrop in the SAE into western Victoria, below the Delamerian sections of the Tasman Element.

3.3.4.1. Gawler Craton

The Gawler Craton is unusual relative to other Australian Proterozoic blocks in that it not only records a large time-span (Figure 3.13), from the Mesoarchean (ca. 3.15 Ga; Fraser et al., 2010), through to the Mesoproterozoic (ca. 1.5 Ga), but also has rocks that bracket the Archean-Proterozoic transition (ca. 2.55–2.4 Ga), in addition to the more ubiquitous ca. 1.9–1.5 Ga ages (e.g., Hand et al., 2007; Reid and Hand, 2012). Rocks of ca. 2.8 Ga and ca. 2.0 Ga have also been recorded (Fanning et al., 2007; Fraser and Neumann, 2010). Felsic magmatism encompasses this time frame and Sm-Nd data are available for nearly all of these periods (Figure 3.13).

Given the large age range in geology, some complexity would be expected in the regional isotopic signatures. The regional pattern, however, is relatively simple (Figure 3.14) and corresponds reasonably well with the geology and geological domains as currently defined (e.g., Ferris et al., 2002). Three main features are apparent:

- Old T_{2DM} ages (ca. 3.4–3.3 Ga) are localised within the Spencer Domain, largely confined to the regions around the known outcrop of Mesoarchean rocks (Fraser et al., 2010). Model ages greater than 2.9 Ga expand this area of old crust into the neighbouring Cleve Domain.
- An arcuate zone of Archean model ages that correspond to (and overlap with) the known and inferred distribution of the late Archean-early Paleoproterozoic Sleaford and Mulgathing complexes (e.g., see Figure 2 of Reid and Hand, 2012). Although there is a lack of data along the margins of the Gawler Craton, particularly to the north and west, the shape of this zone is highlighted by the 2.65–2.45 Ga colour band on Figure 3.14.
- A young circular zone in the south-west with T_{2DM} less than 2.15 Ga, that essentially corresponds to the Nuyts Domain (Figure 3.14, Figure 3.15, Figure 3.16), and includes magmatism of the Tunkillia and St Peter suites, particularly the latter, which has juvenile isotopic signatures (Swain et al., 2008).

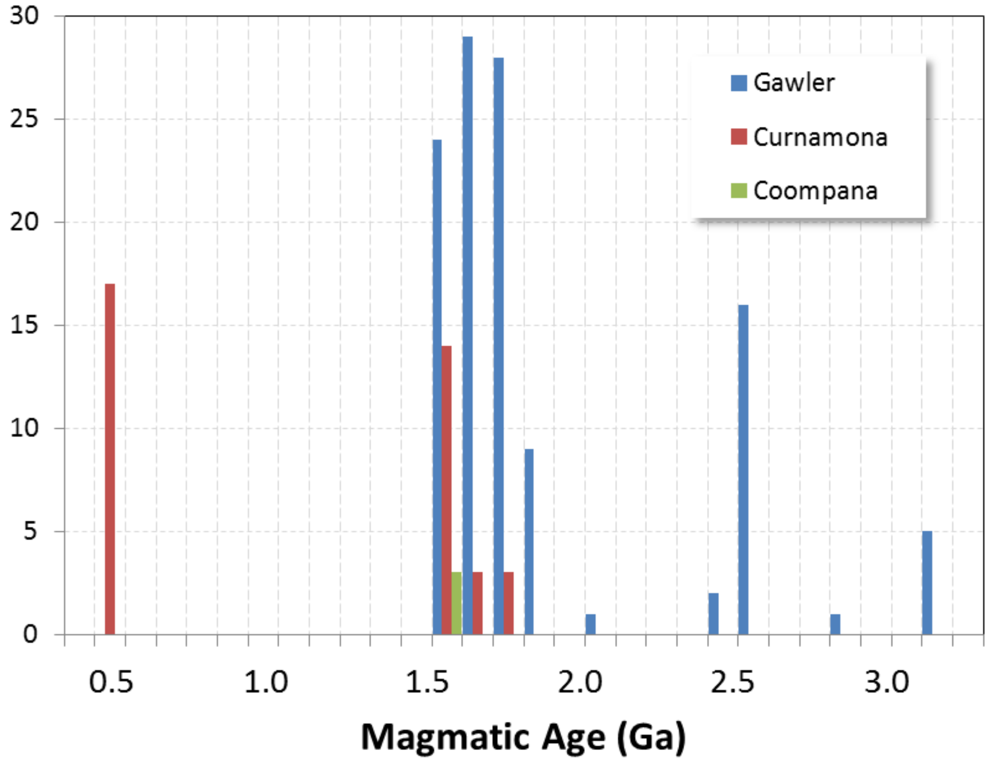


Figure 3.13 Histogram of ages of felsic igneous Sm-Nd samples from the South Australian Element (for the Gawler (115 samples) and Curnamona (37 samples) cratons, and Coompana Block (3 samples)). Total number of samples is 155, of which 22 are Archean, 114 Proterozoic and 17 Paleozoic.

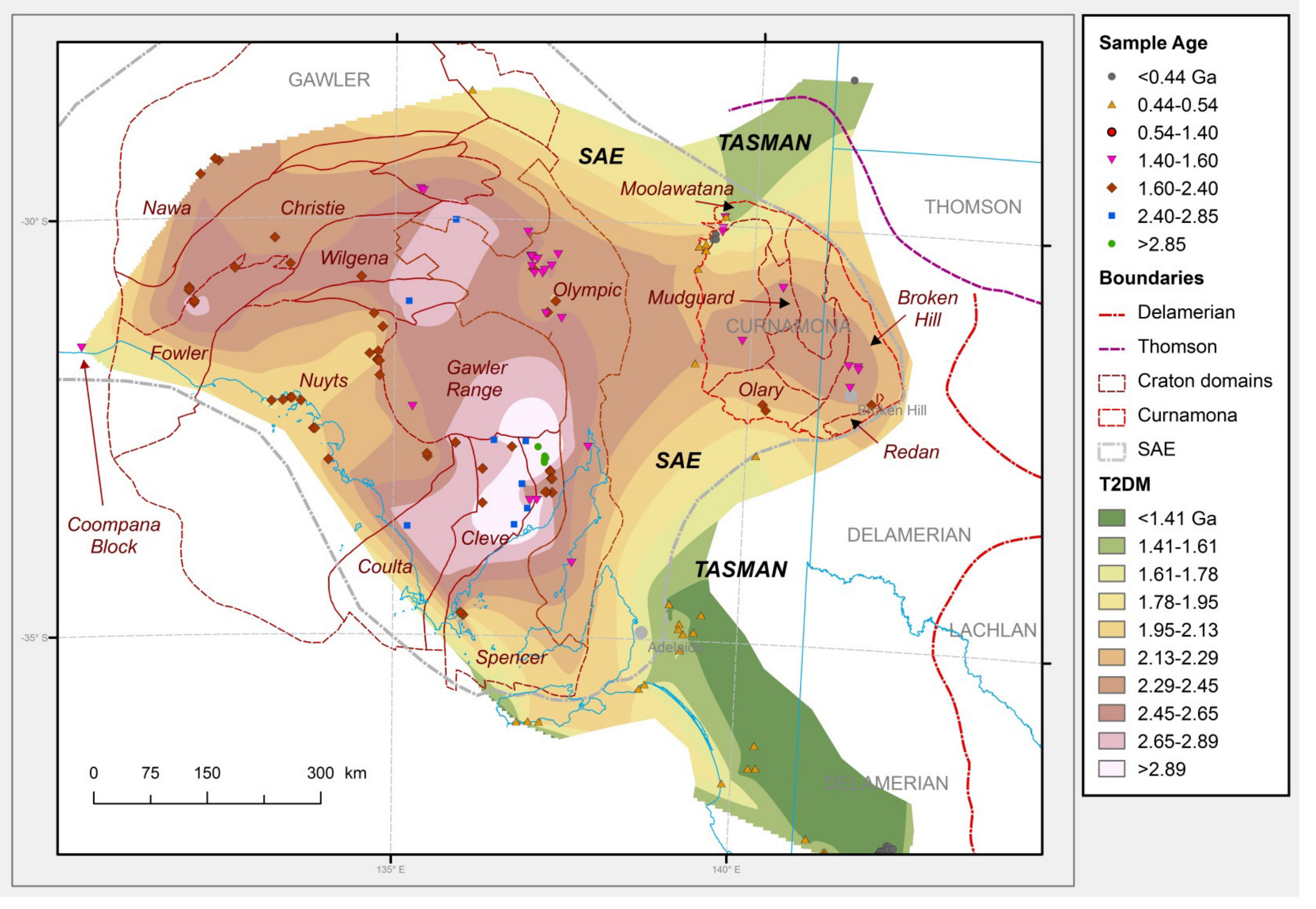


Figure 3.14 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for the South Australian Element (SAE) and surrounding Tasman Element. Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ARCMAP (see main text). Also shown are the Gawler and Curnamona cratons and their domains, and the Delamerian, Lachlan and Thomson orogens of the Tasman Element. Grid constructed from 155 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. These areas have been partially masked.

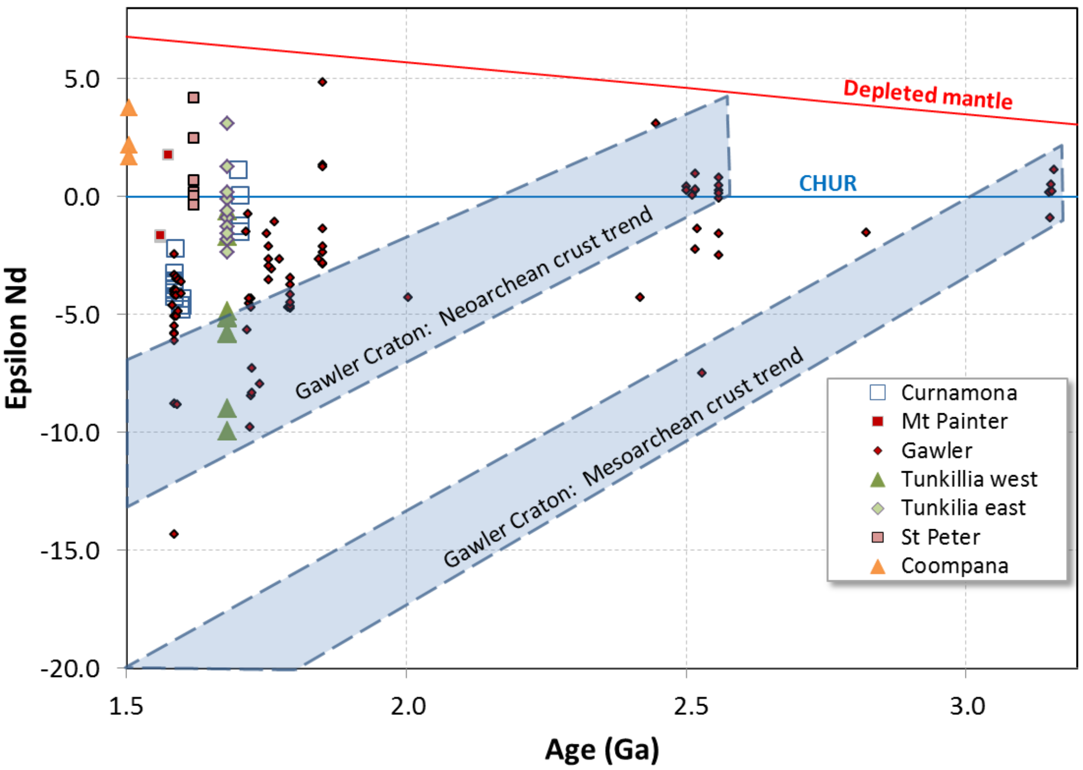


Figure 3.15 Magmatic age versus epsilon Nd (ε_{Nd}) for felsic magmatism of the South Australian Element (SAE). Data and data sources are listed in Appendix B and Appendix C. Note the spread in ε_{Nd} for late Paleoproterozoic and Mesoproterozoic aged rocks. Fields showing isotopic signatures of Gawler Craton Mesoarchean and Neoarchean granites through time are also shown.

It is evident from Figure 3.15 and Figure 3.16 that, with the exception of the Cleve Domain and perhaps the Coulta Domain, there is not a lot of evidence for the existence of, or requirement for, Mesoarchean basement outside of the region around the known outcrop in the Spencer Domain (Fraser et al., 2010). The spread in isotopic data for rocks of the Cleve Domain suggest a role for Mesoarchean basement, while the data for the Coulta Domain is more equivocal. The possible extension of Mesoarchean basement into the Cleve Domain is not without problems. For example, Fraser et al. (2010) recorded a change in seismic character across the boundary identifying seismically distinctive, and by inference, different basement in each domain.

Most of the isotopic data for the Gawler Craton are consistent with late Archean-early Proterozoic crustal growth and reworking of this during younger events, as noted by Reid and Hand (2012). Certainly, with the exception of Nuyts Domain rocks, all other felsic magmatism includes a component of late Archean-early Proterozoic crust. Conversely, the spread in isotopic signatures post 2.0 Ga indicate a not-insignificant role for Proterozoic crustal growth (Reid and Hand, 2012). At least some of this was contemporaneous with magmatism, e.g., as documented for the Hiltaba Suite (Budd, 2006), though models such as those of Mortimer et al. (1988) for Donnington granites invoking melting of a mafic underplate (plus or minus Archean basement), could also produce similar isotopic signatures.

The Nuyts Domain of the Gawler Craton is isotopically distinct from the rest of the craton, characterised by markedly lower T_{2DM} ages and higher ε_{Nd} (Figure 3.14, Figure 3.15, Figure 3.16). The domain is reasonably well defined in the both the north and east where sharp gradients are evident and, more importantly, correspond reasonably well to domain boundaries. This is particularly the case with the Nuyts/Coulta domain boundary (Figure 3.14). Interpretation of seismic reflection data (Fraser et al., 2010) has delineated a crustal-scale feature that is suggested to correspond to this boundary, consistent with the isotopic data. The isotopic nature of the Nuyts Domain is well illustrated by the isotopic behaviour of Tunkillia Suite granites. As demonstrated by Payne et al. (2010), there is a pronounced regional difference in isotopic signature in these granites with more primitive signatures confined to the eastern group (in the northern Nuyts Domain) and more evolved signatures in the Christie and Fowler domains (Figure 3.14, Figure 3.15, Figure 3.16). There is some argument to the tectonic environment of the Tunkillia Suite granites, particularly the possible role of subduction in their genesis (see discussion in Payne et al., 2010). As detailed in Payne et al. (2010) the chemistry of the granites is largely inconsistent with a subduction setting, although there is evidence in some (not all) of the granites for high pressure melting (in the garnet stability field) which could favour such a setting. The isotopic zonation is also consistent with a subduction setting with a north-dipping subduction zone to the south. Other interpretations, equally consistent with the isotopic data, are that the observed isotopic zonation records either a pre-existing zonation in the crust, perhaps from an earlier event, or is related to the amount of extension, i.e., a greater juvenile (mantle) component in the Nuyts Domain relative to other domains. The younger St Peter Suite magmatism (ca. 1620–1608 Ma) in the Nuyts Domain is characterised by isotopic signatures and geochemistry consistent with subduction (Swain et al., 2008). Certainly the St Peter Suite granites are amongst the most isotopically primitive of the felsic Gawler magmatism (Figure 3.15, Figure 3.16), and lack the more evolved end-members found in older Gawler Craton granites. The latter is not surprising given the evidence from the older Tunkillia Suite granites for relatively young crustal growth in this domain.

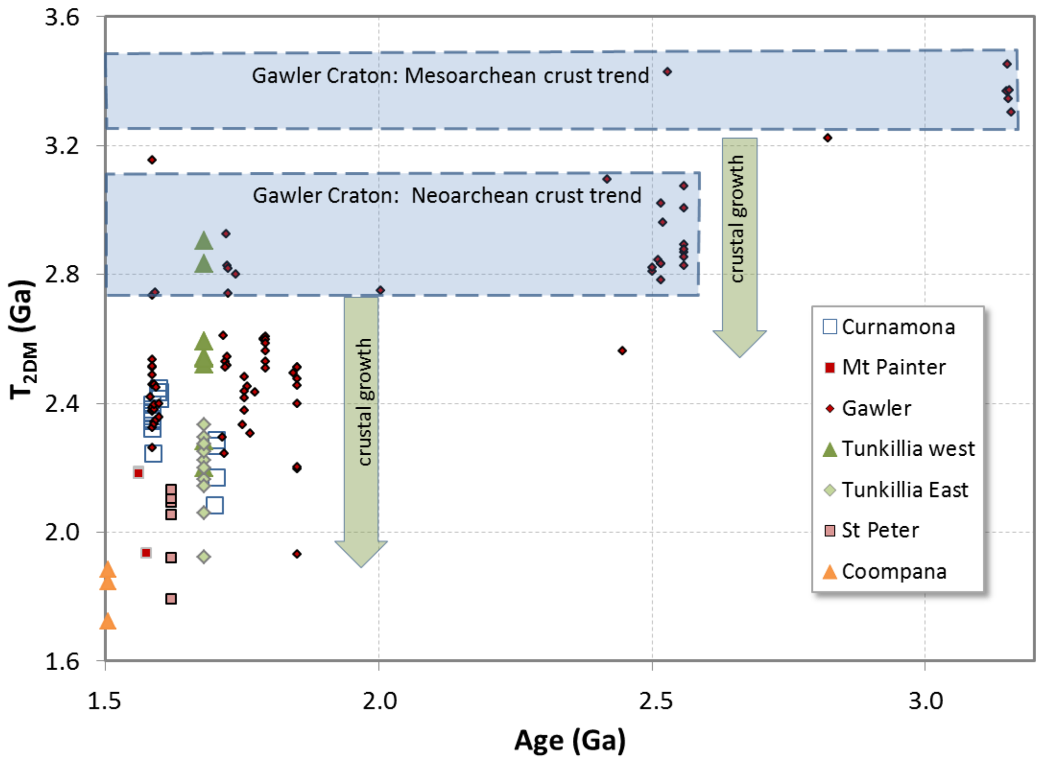


Figure 3.16 Magmatic age versus model age (T_{2DM}) for felsic magmatism of the South Australian Element (SAE). Data and data sources are listed in Appendix B and Appendix C. Note the spread in T_{2DM} particularly within the late Paleoproterozoic and Mesoproterozoic rocks. The data suggest a number of distinct crustal growth events, including one at ca. 3.15 Ga and another in the late Archean-early Paleoproterozoic, as well as younger events in the Nuyts Domain (St Peter and eastern Tunkillia suite granites) and the Coompana Block.

3.3.4.2. Curnamona Craton and surrounds

There are many papers on the geology and evolution of the Curnamona Craton (also called Curnamona Province), particularly on the Broken Hill region, and Burtt et al. (2004), Page et al. (2005a,b), and Conor and Preiss (2008) have produced syntheses of the province. Conor and Preiss (2008) subdivided the Curnamona Province into a number of domains, four of which—Mudguard, Moolatawana, Olary and Broken Hill—have available isotopic data (Figure 3.14). As documented by Conor and Preiss (2008, and references therein), Raveggi et al. (2008), Stevens et al. (2008), Elburg et al. (2003, 2012) and Wade et al. (2012), episodic intrusive and extrusive felsic magmatism has occurred in the province from ca. 1710 Ma to ca. 440 Ma. The earliest recorded magmatism—largely ~1720–1710 A-types (with some I- and S-types)—is recorded in the Olary and Redan domains (e.g., Conor and Preiss, 2008). Slightly younger S-type magmatism (ca. 1705-1685 Ma) occurs in the Broken Hill Domain (Raveggi et al., 2008; Stevens et al., 2008). Subsequent felsic magmatism, ca. 1595 Ma to 1555 Ma, occurs across the craton (e.g., Burtt et al., 2004; Conor and Preiss, 2008), as well as some alkaline magmatism (Rutherford et al., 2007). This is followed by a significant hiatus until the Paleozoic when Delamerian (ca. 500–485 Ma) and Benambran(?) (ca. 440 Ma) magmatism occurs within the Moolatawana Domain (Elburg et al., 2003).

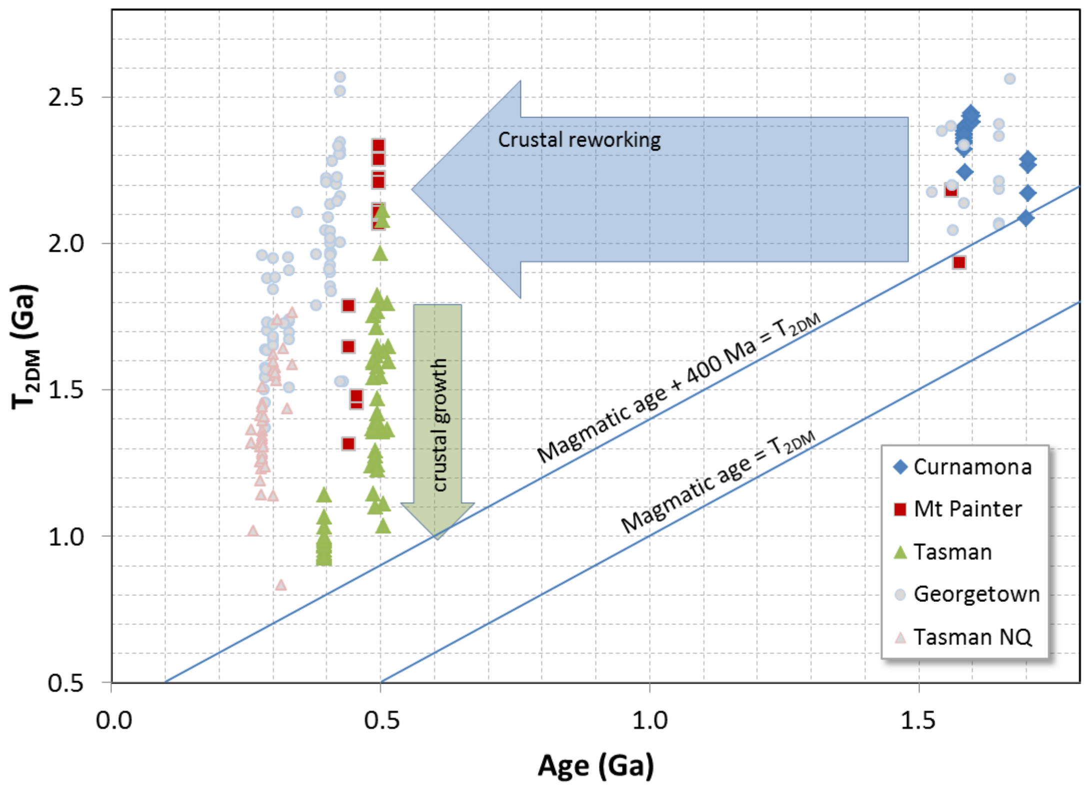


Figure 3.17 Magmatic age versus two stage depleted mantle model ages (T_{2DM}) for felsic magmatism in the Curnamona Craton and surrounding Tasman Element. Also shown (for comparison) are isotopic data for felsic Proterozoic and Paleozoic magmatism in the Georgetown region (North Australian Element) and the neighbouring Tasman Element in that region. Data and data sources are in Appendix B and Appendix C.

The wide range in magmatic ages (1.7 Ga to ca. 0.44 Ga) in the Curnamona Craton provides a snapshot of crustal growth in the region. Paleoproterozoic to Mesoproterozoic A- and I-type magmatism is characterised by a range of two stage depleted mantle model ages (T_{2DM} of 2.4–2.1 Ga; Figure 3.14, Figure 3.16) and ε_{Nd} values (Figure 3.15); essentially similar to many of Australia's Proterozoic provinces (see Figure 3.10). As discussed for the North Australian Element, these model ages do not rule out a late Archean component to the basement. They do, however, effectively rule out any older Archean components such as the Mesoarchean documented recently for the Gawler Craton (Fraser et al., 2010; Figure 3.14). These 2.4–2.1 Ga model ages extend to the early Paleozoic magmatism in the Mount Painter region suggesting (unsurprisingly) that a large component of reworked Paleoproterozoic crust was involved in the younger magmatism. The jump to less evolved (lower) T_{2DM} ages (and higher ε_{Nd}) in the ca. 440 Ma magmatism (Figure 3.17, Figure 3.18), however, clearly requires new crustal growth. The timing of the latter is not well constrained, and may have occurred one or more times between the late Paleoproterozoic and (juvenile addition) during granite formation at ca. 440 Ma. The range in observed T_{2DM} in the Mount Painter Paleozoic magmatism largely matches that found in similar aged magmatism in the Delamerian Orogen in the western part of the Tasman Element (Turner et al., 1992, 1993a,b; Foden et al., 2002; Hergt et al., 2007; Whelan et al. 2007; unpublished GA data; Kemp et al., 2009; Figure 3.13, Figure 3.17).

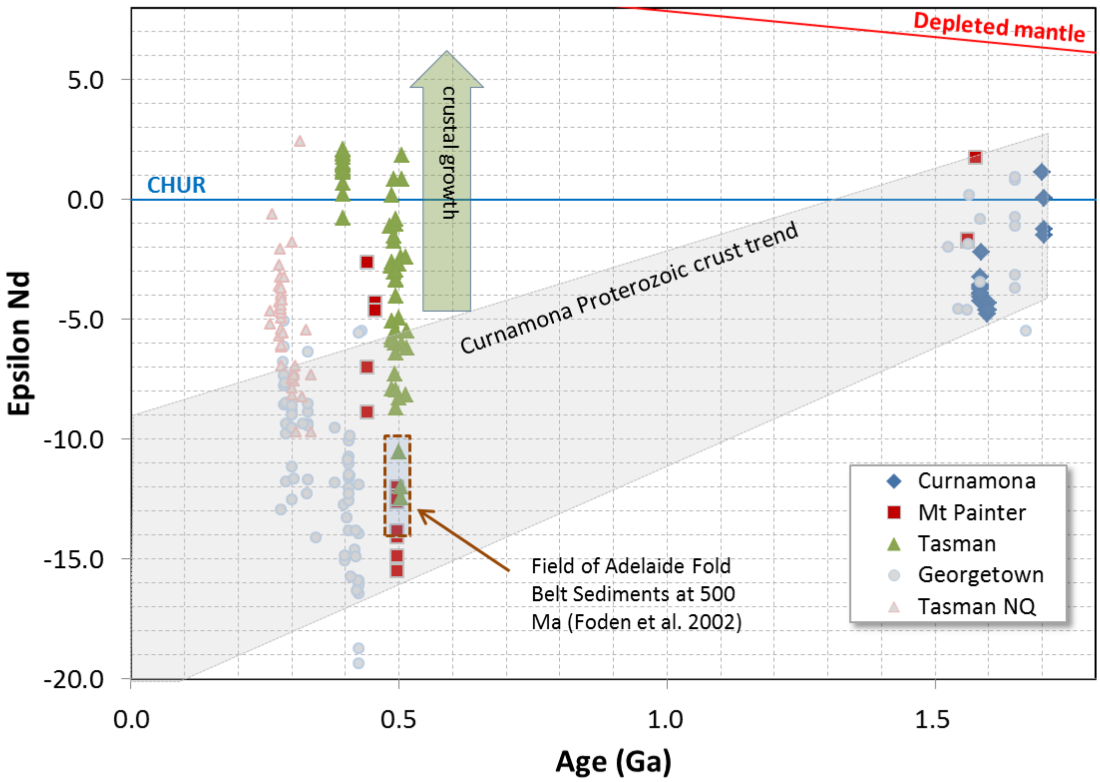


Figure 3.18 Magmatic age versus epsilon Nd (ε_{Nd}) for felsic magmatic rocks in the Curnamona Craton and surrounding Tasman Element. Also shown (for comparison) are isotopic data for felsic Proterozoic and Paleozoic magmatism in the Georgetown region (North Australian Element) and the neighbouring Tasman Element in that region. Data and data sources are in Appendix B and Appendix C. Tasman NQ = north Queensland portion of the Tasman Element.

The granites of the Delamerian Orogen highlight some of the difficulties inherent in interpreting isotopic data, particularly the potential role of sedimentary components (see Table 2.2). The granites in the south Australian and western Victorian parts of the Delamerian Orogen are largely intrusive into metasedimentary rocks of the Adelaide Fold Belt (in South Australia and western Victoria) and the sediments, or melts from them (S-type granites), have been suggested (e.g., Turner et al., 1993b; Foden et al., 2002; Kemp et al., 2009) to have interacted with juvenile mantle-derived melts (plus crystal fractionation) to produce the observed A-types granites (minimum crust input) and I-types (significant sediment/S-type melt interaction). The origin of these rocks is part of an ongoing wider debate on the relative contributions of juvenile melts and sediments to I-type granites in general (e.g., Chappell, 1996; Collins, 1996; Kemp et al., 2007, 2009; Clemens et al., 2011) and is not discussed further here. It does serve, however, to highlight potential pitfalls of using isotopic signatures to infer basement ages (see discussion in Section 2.5). Assuming the models of Turner et al. (1993b) and Foden et al. (2002) are correct, it is evident that the observed isotopic signatures in the western Delamerian granites are telling us little about the basement and most about the sediments and their provenance, which may or may not even be in Australia (see discussion in Preiss, 2000). The comparison between the Mount Painter and western Delamerian magmatism is informative. The former, being in Proterozoic basement, cannot have incorporated Delamerian sediments, and so the range in observed ε_{Nd} and T_{2DM} in those granites must either be inherited directly from the basement or reflect a mixed parentage (basement and juvenile input). In contrast, the isotopic signature of the western Delamerian granites may be informative or totally misleading, depending on the preferred petrogenetic model. The obvious message is that in geological provinces dominated by regions of extensive thick medium- to high-grade metasedimentary sequences, such as in the Delamerian and Lachlan orogens, caution should be used in interpreting model ages. One indicator of such geological regions is the common presence of granites with S-type affinities.

Finally it is worth pointing out that even in such terranes the granites can carry information on the nature of the crustal basement. Hergt et al. (2007) studied Devonian granites with A-type affinities in the Grampian-Stavely Zone of the Delamerian Orogen (east of the granites studied by Turner et al., 1993b and Foden et al., 2002). The chief result from this work was that those granites had a relatively homogeneous, isotopically primitive signature (e.g., ε_{Nd} of +2.1 to -0.8; T_{2DM} of 1.114–0.93 Ga), which Hergt et al. (2007) interpreted as being consistent with derivation from mafic to intermediate Cambrian basement rocks not unlike those exposed in the ca. 495 Ma Bushy Creek body (Whelan et al., 2007).

3.3.4.3. Comparisons with the Georgetown region

Parts of the SAE have a number of similarities with provinces in the eastern part of the NAE and various tectonic reconstructions place the Curnamona Craton near the Mount Isa Orogen (e.g., Giles et al., 2004; Gibson et al., 2012). As suggested by Gibson et al. (2008) there are, perhaps, more similarities in geology between the Curnamona Craton and the Georgetown region in the eastern NAE. More importantly, both the Curnamona Craton and the Georgetown region occur along the presently exposed eastern margins of the SAE and NAE (respectively), and both are bordered by and affected by elements of the Tasman Element, including Paleozoic magmatism. A comparison, therefore, is warranted in looking at the northern and southern extents of the interaction between the Tasman Orogen (e.g., Glen, 2005; Cawood, 2005) with the western margin of Australia as it was at Rodinian breakup time.

Comparisons of the Curnamona region (Curnamona Craton and neighbouring Tasman Element) and Georgetown region (Proterozoic Georgetown and neighbouring Tasman Element; Figure 3.17, Figure 3.18) show many similarities, including:

- Very similar isotopic and model age signatures for the Proterozoic rocks of both regions suggest that similar conclusions about the age of basement can be made for both regions, i.e., Paleoproterozoic and perhaps Archean. Reflection seismic data for the Georgetown region has been interpreted to suggest the presence of an older basement block in that region (Korsch et al., 2012) inferred to be Archean in age. Murgulov et al. (2007) reached similar conclusions regarding Archean basement in the Georgetown area, on the basis of Lu-Hf in zircon data.
- Felsic Paleozoic magmatism in both the Tasman Element and the Proterozoic Curnamona and Georgetown areas, record a very large range in ε_{Nd} and model ages (T_{2DM}), consistent with both reworking of Proterozoic (and possibly Archean) basement and juvenile crustal growth. The isotopic signatures of the Tasman Element granites in the Georgetown region are also potentially complicated by the presence of metasedimentary rocks (as in the Delamerian of southeastern Australia). Unlike their southern counterparts, however, the isotopic evidence from the S-type (and I-type) granites in northern Queensland indicate little significant involvement of, at least, the exposed metasediments (e.g., Champion and Bultitude, 2013a,b). As indicated by Champion and Bultitude (1994, 2013a,b) felsic magmatism in this area suggests the presence of Neoproterozoic to early (to middle) Paleozoic basement to the east of the Proterozoic Georgetown rocks, consistent with seismic data (Korsch et al., 2012); i.e., Paleo- to Mesoproterozoic basement does not continue eastwards to any great extent.

The isotopic data for both the southern and northern parts of the western margin of the Tasman Element clearly identify the old (rifted Rodinian) margin of Australia, and suggest this basement continues some way but perhaps not extensively under the Tasman Element, and highlights the Paleozoic crustal growth related to the Tasman Orogen in the Tasman Element (see also Kemp et al., 2009). This is not unexpected given the outcropping geology also suggests this, as highlighted, for example, in the idea, if not the actual location, of the Tasman Line (e.g., Direen and Crawford, 2003) and the many papers on the convergent margin nature of the Tasman Element (e.g., Gray and Foster, 2004; Cawood, 2005; Glen, 2005, 2013).

3.3.5. Tasman Element and Tasman Orogen

The Tasman Element (Cawood, 2005; Glen, 2005; Huston et al., 2012) is largely comprised of the Late Neoproterozoic to early Mesozoic Tasman Orogen, but also includes younger events related to the break-up of Pangaea and then Gondwana (see Veevers, 2004; Huston et al., 2012; Bryan et al., 2012), as well as intraplate and hot-spot related magmatism, chiefly in the Cenozoic (e.g., Johnson, 1989). Most focus in this section is on the Tasman Orogen, given the limited amount of Sm-Nd data for younger rocks.

The geology and tectonic development of the Tasman Orogen has been the focus of numerous studies, with a voluminous literature, including numerous orogen-based or more regional reviews (e.g., Murray, 1986; 1997; Murray et al., 1987; Coney, 1992; Seymour and Calver, 1995; Bain and Draper, 1997; Gray et al., 2003; Gray and Foster, 2004; Scheibner and Basden, 1998; VandenBerg et al., 2000; Veevers, 2004; Li and Powell, 2001; Crawford et al., 2003; Glen, 2005, 2013; Cawood, 2005). The focus of this research has led to a plethora of tectonic models, which, despite differences, tend toward a general consensus. As summarised by Cawood (2005; see also Glen, 2005; 2013; Champion et al., 2009 and references therein), the Tasman Orogen, part of his Terra Australia Orogen (TAO), encompasses:

- Rodinian-breakup (rifting) and formation of the Pacific Ocean and a passive margin; this also corresponds broadly to development of the Australian component of the Gondwana margin (e.g., Li and Powell, 2001; Cawood, 2005).
- Alternating extensional and convergent orogenic cycles commencing in the Cambrian and continuing through to the Mesozoic, resulting in accretionary growth. Orogenic events include the Cambrian Delamerian through to the Permian–Triassic Hunter-Bowen orogenies. These cycles effectively ended with cratonisation (terminal Gondwanide Orogeny of Cawood (2005) in the Late Paleozoic-early Mesozoic), with the main arc system moving further offshore (arc rollback; e.g., Collins and Richards, 2008).

The Tasman Orogen has been subdivided into a number of smaller orogens (originally called fold belts) including the Delamerian, Lachlan, Thomson, Mossman and New England orogens (e.g., Glen, 2005, 2013; Withnall and Henderson, 2012; Figure 3.20). Older (pre-Tasman) rocks are also present. These include outcropping basement blocks such as in the Western Tasmania Terrane (e.g., Berry and Bull, 2012, and references therein), as well as inferred basement blocks beneath the voluminous metasedimentary rocks of the Lachlan Orogen. Examples of the latter include the Selwyn Block in Victoria (Cayley, 2011; Cayley et al., 2002, 2011), thought to be the northern continuation of west Tasmania (Cayley et al., 2002; Cayley, 2011), and the recently proposed Hay-Booligal Block (see Glen, 2013).

These inferred blocks are contentious (though seismic data appear to support the existence of the Selwyn Block, e.g., Cayley et al., 2011), as is the more general question regarding the nature of the basement in the Tasman Orogen. Osmium isotopic data from mantle xenoliths in eastern South Australia and western Victoria (Handler et al., 1997), suggests that early Proterozoic basement extends some 400 km eastward from known outcrop in the South Australian Element into western Victoria, below the Delamerian Orogen. Interpretations of recent seismic data in western and central Victoria appear to support this (e.g., Cayley, 2011; Cayley et al., 2011). This situation appears to be the opposite for Tasmania, where Black et al. (2010) suggested, on the basis of different inherited zircons patterns in eastern and western Tasmanian granites, that felsic Proterozoic crust like the outcropping Delamerian and older rocks in the western two-thirds of the island (the Western Tasmanian Terrane of Berry and Bull, 2012), did not exist beneath the Lachlan-aged Paleozoic sequences in the east (Eastern Tasmanian Terrane of Berry and Bull, 2012). In general, however, both Proterozoic and/or oceanic crust basement have been inferred beneath the Lachlan (and other orogens; e.g., Chappell et al., 1988; Cayley et al., 2011; Glen et al., 2013). Much of the argument has centred on interpretation of the granites, their inherited components and their petrogenesis (e.g., Chappell et al., 1987, 1988; Chappell, 1996; Collins, 1996; Kemp et al., 2007, 2009; Black et al., 2010; Clemens et al., 2011; Clemens and Stevens, 2012).

Less is known about the basement beneath the Thomson Orogen, though Glen et al. (2013), following on from an earlier model of Harrington (1974) , have suggested much of that orogen is underlain by late Neoproterozoic to early Cambrian oceanic crust (called the Barcoo Basin by Harrington (1974)). Both Harrington (1974) and Glen et al. (2013) suggested the Barcoo Basin formed as a back-arc basin behind an interpreted rifted continental sliver of Precambrian age in the eastern part of the orogen. In the narrower Mossman Orogen in north Queensland, which, like the Lachlan Orogen, is largely comprised of extensive turbiditic sequences, granite studies and seismic data suggest the presence of Proterozoic and early Paleozoic basement (e.g., Champion and Bultitude, 1994, 2013b; Korsch et al., 2012). Even within the well-exposed New England Orogen there is some conjecture about the possible existence of Proterozoic basement. Evidence from mantle xenoliths (Powell and O'Reilly, 2007) and Hf model ages from granites (Shaw et al., 2011) have been used to suggest possible Neoproterozoic crust and lithospheric mantle in New England (also see discussion by Glen, 2013 also).

Numerous Sm-Nd isotopic data are available for the Tasman Element, for the Delamerian and Lachlan (McCulloch and Chappell, 1982; Turner et al., 1993a, b; Sun and Higgins, 1996; Foden et al., 2002; Hergt et al., 2007; Whelan et al., 2007; Kemp et al., 2009; Black et al., 2010; GA unpublished), New England (Hensel et al., 1985; Bryant et al., 1997; Allen, 2000; Allen et al., 1997; Champion and Bultitude, 2013a; GA-GSQ unpublished), and Thomson and Mossman orogens (Black and McCulloch 1990; Champion, 1991; Champion and Bultitude, 2013a, b; GA-GSQ and GSQ-Mark Fanning unpublished; see Appendix B, Appendix C). Additional unpublished and/or unlocated data is available, including Stolz (1995), McCulloch and Woodhead (1993), Kemp et al. (2002, 2009), and unpublished data of the Geological Survey of New South Wales. Samples cover the age range of felsic magmatism in the Tasman Element (520 to 100 Ma), though are biased towards the Carboniferous-Permian magmatism within the New England, Thomson and Mossman orogens (Figure 3.19). There are notable gaps in the isotopic coverage in the Lachlan, Delamerian and Thomson orogens. The widespread early to middle Cretaceous magmatism of the Whitsunday Volcanic Province (Whitsunday silicic large igneous province of Bryan et al., 2012) is also under-represented.

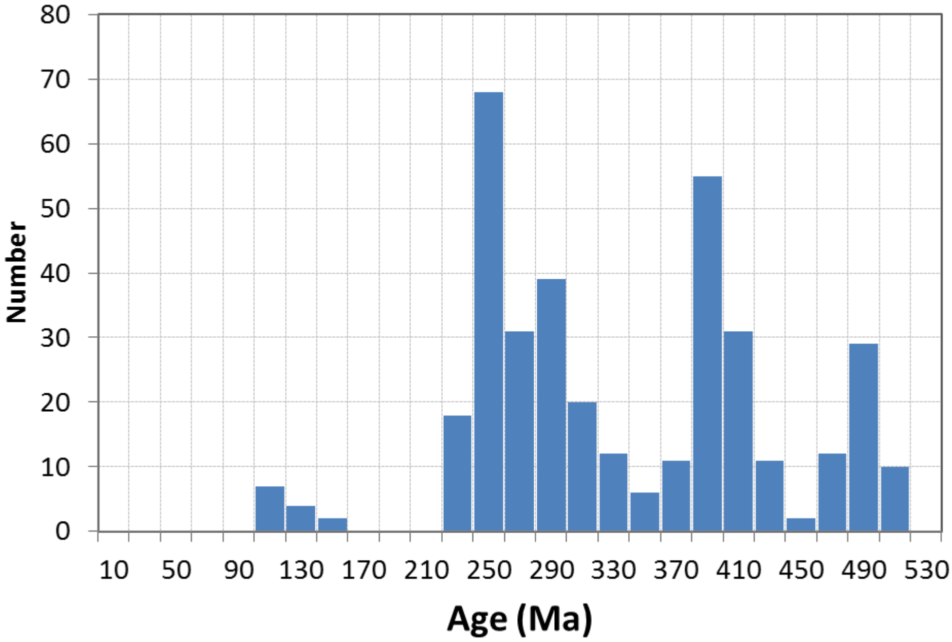


Figure 3.19 Histogram of ages of felsic igneous Sm-Nd samples from the Tasman Element (for the Delamerian (62 samples), Lachlan (78 samples), Thomson (58 samples), Mossman (35 samples) and New England (134 samples) orogens). Total number of samples is 367, of which 169 are Carboniferous to Permian, and 110 are Silurian to Devonian.

Regional variations of neodymium isotopic signatures within the Tasman Orogen have been previously discussed by Kemp et al. (2009) and more recently by Champion et al. (2010). Kemp et al. (2009) looked at isotopic patterns and implications for crustal growth across the southern Tasman Orogen, while Champion et al. (2010) focussed on the northern Tasman, particularly on the relationship of the New England Orogen to the rest of the Tasman Orogen. The two ends of the Tasman Orogen show generally similar behaviour, but with some important differences, in part related to geological variations. The southern Tasman Orogen essentially represents a complicated accretionary orogen (e.g., Gray and Foster, 2004; Glen, 2013) spanning over 800 km from the Delamerian margin to eastern Victoria. The northern Tasman Orogen, in contrast, is much narrower, with Cambrian–Ordovician, Silurian–Devonian and Carboniferous–Permian magmatism spatially associated with Mesoproterozoic magmatism, (for example, the Georgetown region, e.g., Richards, 1980). Champion et al. (2010) and Champion and Bultitude (2013a, b) showed that the isotopic evidence from the northern Tasman Orogen is consistent with the presence of Proterozoic-early Paleozoic basement in that region. Numerous papers have also documented Lu-Hf isotope variations within granites of the Tasman Orogen (e.g., Kemp et al., 2007, 2009; Shaw et al., 2011), results of which are applicable to the Nd-Sm systematics discussed below.

3.3.5.1. Tasman Orogen – isotopic signature of an accretionary orogen

The generally interpreted accretionary nature of the Tasman Orogen (e.g., Gray and Foster, 2004; Glen, 2005, 2013; Cawood, 2005) makes it an ideal place to investigate the isotopic signatures of accretionary orogens (such as in Kemp et al., 2009; Champion et al., 2010). The gridded T_{2DM} image for the Tasman Element and surrounds (Figure 3.20) shows a number of obvious features:

- There is a pronounced isotopic gradient from the exposed Paleoproterozoic to Mesoproterozoic (and Archean) crust in the Gawler/Curnamona and Georgetown/Isa regions, into the younger crust of the Tasman Element. This change corresponds reasonably well with the inferred boundary of the Tasman Line (used here as the inferred easternmost margin of Mesoproterozoic, and older, Australia, i.e., margins of the SAE and NAE). This is most clear for northern Australia where there are abundant data (e.g., Webb and McDougall, 1968; Black and McCulloch, 1990; Champion and Bultitude, 2013a,b). The picture is less convincing for southern Australia, though is hindered by the lack of data.
- East-west isotopic zoning is best illustrated by the isotopically-young New England Orogen, and the marked change in isotopic signature across the NEO boundary, as noted for example by Kemp et al. (2009) for the southern NEO and Champion et al. (2010) for the northern NEO.
- Additional zonation of Nd model ages is also evident in regions of the Tasman suggested to represent island arcs (Figure 3.20), i.e., the 'Netherwood arc' in the eastern Greenvale Province, north Queensland (e.g., Henderson et al., 2011), and the Macquarie Arc in the eastern Lachlan (e.g., Glen, 2005; Glen et al., 2012). Notably the Devonian Calliope-Gamilaroi Arc (also suggested to be an island arc, e.g., Murray, 2007) is not visible within the general New England sequence (Figure 3.20), again highlighting the isotopically juvenile nature of that orogen.
- On a broad scale the Lachlan and Thomson are not dissimilar, though the lack of widespread data for the Lachlan hampers this interpretation. Unfortunately there are also no data for central Victoria where the Proterozoic Selwyn Block is inferred (e.g, Cayley, 2011).

A number of more subtle features are also evident, including:

- The available data for the Thomson and northern Delamerian, although very limited (and of uncertain origin, i.e., may be S-type magmatism), suggests the presence of an embayment in the Qld-NSW-SA border area, mirroring the 'Larapinta Seaway' and the Tasman Line in that area (e.g., Webby, 1978). There is also some suggestion that the northern and southern Thomson may be zoned.
- In contrast, there appears to be insignificant east-west change in isotopic signature of I-type granites across Tasmania, i.e., little difference between T_{2DM} between granites of the Western and Eastern Tasmanian Terranes.

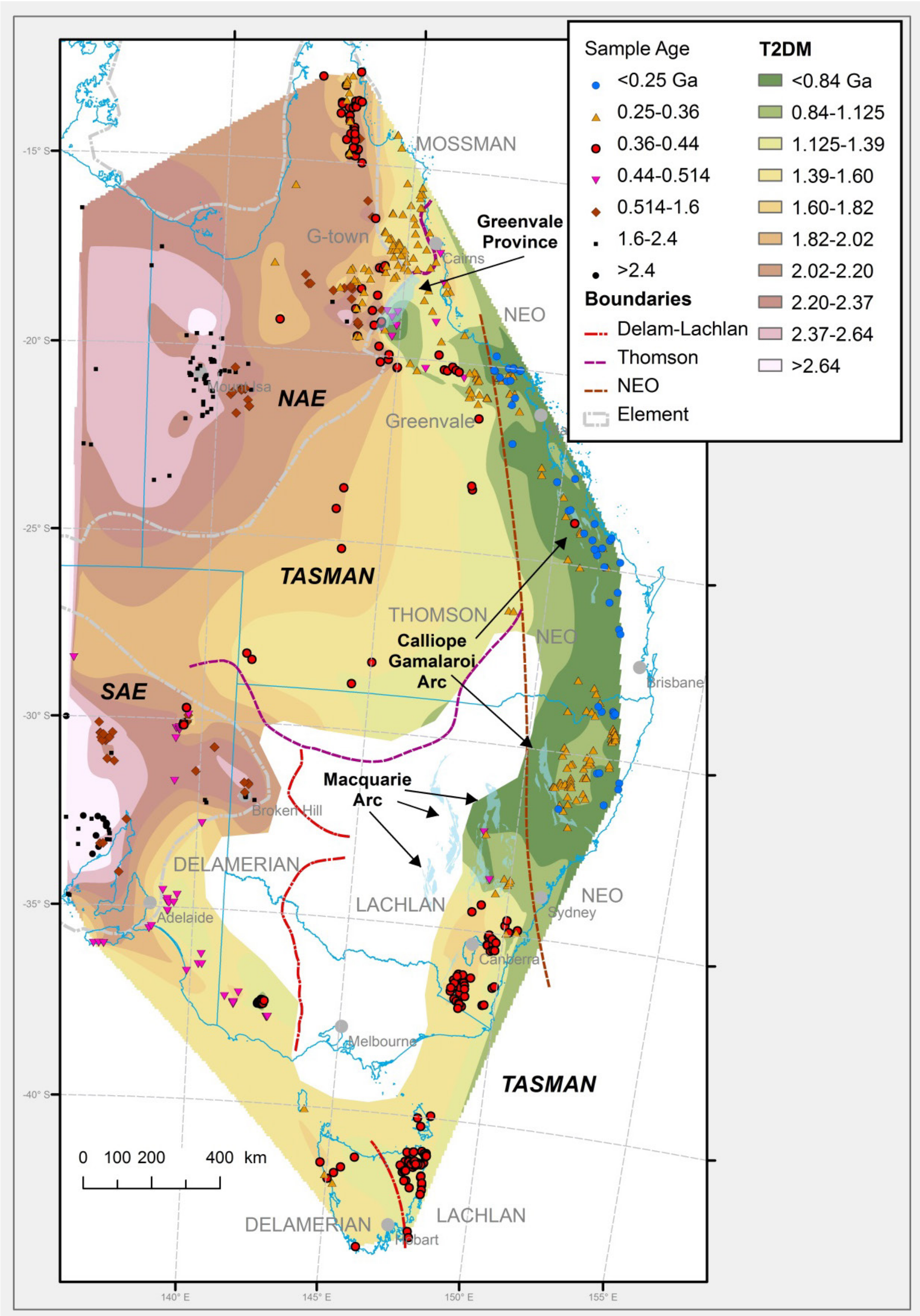


Figure 3.20 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for the Tasman Element and surrounding regions (South (SAE) and North (NAE) Australian elements). Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap® (see main text). Also shown are the Delamerian, Lachlan, Thomson, Mossman and New England (NEO) orogens of the Tasman Element, as well as, (in light blue shading), the current locations of interpreted island arc rocks, the 'Netherwood' arc in the Greenvale Province, and the Macquarie and Calliope-Gamilaroi arcs. Grid constructed from 635 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. These areas have been partially masked.

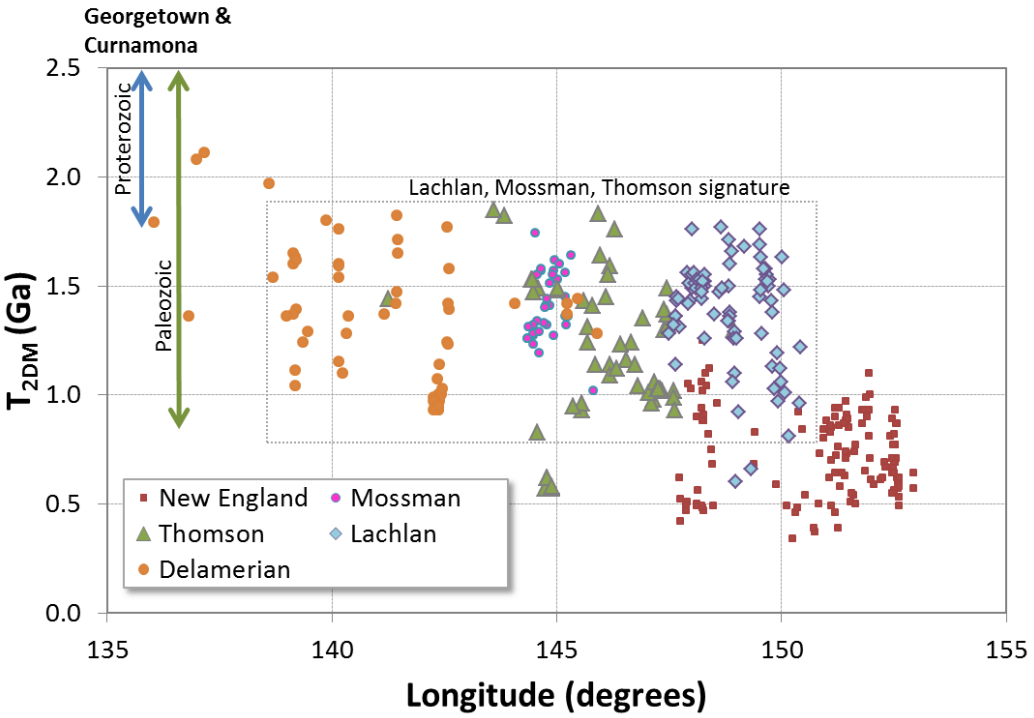


Figure 3.21 Longitude (degrees) versus two-stage depleted mantle model (T_{2DM}) ages for felsic igneous rocks of the Tasman Element. The data reinforce the easterly decrease in model ages evident in Figure 3.20. They also show a similar broad range of signatures in the Lachlan, Mossman and Thomson orogens. Data and data sources are in Appendix B and Appendix C.

- There also appears to be a region of slightly older material within the southern NEO. It is uncertain whether this is real or just an artefact, though Shaw et al. (2011) have suggested that a Neoproterozoic infracrustal source is required for one I-type supersuite in this region. Similarly, Powell and O'Reilly (2007) suggest Neoproterozoic mantle lithosphere in the region, based on Re-Os isotopes in mantle xenoliths. Powell and O'Reilly (2007) further suggested that this may be an example of where older mantle lithosphere has survived though the corresponding crustal portion has not.

The regional 'younging' (becoming more juvenile) of isotopic signatures in the Tasman Orogen (from west to east), support the earlier findings of Webb and McDougall (1968) and Kemp et al. (2009), and are consistent with an accretionary orogen (being built by roll-back from west to east with the progressive addition of juvenile crust). In a more recent study investigating variations and ranges of Hf isotope signatures (in zircons from detrital and magmatic sources), Collins et al. (2011) found that different types of orogens (circum-Pacific = accretionary versus Eurasian = dominantly collisional) could be discriminated on the basis of isotopic signature. In their work, the general accretionary signature was manifest by a trend towards more juvenile signatures with time (to more radiogenic Hf), similar to the Nd (and Hf) trends in the Tasman Orogen. Within the Tasman Orogen, especially the southern part, this trend towards more juvenile signatures is evident in both space and time (Figure 3.21, Figure 3.22 and Figure 3.23). Figure 3.21 shows that although there is a significant range in isotopic signatures within each orogen (indicating multiple components, either different protolith ages within the crust and/or mixing with juvenile magmas), there is a clear trend to decreasing maximum model ages from west to east. This decreasing trend in maximum model ages (T_{2DM}) is most apparent as two pronounced steps from the Proterozoic Curnamona and Georgetown regions (basically the old Rodinian margin), across to the Delamerian, Lachlan and Thomson orogens and then again from the latter orogens to the New England Orogen. The increasing juvenile signature is even more pronounced when model ages and ε_{Nd} are plotted against time (Figure 3.22, Figure 3.23). As noted by Kemp et al. (2009) for the New England Orogen, the culmination of this accretionary margin is dominantly comprised of juvenile continental crust with little isotopic evidence for significant older cratonic material, consistent with general tectonic models for its formation (late Devonian to early Triassic arc-backarc environment, e.g., see Korsch et al., 2009 and references therein). Champion et al. (2010) reached similar conclusions for the northern part of the orogen. Dating of detrital zircons in sedimentary rocks within the New England Orogen (e.g., Korsch et al., 2009) show essentially similar results, i.e., juvenile sediments sourced from within the orogen. These authors found material with a cratonic provenance, within quartz-rich sediments from the eastern parts of the accretionary wedge. Korsch et al. (2009) suggested, however, that these cratonic sediments were derived from the Australian interior (by longitudinal transport and breaching of the New England arc) and not from the New England Orogen itself.

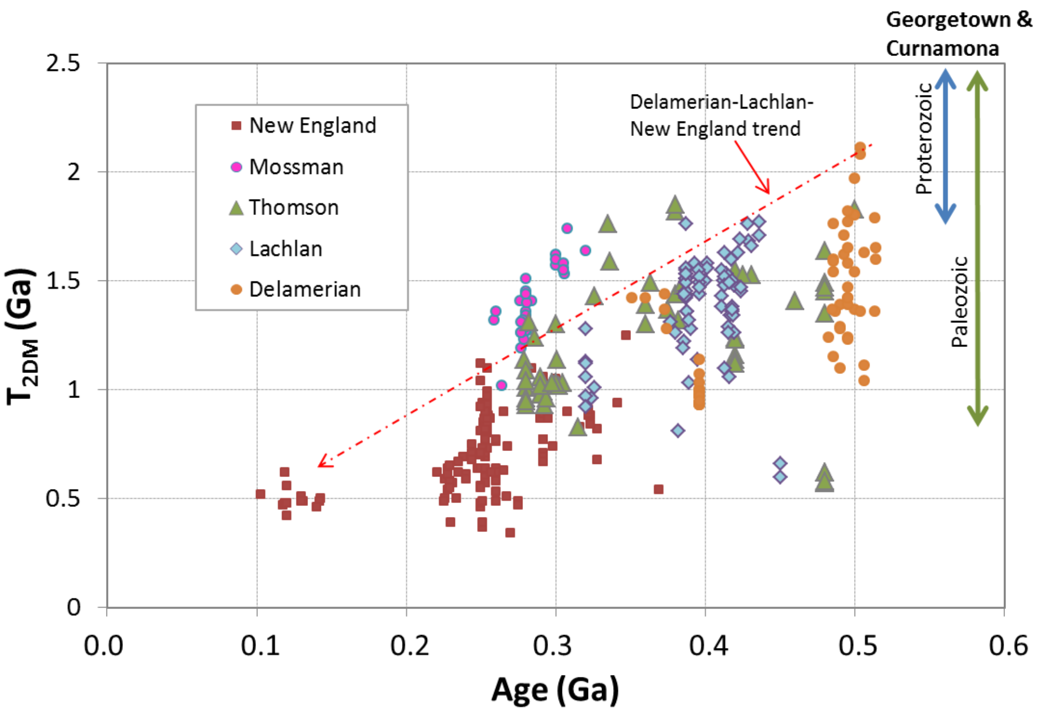


Figure 3.22 Two stage depleted mantle model ages (T_{2DM}) versus magmatic age for felsic magmatism in the New England, Mossman, Thomson, Lachlan and Delamerian orogens of the Tasman Element. Note the strong decrease of T_{2DM} with decreasing magmatic age, consistent with ongoing crustal growth during the Paleozoic. Also shown are the ranges of T_{2DM} for Proterozoic and Paleozoic felsic magmatism in the nearby Curnamona Craton and Georgetown region. Data and data sources are in Appendix B and Appendix C.

Also observable within the isotopic data is an apparent change in isotopic signatures from north to south. This is evident in Figure 3.23 which basically shows that the northern (and possibly the western) Thomson Orogen and the Mossman Orogen tend to have more evolved isotopic signatures. This change coincides with a marked narrowing of the Tasman Orogen in the north, such that rocks of similar age to those in the New England Orogen have been emplaced close to and within Paleoproterozoic-Mesoproterozoic (and older?) basement (of the NAE; Figure 3.20). On the basis of granite geochemistry and isotopic signature, Champion and Bultitude (1994, 2013b) suggested Neoproterozoic-early Paleozoic rocks formed basement to the Mossman Orogen. Figure 3.23 would suggest that this may also be the case for the northern Thomson Orogen, consistent with interpretations of recent seismic data in that region (Korsch et al., 2012). This may also be the case for the western Thomson though only two samples are available.

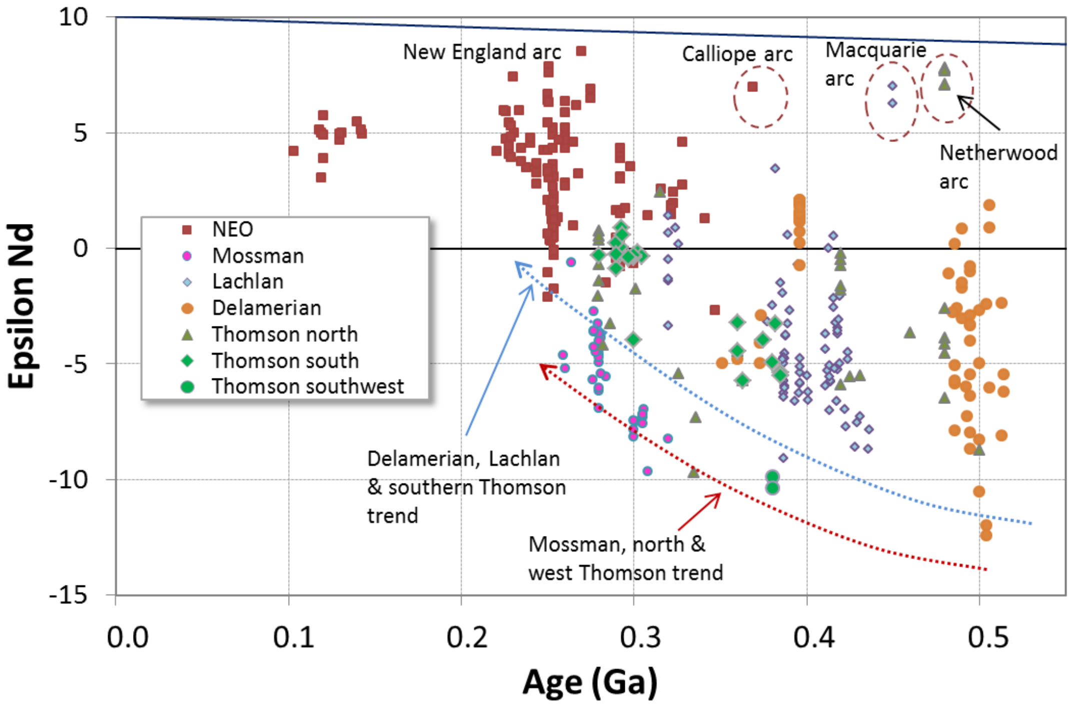


Figure 3.23 Epsilon Nd (ε_{Nd}) versus magmatic age for felsic magmatic rocks of the Tasman Element. The Thomson Orogen samples have been divided by geography (south, southwest and north). The southern Thomson samples plot with the Delamerian and Lachlan orogens; the northern and southwestern Thomson samples extend to more evolved signatures and more closely resemble samples from the Mossman Orogen. Samples from the Mount Windsor region (northern Thomson; data from Stolz, 1995) are also shown. Also note the very juvenile signatures in felsic magmatic rocks of the 'Netherwood' arc (Thomson Orogen), Macquarie Arc (Lachlan Orogen), Calliope Arc (New England Orogen), and New England Orogen. Data and data sources are in Appendix B and Appendix C. Pink and blue dotted lines represent the secular change in maximum ε_{Nd} values for rocks of the Mossman/northern and southwestern Thomson, and Delamerian/Lachlan/southern Thomson, respectively.

Kemp et al. (2009) also documented secular within-cycle changes of isotopic signatures with signatures becoming more juvenile. These changes were noted for the Delamerian and Lachlan orogens and were matched by switches in magmatism, from S-type to I-type to A-type, suggested to be related to switches from compressional to extensional tectonic environments. While this certainly appears to be the case for regions within these orogens, it is evident that this is not the case for orogens in general, as Kemp et al. (2009) themselves noted. For example, it is not the case for the New England Orogen, though this appears to be because that orogen experienced a number of extensional-compressional switches. For example, Phillips et al. (2011) showed a broad relationship between the juvenile Hf isotopic signature in granites and interpreted tectonic setting. As shown by Champion and Bultitude (1994, 2013a,b) Permian magmatism in the Mossman Orogen shows no such secular changes in isotopic signature, or changes with magmatic type, as there is no difference between the Nd isotopic signatures of I-type and S-type magmatism in that region. As indicated by Kemp et al. (2009), while the switch to A-type magmatism often (not universally) involves a more juvenile signature, in most orogens (with perhaps the exception of the southern Delamerian, e.g., Turner et al., 1993a,b), the volume of A-types is minor and the contribution of this juvenile addition to continental growth is also minor. The Lachlan Orogen, for example, is suggested to contain only a small percentage of A-type magmatism (<1% based on surface outcrop figure in Chappell et al., 1990). The greatest contribution to crustal growth in the Tasman Orogen is related to I-type (and also as a potential component of S-type) magmatism.

3.3.5.2. Ambiguous isotopic signatures: examples from Tasmania and Bega

The geology of Tasmania has been divided into a number of tectonic elements that have been grouped into two terranes: a dominant (Mesoproterozoic–) Neoproterozoic–Paleozoic West Tasmanian Terrane (comprising two-thirds of the island) and the early-middle Paleozoic turbidite-dominated East Tasmanian Terrane (e.g., see Seymour and Calver, 1995; Berry and Bull, 2012). Tectonic models for the island suggest that an island arc collided with, and accreted onto, the West Tasmanian Terrane in the Cambrian, with related ophiolite emplacement (Crawford and Berry, 1992). The location of the neighbouring East Tasmanian Terrane in the early-middle Paleozoic is uncertain. Detrital zircon data from sediments in northeastern Tasmania indicate no apparent provenance from western Tasmania, leading Black et al. (2004) to suggest that the two Tasmanian terranes were separate at this time. In this interpretation, the two terranes may have come together during the Tabberabberan deformation (ca. 388 Ma; Black et al., 2004, 2005). Certainly the two terranes were together by this time as the whole island is intruded by Devonian (-earliest Carboniferous) granites (Black et al., 2005). Basement to the East Tasmanian Terrane is also uncertain. Black et al. (2010) extensively studied the Tasmanian Devonian granites and showed that there was little apparent difference in Nd isotopic signatures of the granites between the two terranes, which in the simplest interpretation would suggest little basement difference between the two terranes.

Black et al. (2010), however, highlighted the complexity of the Tasmanian granites and suggested the presence of multiple components, including a strong sedimentary component (based on similarity of inherited zircon patterns with local metasedimentary sequences). If correct, then the isotopic signatures of the Tasmania I-type granites do not reflect the 'age' of any crustal source but rather represent mixing of a number of components, including local sedimentary rocks. Black et al. (2010) did suggest, however (largely on the basis of inherited zircon data) that there was no evidence for felsic Proterozoic basement in the East Tasmanian Terrane (although they could not rule out a mafic basement).

The lack of significant change in Nd model ages across Tasmania is interesting and would appear (at first glance) to support the work of Black et al. (2010). The Nd isotopic data for the Tasmanian granites, however, are intriguing. Model ages show that the most evolved I-type granites are actually in the east, not the west (Figure 3.24). This is despite the fact that the Nd data for S-type granites (and by inference sedimentary sequences that they were derived from or strongly interacted with) in eastern and western Tasmania (Black et al., 2010) show the opposite, i.e., distinctly more evolved in the west than the east (Figure 3.24). In addition, Black et al. (2010) established a clear distinction in the pattern of inherited zircons in eastern and western Tasmanian granites, including the presence of ca. 1.6 Ga inherited zircons in the western granites which were absent from the eastern granites (part of the evidence they used to discount the presence of felsic Proterozoic basement beneath eastern Tasmania). In support of their arguments, samples from exposed metasedimentary sequences (Black et al., 2010) show generally similar model ages (ca. 2.0–1.9 Ga) east and west, though are more variable in the west. The presence of similar model ages across Tasmania is also not supportive of the proposed tectonic model of Black et al. (2010), i.e., an east facing subduction zone and arc in the western part of the East Tasmanian Terrane. Notably, however, the internal isotopic zonation (oldest model ages in the east; Figure 3.24) observed within the East Tasmanian Terrane is consistent with their model.

There is no simple resolution to these conundrums. In addition to the valid interpretations of Black et al. (2010), the available data could also be interpreted to suggest that either there is no east-west break across the Tasmanian deep crust, despite the identified differences at the surface (e.g., Berry and Bull, 2012), or even that there exists older basement in the very eastern part of Tasmania (east of ~147.7 degrees; Figure 3.24). The Nd signatures in Tasmania do, however, highlight the potential ambiguities in interpreting the nature of basement from petrogenetic models for granite genesis, and more specifically regarding the nature of the deep crust in Tasmania (and in general).

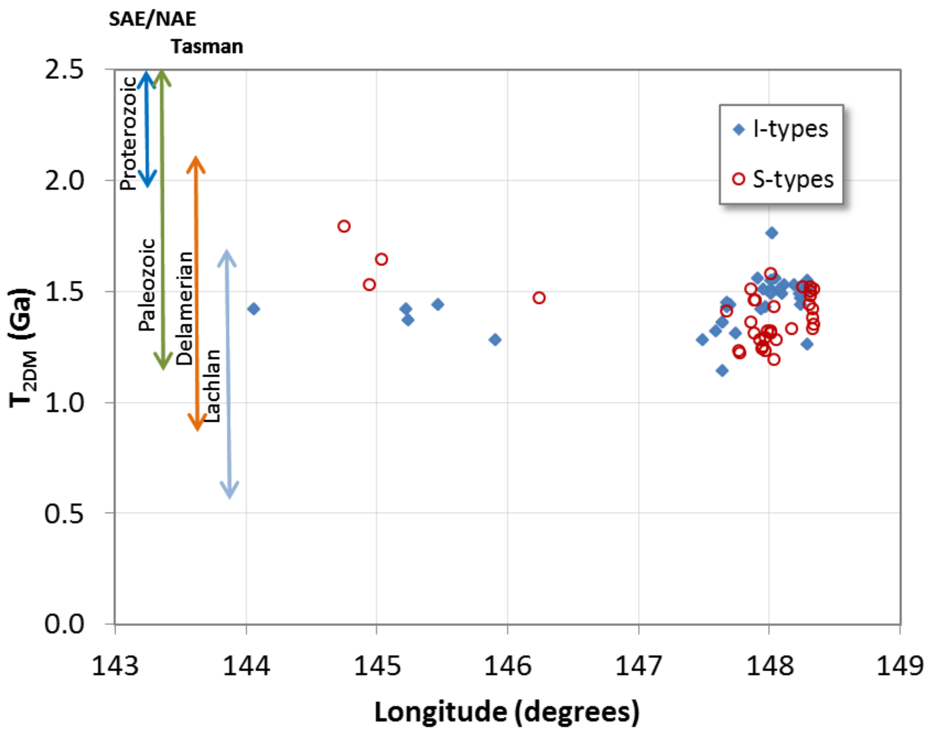


Figure 3.24 Two stage depleted mantle model ages (T_{2DM}) versus longitude for Paleozoic I- and S-type granites of Tasmania. The range of T_{2DM} for Proterozoic and Paleozoic felsic magmatism in the Curnamona and Georgetown regions (SAE/NAE), and for felsic magmatism from the Delamerian and Lachlan orogens are shown for comparison. Tasmanian data primarily from Black et al. (2010); other data and data sources are given in Appendix B and Appendix C.

Isotopic complexity and how to interpret it is well illustrated in the Bega Batholith, eastern Lachlan Orogen. This large batholith (~9000 km^2) is characterised by pronounced east-west gradients in granite geochemistry and isotope signature (e.g., Chappell, 1996; Williams et al., 2011; Figure 3.25). Furthermore, there is little significant north-south chemical or isotopic variation. For example, Williams et al. (2011) point out that the Glenbog Suite (comprising 12 separate plutons), although never more than 10 km wide, runs north-south over nearly 300 km. Numerous models for genesis of these granites, and their chemical and isotopic zonation, have been proposed. Although all models favour multi-component sources for the batholith—a clear requirement of the chemical and isotopic zonation—considerable controversy revolves around the nature of these multi-components. Models range from crustal melts that largely image their source, i.e., melting a crust that must in itself be chemically and isotopically zoned (e.g., Chappell et al., 1987; Chappell, 1996; Williams et al., 2011), through to two- or three-component mixing models involving crustal, mantle and metasedimentary components (e.g., Collins, 1996; Kemp et al., 2007, 2009), i.e., the chemical and isotopic zonation reflects mixing. Whole rock Sr and Nd isotopic data show little within-pluton variation despite the marked east-west variation (e.g., ε_{Nd} ranges from +4.3 to -8.7, $^{87}Sr/^{86}Sr$ ranges from 0.704 to 0.709; Williams et al., 2011), suggesting that there was either little in-situ mixing, or perhaps very efficient mixing.

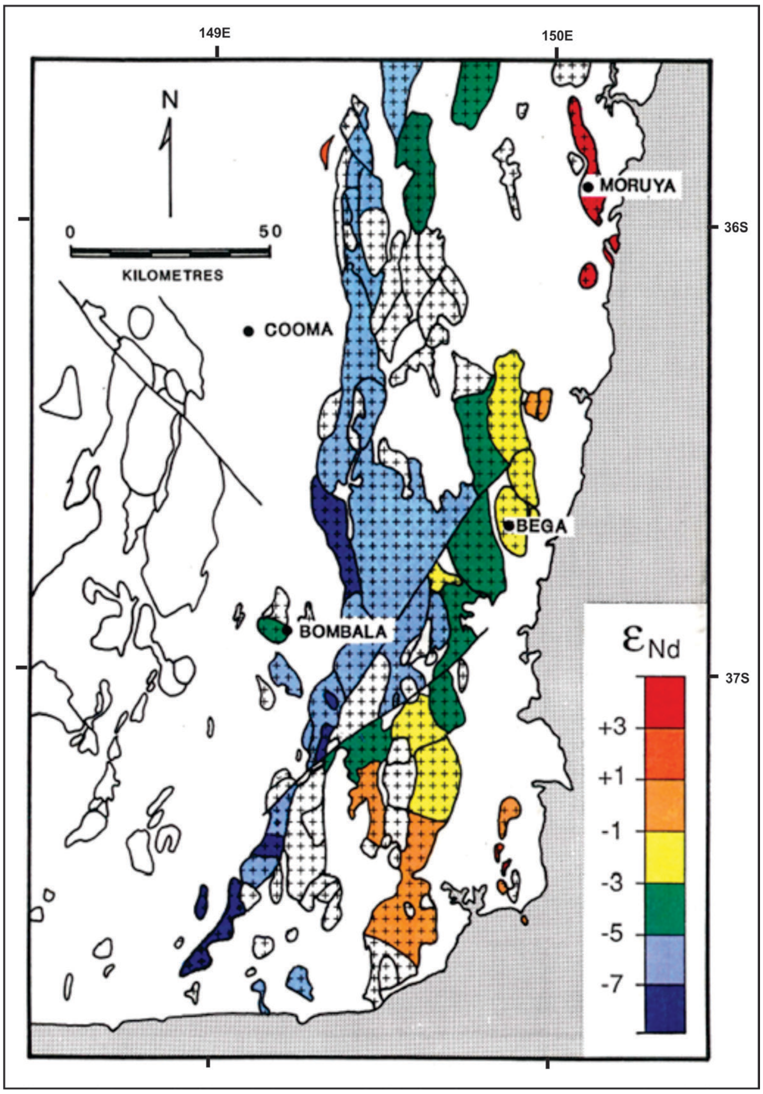


Figure 3.25. Neodymium isotope signatures of the granites of the Bega Batholith (+ symbol), southeastern New South Wales, showing the strong east-west zonation in epsilon Nd. Figure from Chappell et al. (1990).

While there is clear field evidence for at least some mixing, the argument centres on the relative contributions of these respective processes. Kemp et al. (2007, 2009), studying Hf and O (in zircon) isotope data from these (and other Lachlan) granites, found correlated $\delta^{18}O$-ε_{Hf} signatures within individual granites, providing evidence for a high $\delta^{18}O$-low ε_{Hf} sedimentary component and a low $\delta^{18}O$ – high ε_{Hf} end-member component (crustal melt and/or mantle melt). More recent work by Williams et al. (2011; I. Williams, pers. Comm., 2013), in contrast, found a very narrow range of both oxygen and Hf isotope (in zircon) signatures within individual plutons of the batholith, and a close correlation between Hf signatures (in zircon) and whole rock Nd signatures, lending support to models favouring source variations and not mixing. Whilst these results do not unequivocally rule out mixing, it requires (for those samples analysed by Williams et al., 2011) that any mixing must have occurred very efficiently prior to zircon crystallisation. This latter requirement appears to be contrary to current popular models that argue for assembly of granite plutons by multiple intrusions of small magma batches (e.g., Michaut and Jaupart, 2011).

The Tasmanian and Bega Batholith arguments represent a snap shot of the current picture of debate regarding granite genesis and the causes of chemical (and isotopic variation), and by extension, what the isotopic signature of such rocks actually means. As discussed, much of this ambiguity relates to both the potential complexity of felsic magmatic systems and the interpretation of such complexity. This is especially the case for multiple components, e.g., crustal melts ± other crustal melts, mantle melts, sedimentary material, which will modify the primary isotopic signature. Clearly all processes operate to some degree. The increasing literature on Lu and O isotopes mostly point to a range of isotopic signatures within zircons within individual granites, commonly interpreted as resulting from mixing and/or assimilation. Most controversy presently revolves around the relative importance of these multi-components. Current models range from crustal melts that largely image their source (i.e., mixing and other processes are considered minor), through to two- or three-component mixing models involving crustal, mantle and metasedimentary components (i.e., the chemical and isotopic zonation largely reflects mixing). Recent model for granite genesis by Stevens et al. (2007), Clemens et al. (2011) and Clemens and Stevens (2012), for example, argue for a strong crustal control in their genesis, with other processes only ancillary to that. Presumably both end-member (and other) processes occur to varying degrees (see Clemens and Stevens, 2012); deciding which is dominant in individual granites or regions will require individual studies. As the Bega Batholith examples show, however, even this may not resolve the arguments.

In many cases this will not be important to interpretation of the Sm-Nd data, e.g., a change to a more juvenile signature is indicative of young crustal growth irrespective of whether it was (slightly) earlier than the magmatic event or contemporaneous, either as reworked crust or direct mixing with a mantle melt. Most difficulty with interpretation arises from the involvement of sedimentary components (section 2.5). This is particularly the case where the sedimentary component may not be locally derived, thus providing a signature not of the local crustal block but of the ultimate provenance of the sediments. This potentially misleading isotopic signature was the reason Sm-Nd data from S-type granites were not used in the present work, even though it is evident that in certain areas the Sm-Nd isotopic signatures of co-existing I- and S-types magmatism are similar, e.g., the New England Orogen (Hensel et al., 1985), and the Mossman Orogen (Champion and Bultitude, 2013a, b). The potential involvement of sedimentary material is also, however, of some concern to other felsic magmatic types. It also means, therefore, that Nd data from magmatic rocks should be interpreted with caution in regions with widespread thick metasedimentary sequences, such as in the Tasman Element, or where S-type granites are present. This is a good example of where the use of other isotopic systems, especially oxygen isotopes (in zircon and whole rock; see section 6.3), would directly benefit the interpretation of whole rock Sm-Nd data (and Lu-Hf zircon data).

4. Revised crustal growth curve for Australia

4.1. Australian Nd growth curves versus the magmatic record

McCulloch (1987) presented a crustal growth curve for the Precambrian component of Australia (Figure 4.1), based on Nd model age data. McCulloch (1987) highlighted three periods with high crustal growth rates, at ca. 2.7 Ga, ca. 2.2 Ga, and ca. 1.8 Ga, as well as a (smaller) peak at ca. 3.6 Ga. The largest peak, at ca. 2.2 Ga, accounted for ~25% of the crustal growth of the Australia continent (Figure 4.1). Significant amounts of new Nd isotope data have become available since the compilation of McCulloch (1987). This expanded data set has allowed new crustal growth curves to be calculated, not just for Australia but individually for the six crustal elements (Figure 4.1). New crustal curves were calculated using all available Sm-Nd data for all mafic to felsic igneous rocks (excluding S-types). Model age histograms (based on 100 Ma intervals) were calculated for individual geological terranes (where sufficient data were available). Growth curves were then calculated for crustal elements and for Australia, using weighted (by surface area) averages of the constituent geological terranes and elements (full details are outlined in Appendix D). Results for individual crustal elements and for Australia are shown in Figure 4.1, along with the previous results of McCulloch (1987), as well as growth curves based on outcrop. Curves for individual elements broadly conform to the known geology and show that early crustal growth was mostly confined to the WAE, followed by the SAE, NAE, then CAE and Pinjarra, with voluminous Paleozoic and younger growth largely confined to the Tasman Element.

Although both the new Australian curve and that calculated by McCulloch (1987) share overall similarities, there are a number of differences and one significant similarity. Firstly the new Australian curve shows a more even growth-rate for the continent, which may partly reflect the much larger data set now available. If taken at face value, Figure 4.1 shows that 20% of the Australian continent had formed 3 billion years ago, 40% by 2.5 billion, 60% by 2 billion and ~75% by 1.5 billion years ago. Given the differences in the methodology used for model age calculations (see Appendix D), McCulloch's 2.2 Ga peak largely corresponds to the 2.6–2.3 Ga peak defined by the new data. The latter time period, although slightly larger than the 200 Ma interval used by McCulloch, corresponds to ~21% of the Australia crustal growth (compared with the background rate of ~10% per 300 Myr period), surprisingly similar to that of McCulloch (1987) for this Paleoproterozoic peak.

To help interpret the new crustal growth curve and the observed 2.6–2.3 Ga peak, it is instructive to compare this curve with histograms of both geological and magmatic ages for Australia. Figure 4.1A shows the age distributions of all outcropping rocks, all outcropping magmatic rocks and all outcropping felsic magmatic rocks in Australia (based on Raymond et al., 2012). All three curves show jumps in the Late Archean, Paleoproterozoic-early Mesoproterozoic and Paleozoic, essentially corresponding to the major peaks in (preserved) crustal growth. These peaks unsurprisingly closely match peaks in magmatic (U-Pb) ages of Australian granites and related rocks (Figure 4.1A and C; Sircombe et al., written communication, 2011). Studies elsewhere have shown that peaks in magmatic ages match well with peaks found in compilations of detrital zircon ages, and that both are markedly episodic, and correspond to suggested ages of supercontinents (e.g., Campbell and Allen, 2008; Condie et al., 2009; Iizuka et al., 2010; Voice et al., 2011).

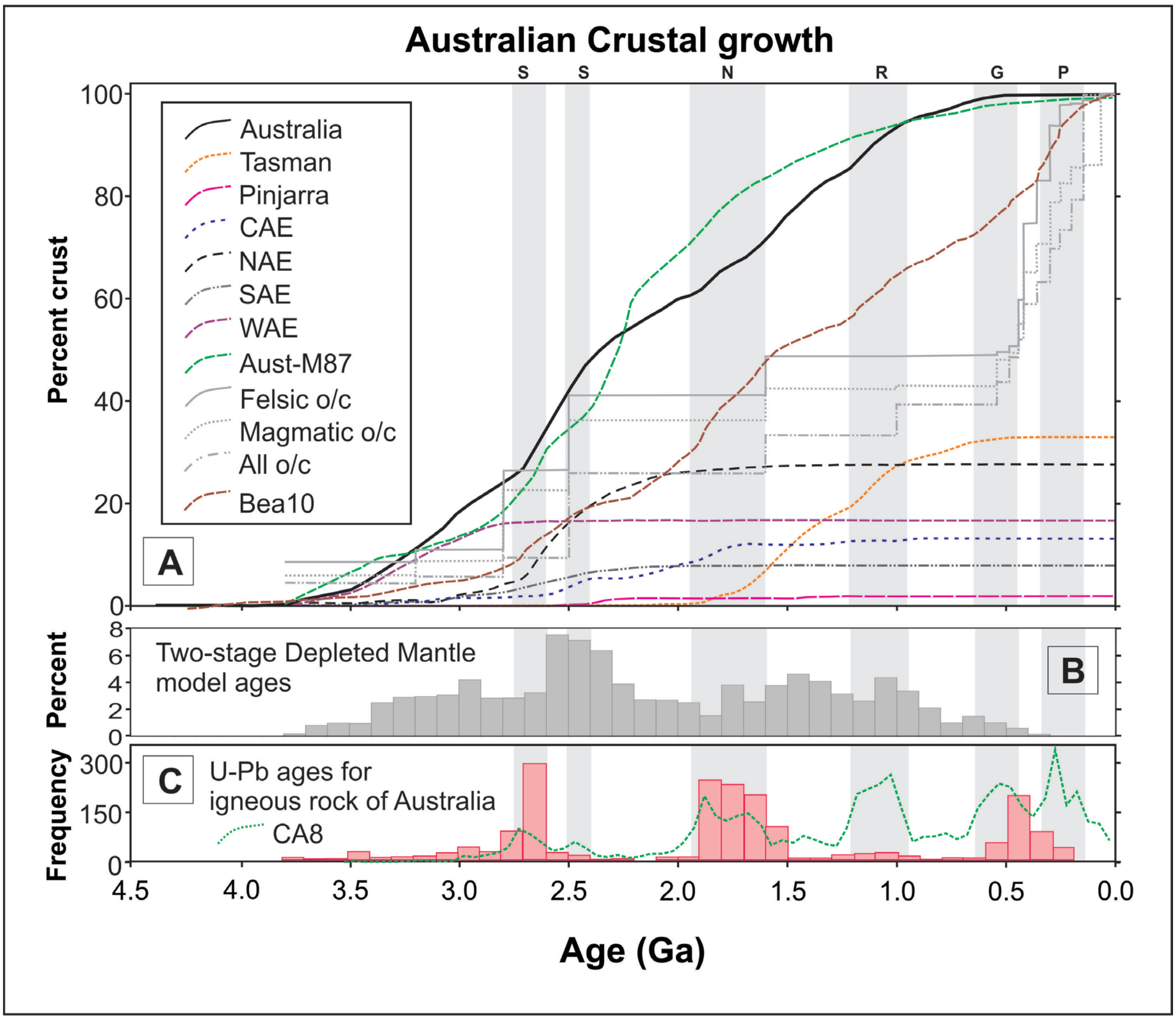


Figure 4.1 (A). Crustal growth curves for Australia and its six elements, showing percentage of Australian crust produced per 100 Myr interval, based on two-stage depleted mantle model ages (T_{2DM}) of Australian igneous rocks. The crustal growth curve of McCulloch (1987; Aust-M87), also based on Nd model ages, is shown for comparison. Also shown are percentage of outcrop for Australia (based on Surface Geology of Australia map (Raymond et al., 2012), through time, calculated for all outcrop, all magmatic rocks and all felsic magmatic rocks. Note this is only at the level of Eras (Precambrian) and Periods (Phanerozoic). The curve for U-Pb ages from Belousova et al. (2010; Bea10) is also shown. S, S, N, R, G and P (and associated grey bands) refer to the supercontinents Superia/Sclavia, Nuna, Rodinia, Gondwana and Pangaea, respectively (age ranges from Campbell and Allen, 2008). (B). Histogram showing distribution of T_{2DM} ages (as percentages) used to calculate the crustal growth curve for Australia. (C). Histogram showing frequency of magmatic U-Pb ages of Australian igneous rocks based on probability distribution plot of U-Pb ages of igneous rocks in Australia (from K. Sircombe, written communication, 2011), the peaks of which correspond well with outcrop geology curves (in A). Age curve based on detrital zircon ages from 40 large rivers around the world (Campbell and Allen, 2008; CA8) also shown, highlighting the dearth of (exposed) Rodinian-aged magmatic rocks in Australia. Refer to Appendix D for methodology regarding calculation of crustal growth curve. CAE = Central Australia Element, WAE, SAE, and NAE = West Australia, South Australia and North Australia elements, respectively.

Apart from the lack of a Rodinian peak (either not present or more likely not exposed), the main peaks of geological and magmatic ages in Australia largely mirror the more extensive (world-wide) compilations (e.g., Campbell and Allen, 2008; Figure 4.1), so are relevant to the interpretation of the Australian Nd growth curve. The (outcrop and) magmatic age curves are clearly different to the Nd crustal growth curves. Not only are the magmatic age peaks skewed, unsurprisingly to younger (better preserved) rocks, their episodic nature contrasts with the Nd growth curve. Furthermore, it is evident that the large 2.6–2.3 Ga peak found in the Nd growth curve is not present in the magmatic age data at all, at best only partly overlapping with the 2.7–2.6 Ga age peak. The mismatch between crustal growth curves as calculated from isotopic data and observable peaks in the geological and magmatic record match findings elsewhere; it is a matter of some contention whether these age peaks record actual growth spurts, and/or periods of intense crustal reworking and/or are an artefact of preservation (see general discussion in Hawkesworth et al., 2010). Taken at face value, however, these differences suggest that the peaks in Australian magmatism records significant crustal reworking and not intense new crustal growth.

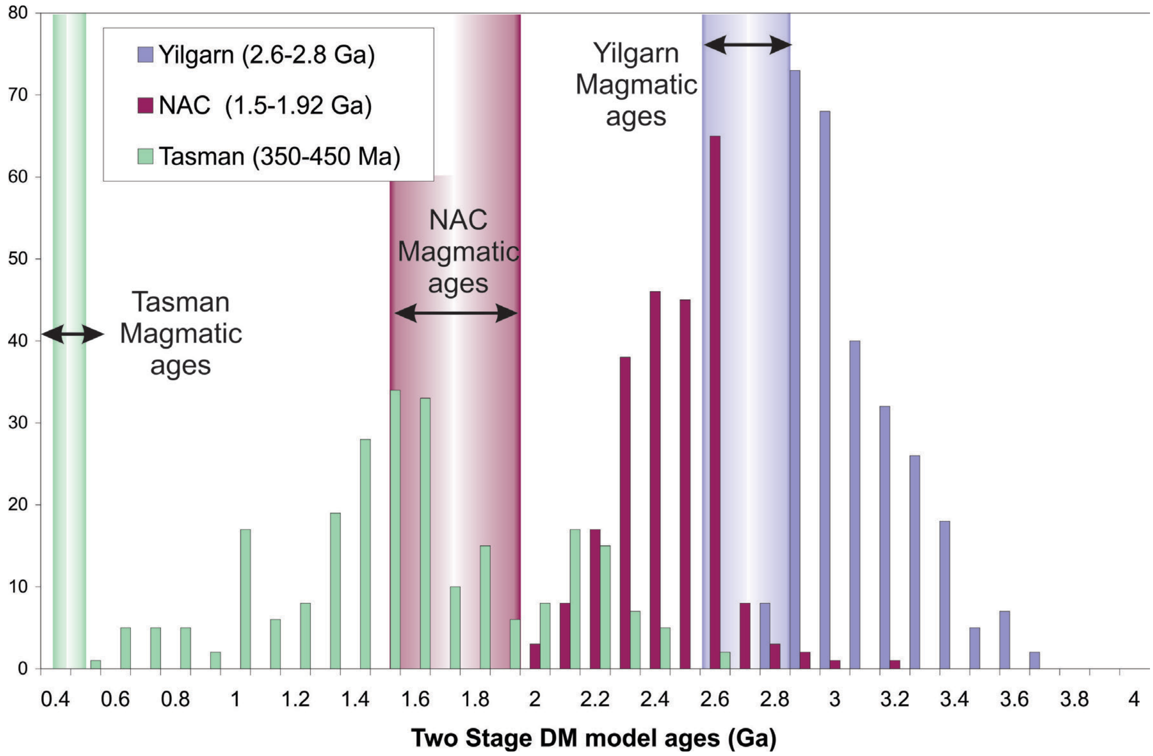


Figure 4.2 Histogram of neodymium depleted mantle model ages (T_{2DM}) for igneous rocks of the Yilgarn Craton (in the West Australian Element), North Australian Element, and the Tasman Element. Model ages are only shown for those rocks that have magmatic ages between 2.8–2.6 Ga, 1.92–1.5 Ga or 0.45–0.35 Ga, i.e., corresponding to the age peaks on Figure 4.1. The range of magmatic ages for each region are shown as coloured bands. Model ages are significantly older than crystallisation ages for Paleozoic and Proterozoic magmatism. The Archean magmatism is different in that the peak model age is not much older than the oldest magmatic age.

This crustal reworking can be demonstrated by directly comparing magmatic ages with Nd model ages. As noted above, magmatism in Australia is dominated by three age periods: Neoarchean, late Paleoproterozoic-early Mesoproterozoic and early-mid Paleozoic. Histograms of two-stage Nd depleted mantle model ages (T_{2DM}) for rocks of each of these three age groups (Figure 4.2) clearly show that model ages for these rocks are significantly older than magmatic ages, a result of significant crustal reworking. This is the case even if chondritic mantle model ages (T_{CHUR}) are used. There are a variety of ways this non-juvenile component can be sourced (see Table 2.2) and possibly all may have been operative at one time or another. A number of observations can be gleaned from Figure 4.2, particularly regarding both the shape of the model age distribution, and the range of residence ages (model ages minus magmatic ages), for each magmatic period. Firstly, for the late Archean, the model age curve is distinctly one-sided with most model ages not significantly older than magmatic ages (residence ages mostly <500 Myr). This is in distinct contrast to the ca. 1.9–1.6 Ga magmatism of the NAE, where model ages are much older than magmatic ages and peak at 2.36–2.3 Ga. The number of samples with model ages only slightly higher than model ages is very low (Figure 4.2). The variation between model ages and magmatic ages is even more pronounced for Tasman Element rocks. Voice et al. (2011) showed similar relationships between magmatic ages and Hf model ages for these three growth periods within their large compilation of detrital zircons from around the world.

4.2. Comparisons with world crustal growth curves

The growth of continental crust is controversial and models vary enormously (see reviews by Hawkesworth et al., 2010; Cawood et al., 2013), ranging from extreme early growth e.g., Armstrong (1981), through to models with most growth occurring post-Archean (e.g., Hurley and Rand, 1969; Figure 4.3). The Australian growth curves tend to fall somewhere in the middle suggesting more continuous growth with no marked episodicity. This is similar to other, more recent, uncorrected models (e.g., Belousova et al., 2010; Dhuime et al., 2012; Figure 4.3) calculated with Hf model ages (from Hf isotopes in detrital zircons).

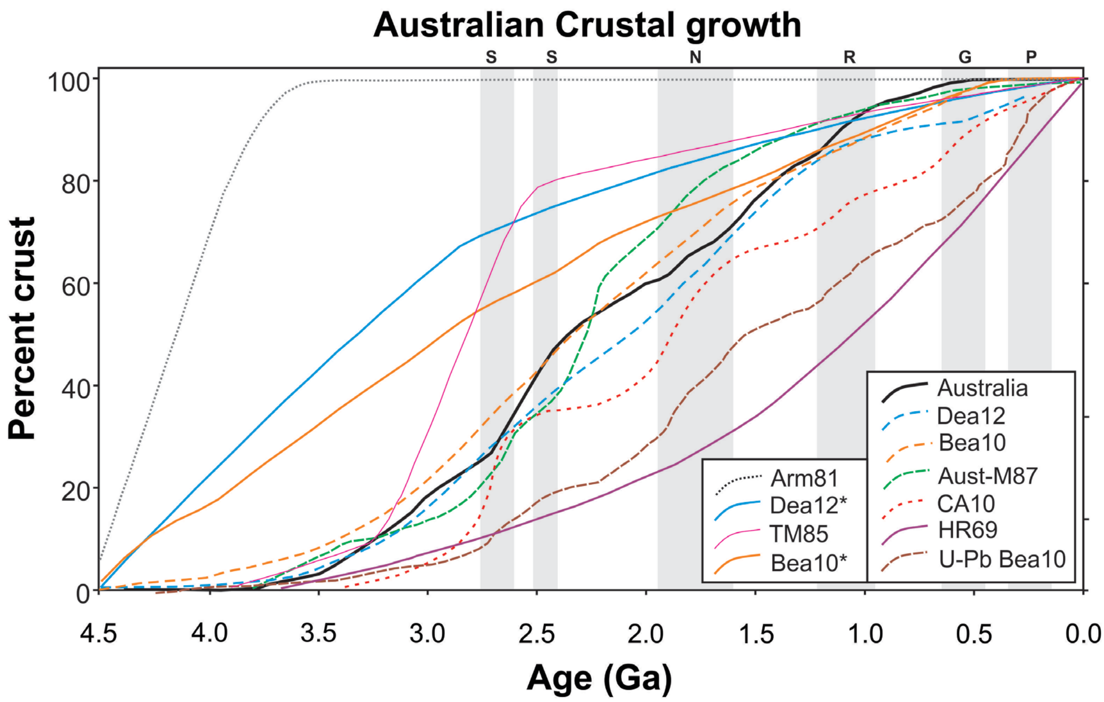


Figure 4.3 Crustal growth curves of Australia relative to previous models of world crustal growth. Growth curves are shown as percentages of crust formed, where 100% represents the present-day volume of crust. References as follows: Australia-Australian growth curve as calculated in this report; Aust-M87-Australian growth curve of McCulloch (1987); Arm81-Armstrong (1981); Dea12/Dea12-Dhuime et al. (2012) uncorrected and corrected, respectively; Bea10/Bea10*-Belousova et al. (2010) uncorrected and corrected, respectively; U-Pb-Bea10-U-Pb ages of zircons, Belousova et al. (2010); TM85-Taylor and McLennan (1985); CA10-Condie and Aster (2010); HR69-Hurley and Rand (1969). Also shown are supercontinent ages from Campbell and Allen (2008); S, S, N, R, G and P (and associated grey bands) refer to the supercontinents Superia/Sclavia, Nuna, Rodinia, Gondwana and Pangaea, respectively.*

More recently, a number of corrections have been applied to crustal growth curves calculated from isotopic (Hf) data, in an attempt to better incorporate the effects of crustal reworking (e.g., Belousova et al., 2010; Dhuime et al., 2012; Figure 4.3). As summarised by Cawood et al. (2013), these corrected models suggest more rapid growth in the first half of Earth's history (falling between earlier curves of Armstrong (1981) and Taylor and McLennan (1985)).

One of the chief difficulties with using isotopic model age data, especially where isotopic signatures clearly result from crustal reworking, is that these isotopic signatures are averages, i.e., they represent a mixed signal which under-estimates the true ages of the older components (and any juvenile component; see Belousova et al., 2010; Voice et al., 2011; Hawkesworth et al., 2010; Dhuime et al., 2013). This is a problem not just for whole rock data but also for mineral isotopic data, and applies to both contemporaneous magma-formation processes (e.g., magma mixing, assimilation), and to the prehistory of the respective components the granite is sourced from. Given the evidence in the Australian magmatic record for significant crustal reworking, it is apparent that the Australian crustal growth curve would also benefit from some correction. A number of strategies have been used to correct crustal growth models. Belousova et al. (2010) utilised comparisons of crystallisation ages with model ages to provide estimates of the proportion of juvenile versus reworked crust. The advent of in-situ oxygen isotope analysis of zircons has meant model ages from Lu-Hf (in zircon) can be combined with the oxygen data to directly ascertain percentages of reworking (addition of sedimentary material) versus new growth. This methodology was applied by Dhuime et al. (2013; Figure 4.3) to determine the amounts of juvenile (new) crust through time. Those authors then combined their juvenile crust estimates with histograms of (detrital) zircon U-Pb ages to calculate proportions of reworked crust through time. This latter calculation was used to correct the crustal growth curve calculated from Hf model age data. Notably, the corrected crustal growth curves of both Belousova et al. (2010) and Dhuime et al. (2013) are not dissimilar (Figure 4.3). Both advocate significant crustal growth in the Archean—significantly more than suggested by curves based on Nd and Hf model age data alone.

An additional problem is that isotopic signatures of multi-component mixes are determined by not just the ratios of respective components but also by the relative amounts of parent and daughter isotopes (e.g., Sm and Nd) in the respective end-members. Crustal rocks tend to have significantly higher REEs than juvenile mantle melts and so their isotopic signature dominates, underestimating any juvenile component. Involvement of sedimentary components will exacerbate these difficulties. For example, Kemp et al. (2009) have suggested (on the basis of Hf and O isotopes and modelling) that I-type granites in the southern Tasman Orogen may have upwards of 60–90% juvenile material in them, and even S-types may have 20–40% juvenile component. These values are high, and are model dependent; though even if only partly correct, they provide some insight into how juvenile addition can be underestimated. The approach of Belousova et al. (2010) and Dhuime et al. (2013) appears to underestimate this hidden juvenile component. Both, though especially Dhuime et al. (2013), show high rates of crustal reworking during the Phanerozoic, which contrasts with the results of Kemp et al. (2009) for the southern Tasman Orogen, suggesting, at least for Australia, that Phanerozoic crustal growth was greater than the corrected growth curves those authors would suggest. There is supporting evidence for this latter assertion within the chemistry of felsic magmatism in Australia. Champion et al. (2012) investigated changes in the potassium, thorium and uranium contents of Australian granites through time. Using two independent data sets (whole rock geochemistry and airborne gamma-ray spectrometric data; see Figure 10.10 of Champion et al., 2012), they were able to show increasing thorium contents from the Archean to the Mesoproterozoic and significantly lower and rather constant values from the Neoproterozoic onwards (with the exception of a significant higher peak in the Carboniferous). This trend actually corresponds reasonably well to the juvenile crust calculations of Dhuime et al. (2013; based on the proportion of zircons with mantle-like oxygen isotope signatures), which show high rates of crustal reworking peaking in the late Paleoproterozoic and early Mesoproterozoic, and significantly decreasing thereafter.

These considerations all suggest that best estimates for the Australian crustal growth curve would appear to lie somewhere between the new curve produced here (from Nd model age data) and the corrected curve of Dhuime et al. (2013). What this clearly indicates is that a significant proportion (~40–70%; Figure 4.3) of the Australian crust was in place by the end of the Archean, and most (~65–85%) by the end of the Mesoproterozoic.

4.3. Crustal growth in Australia and age of basement blocks

The results of the crustal growth modelling lend some credence to the overall general picture of the Australian crust based on Nd depleted mantle model ages (e.g., Figure 3.2). They also serve to broadly calibrate the isotopic data thus allowing broad basement ages to be inferred for regions of Australia (particularly areas where there is significant data), e.g., ~40–70% of the crust is probably Archean. This approach can be combined with the identified crustal blocks within each crustal element (i.e., cratons, orogens, provinces, subprovinces discussed in Chapter 3), and with the available geological data (and interpretations of the latter data, such as tectonic models, e.g., Myers et al. (1995); Huston et al. (2012) and Glen (2013)), to produce a basement age map of Australia (Figure 4.4). Although clearly speculative, this preliminary map provides a working hypothesis that can be tested. Unlike the gridded depleted mantle model age maps, the basement age map is also directly amenable to comparison with geological, geophysical and other data sets. The map highlights areas with interesting isotopic zonation, e.g., in the Tanami region of the North Australian Element, and areas (not all undercover) with little or no data, e.g., Lachlan Orogen in Victoria, that would both benefit from additional data.

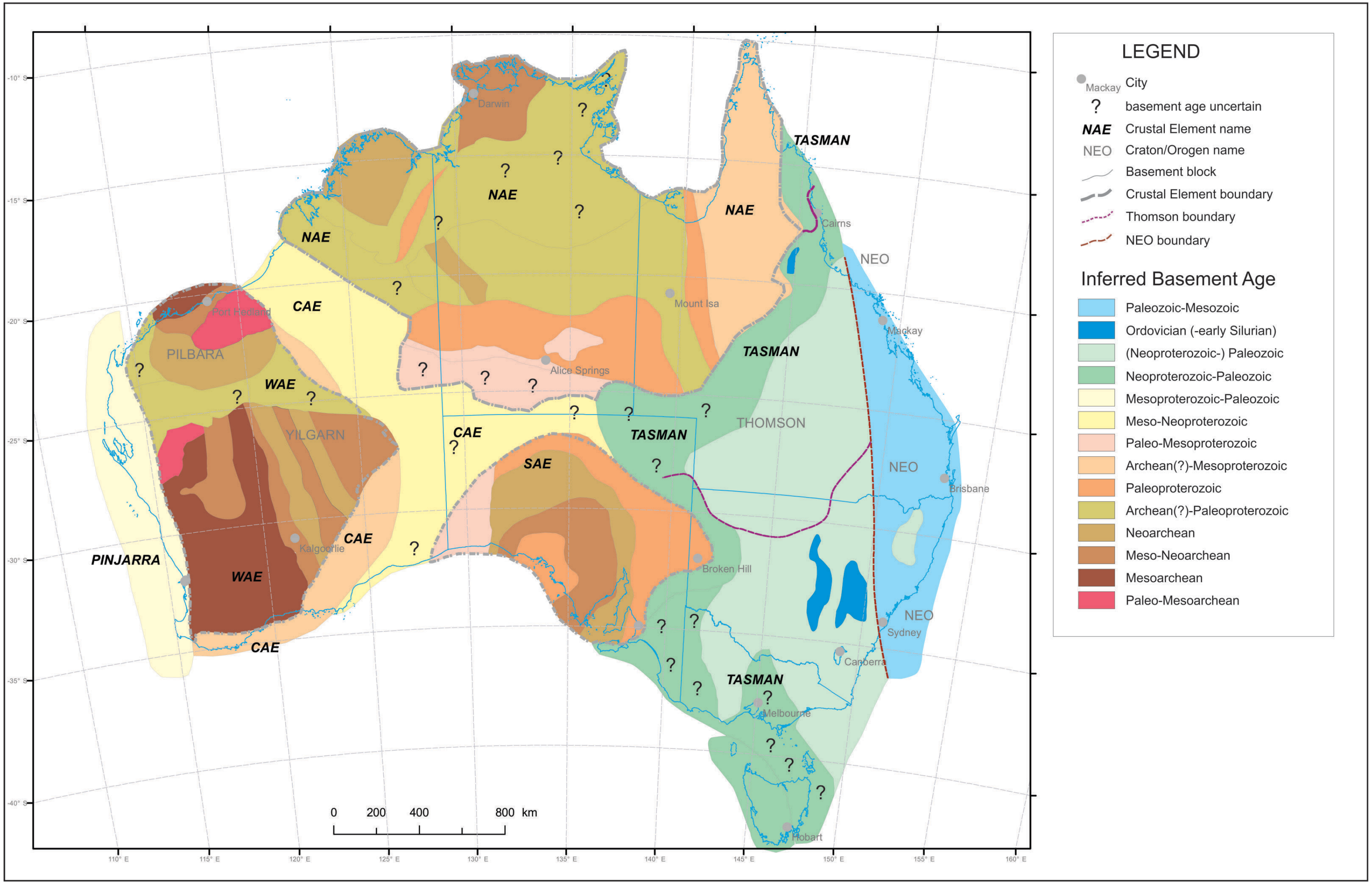


Figure 4.4 Speculative basement age map of Australia. Broad ages for basement blocks are based on both Nd isotope signature and geology. Basement blocks are based on a combination of isotopic signature and locations of geological orogens, cratons, provinces and subprovinces (refer to crustal element sections in Chapter 3).

5. Mineralisation

5.1. Introduction

The mineral systems approach, e.g., Wyborn (1997), recognises that mineral deposits, although geographically small in extent, are the result of geological, including geodynamic, processes that occur, and can be mapped at, a variety of scales, up to craton-scale. Accordingly, understanding the four-dimensional evolution of any geological terrane is important. Better understanding of the space-time evolution of geological terranes and their components provides important constraints on the geodynamics and architecture of mineral systems. It also has the potential to explain the often heterogeneous distribution of mineralisation within these regions. One approach to constraining the crustal evolution of any region, as outlined in previous sections of this record, is by using the geochemical, isotopic and geochronological characteristics of granites and other felsic igneous rocks. Being dominantly derived from the (lower-middle) continental crust, these rocks provide direct constraints on the timing, extent and nature of crustal growth. They also provide important, but less precise, indirect constraints on the nature and age of the crustal domains these rocks occur within. As discussed previously, these features are true even where the granites have a multi-component origin although determining the crustal signature becomes correspondingly more difficult and results more ambiguous. These potential ambiguities are tempered somewhat by the nature of the gridding process (which tends to provide an averaged view obscuring small wavelength variations that may be due to such processes as magma mixing, sediment assimilation, etc.). A test of this assumption and the more general applicability of using isotope maps for metallogenic analysis and prediction is by determining whether empirical relationships between mineralisation styles and isotopic signatures exist. This can be also undertaken directly for magmatic-related mineralisation styles, particularly for well understood granite-related mineralisation, such as porphyry copper-gold (Cu-Au), porphyry-molybdenum (Mo), intrusion-related gold, tin, tungsten (W) etc. (e.g., Blevin and Chappell, 1992; Blevin et al., 1996; Thompson et al., 1999; Lang et al., 2000).

5.2. Lessons from the Yilgarn Craton

An unexpected outcome from work on the granites of the Yilgarn Craton was the apparent correlation between the regional Sm-Nd signature and mineralisation. Cassidy et al. (2005) and Huston et al. (2005, 2013) documented an apparent spatial association of larger komatiite-associated Ni-Cu (KAN), volcanic-associated massive sulphide base-metal (VAMS) and orogenic Au deposits with crustal regions with specific isotopic signatures. Komatiite-associated Ni-Cu deposits, for example, appear to be spatially associated with terranes with pre-existing evolved crust (Youanmi, Kalgoorlie, the 'older' eastern half of the Kurnalpi Terrane), as identified by isotopic signature (Figure 5.1). It was found that juvenile terranes are the least prospective for this mineralisation style. This appears to hold even though komatiite type is variable, and the age of the komatiites and pre-existing crust age is variable. Conversely, it has long been recognised there is an apparent antithetic relationship between komatiite-associated Ni-Cu and VAMS base-metal mineralisation (Groves and Batt, 1984), and Cassidy et al. (2005) and Huston et al. (2005) showed that the latter mineralisation in the Yilgarn is associated with terranes with isotopically primitive crust (and also HFSE-enriched, bimodal volcanic-plutonic associations and rift settings).

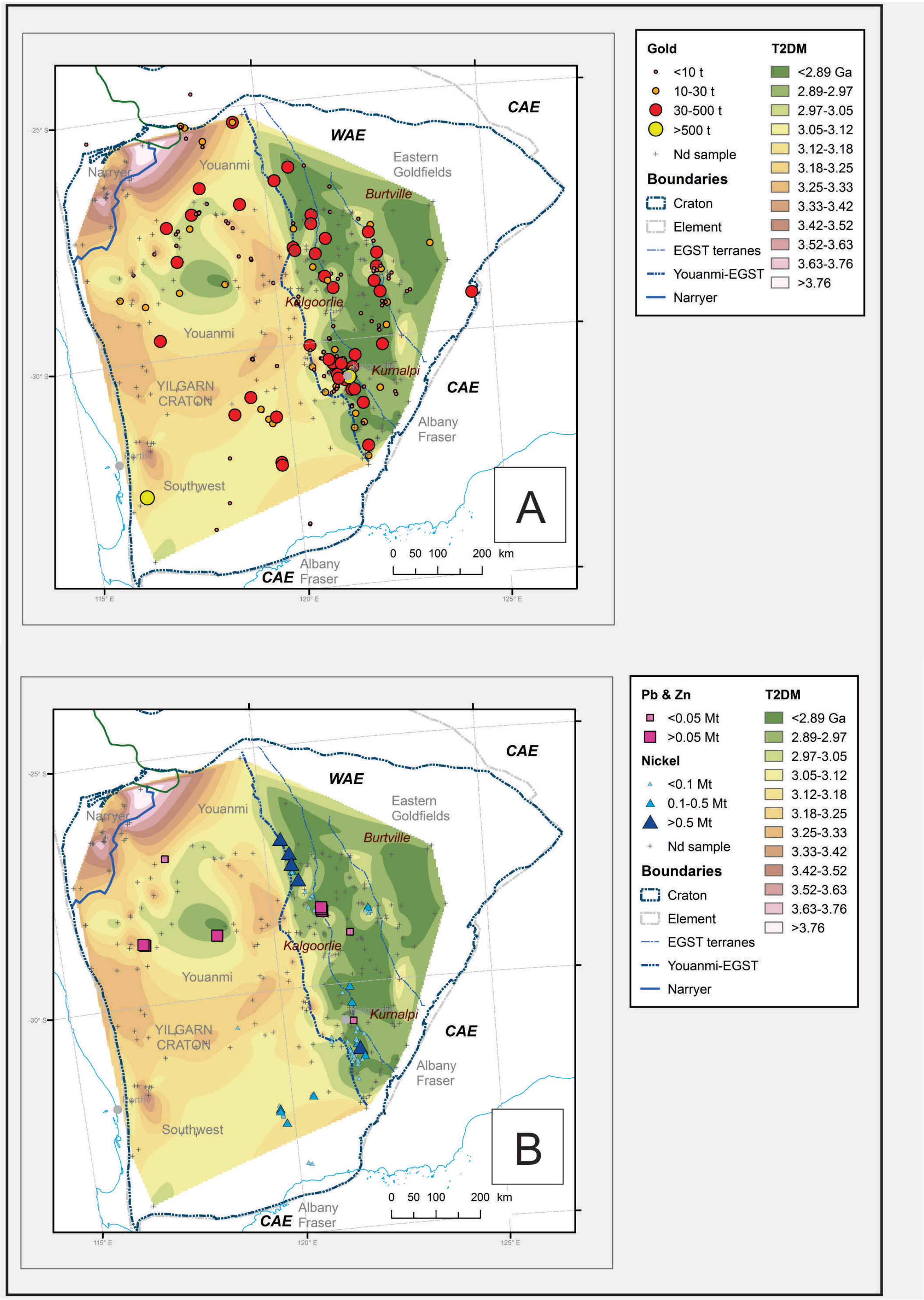


Figure 5.1 (A) Location of gold and (B) nickel (nickel sulphide) and volcanic hosted massive sulphide (Pb-Zn) deposits, by size, in the Yilgarn Craton, superimposed over gridded two-stage depleted mantle model ages (T_{2DM}). Grid created in ArcMap® (see main text). Grid constructed from 305 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. Mineral deposit locations are from the Australian Mines Atlas (http://www.australianminesatlas.gov.au/).

These occur in the western part of the Kurnalpi Terrane, northeastern part of the Kalgoorlie Terrane, and the central 'younger' zone in the Youanmi Terrane (Figure 5.1). Cassidy et al. (2005) also recorded an apparent relationship between orogenic gold mineralisation and older crustal terranes (similar to that observed for KANS).

Within the Eastern Goldfields Superterrane of the Yilgarn Craton (where much of the mineralisation is best developed), there is also a reasonable (though by no means perfect) correlation between the isotopic signature and the identified terranes (Figure 5.1). For example, although crossing into the Kalgoorlie Terrane (in the north), the juvenile isotopic zone is broadly correlated with the western two-thirds of the Kurnalpi Terrane. It could be suggested, therefore, that the correlation between isotopic signatures and mineralisation is more simply a reflection of the different terranes, i.e., mineralisation correlates with geology. This is not easy to disprove, especially in the case of gold mineralisation. The best evidence against this comes from the VAMS mineralisation. Huston et al. (2005, 2013) investigated the isotopic relationship between primitive isotopic domains and VAMS mineralisation and not only showed the relationship held in the Yilgarn (for Pb as well as Nd isotopes), but importantly demonstrated this general relationship appears to hold for all Archean (and, possibly, Proterozoic) VAMS mineralisation world-wide. This was best demonstrated through the relationship between fertility (tonnes of metal resource) versus isotopic signature. Both Nd and Pb data in the high fertility domains indicate there was limited interaction with pre-existing crust and Huston et al. (2013) suggested that the isotopes are recording the favourable tectonic setting for this mineralisation in extensional zones characterised by high-temperature juvenile magmas (and extensive structuring).

As summarised by Cassidy et al. (2005), the link between both nickel and gold with regions of isotopically more evolved (i.e., = older crust) was not well understood, and they speculated on a variety of reasons. The relationship between nickel and crustal domains of the Yilgarn has been investigated by both Barnes and Fiorentini (2010a, b) and Begg et al. (2010). Barnes and Fiorentini (2010a, b) showed that most of the nickel endowment in the Yilgarn was concentrated within the Kalgoorlie Terrane and that that terrane was characterised by strongly olivine-enriched (cumulate) lithologies, relative to other terranes in the Eastern Goldfields Superterrane (although they also occur within the Youanmi Terrane). These authors suggested that the nickel endowment was a function of a number of factors that allowed high volumes and prolonged fluxes of komatiitic magmas into the Kalgoorlie Terrane crust, and they followed the craton-margin model of Begg et al. (2010). The latter model suggests that lithospheric architecture was an important factor with komatiitic melts being preferentially channelled away from regions of thicker lithosphere to areas of thinner lithosphere, such as found on old craton margins. The Nd isotopic map of the Yilgarn Craton supports this hypothesis with older (interpreted as thicker) lithosphere in the Youanmi terrane bound by younger (and thinner) lithosphere in the east, specifically the neighbouring Kalgoorlie Terrane.

With regards to gold endowment, Cassidy et al. (2005) suggested a combination of geological factors to explain the correlation with isotopic signature, including the association of (older) plume magmatism, occurrence of subduction-modified mantle melts, as well as the presence of lithospheric-scale orogeny. Recent sulphur isotope data (Xue et al., 2013) favours gold from either crustal magmatic and/or mantle sources and appears to rule out leaching from komatiitic rocks. Of the likely candidates in the Yilgarn Craton only perhaps the more enriched (high-LILE) Mafic group magmatism (Champion and Sheraton, 1997; Champion and Cassidy, 2007, 2010) has a close spatial association with gold mineralisation. This association could explain why the isotopically primitive Archean Abitibi Terrane in the Superior Province, Canada (where similar rocks occur, e.g., Beakhouse, 2007) is also well endowed with gold.

5.3. Lessons from the Gawler Craton

Recently Skirrow (2013) demonstrated a useful relationship between regional isotopic zonation and iron oxide copper gold (IOCG) deposits in Australia, namely that IOCG belts have an empirical association with isotopic gradients that most probably mark crustal suture zones (Figure 5.2). This relationship is not surprising. In a recent review of IOCGs, Groves et al. (2010) suggested that larger Precambrian IOCG deposits (>100 tonnes of resources) were located in intracratonic settings but close to (within ~100 km) of either craton margins or lithospheric boundaries. As discussed in previous sections, the regional Nd isotopic patterns successfully identify both old craton margins and/or suture zones. Groves et al. (2010) further suggested that the larger IOCGs formed shortly following supercontinent formation (100-200 Myr after), implying that age criteria can also be used for identifying potential IOCG corridors. Caution is needed, however, as this relationship in part reflects how IOCGs are classified. IOCG deposits in Tennant Creek, Northern Territory, for example, were generated during Nuna formation not afterwards (e.g., Huston et al., 2012); though Groves et al. (2010) placed the Tennant Creek deposits into a high grade Au (+Cu) class, distinct from true IOCGs. They further suggested that these latter deposits may be more akin to orogenic gold or even intrusion-related gold deposit styles.

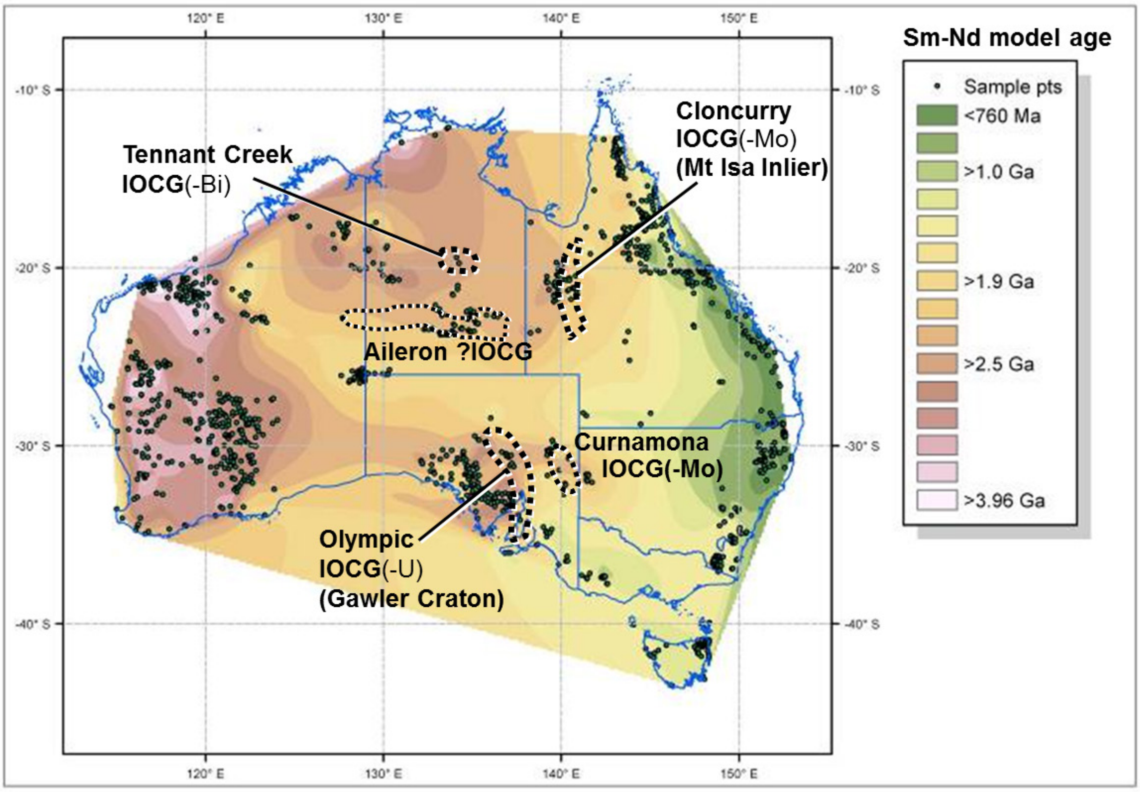


Figure 5.2 Plot of iron oxide copper gold (IOCG) provinces overlain over gridded two-stage depleted mantle model age (T_{2DM}) map of Australia. Figure from Skirrow (2013). As noted by Skirrow (2013), there is a good correlation between these mineral provinces and apparent gradients (breaks) in the regional T_{2DM} map.

Given the apparent preferred location of IOCGs close to craton margins/sutures, Groves et al. (2010) postulated a role for (subduction-related) metasomatised lithospheric mantle and presented a model whereby partial melts of this lithosphere transported Cu, Au and volatiles into the crust (although local country rocks have also been suggested to supply elements including uranium (e.g., Olympic Dam, Skirrow et al., 2007). Such lithospheric melts would certainly be expected to be oxidised (e.g., Rowe et al., 2009) and have the potential for elevated gold solubilities (e.g., Jégo et al., 2010). The presence of such rocks could be used in conjunction with the isotopic maps to further highlight areas of potential.

Interestingly, melts of such metasomatised lithosphere would in themselves not necessarily have juvenile isotopic signatures, depending on both the timing of metasomatism and the role of sediments (if any) in the subduction component responsible for metasomatism. A potential example are the Tasmanian Jurassic dolerites which Hergt et al. (1989) interpreted as being derived from subduction-related metasomatised mantle lithosphere and which have very evolved isotopic signatures (e.g., ε_{Nd} of -6). Finally, it should be noted that although both Johnson and McCulloch (1995) and Skirrow et al. (2007) suggested, on the basis of Sm-Nd isotopes and correlations with Cu contents, that juvenile mantle melts (thought to be either alkaline mafic or ultramafic melts, produced during the Hiltaba Suite magmatism) were the source of at least some of the copper at the very large Olympic Dam deposit, these is no compelling evidence that these are (or are not) lithosphere melts. This does not, however, change the apparent empirical relationship between Nd isotopic signature and IOCG belts as pointed out by Skirrow (2013; Figure 5.2).

5.4. Granite-related mineralisation

Significant advances in controls of granite-related metallogeny have been made since the landmark papers of Ishihara (e.g., Ishihara, 1977, 1981) who recognised the important controls the redox state has on granite magmas and resulting mineralisation styles. This work was extended by Blevin and co-workers (Blevin and Chappell, 1992; Blevin et al., 1996, Blevin, 2004), who showed that factors such as the degree of chemical evolution of the granite also had important controls on mineralisation styles (Figure 5.3). More recently, Thompson et al. (1999) came to similar conclusions (Figure 5.3) and added a tectonic interpretation. The latter shows, unsurprisingly, that more-lithophile elements such as tin (Sn), molybdenum (Mo) and tungsten (W) are associated with continental material in backarc and arc-rift environments etc., in contrast to the chalcophile Cu and Cu-Au mineralisation, which they suggested were related to more primitive crust, e.g., island arcs, primitive continental arcs (consistent with the oxidised nature of arc rocks, e.g., Parkinson and Arculus, 1999). Considerations of these relationships suggests isotopic data, such as Nd, would be best at delineating potential regions for porphyry Cu and Cu-Au mineralisation (i.e., regions with more juvenile isotopic signatures). A good example of this in Australia is the Ordovician (-earliest Silurian) Cu-Au mineralisation associated with isotopically juvenile magmatism in the Macquarie Arc, in central New South Wales (e.g., Cooke et al., 2007; Figure 5.4). These rocks are readily identifiable in the Nd data even though there are only a few points in the data set (Figure 3.20; Figure 3.23). Another potential example is the Cu-Au mineralisation at Mount Morgan (central Queensland), associated with rocks thought to be related to either a primitive continental arc (e.g., Morand, 1993) or island arc (Murray and Blake, 2005; Calliope Gamilaroi arc), although its mineralisation style is controversial. These rocks are isotopically primitive though are not readily discriminated in the gridded Nd model age data as they fall within the isotopically primitive young rocks of the New England Orogen (Figure 3.20; Figure 3.23). They are, however, clearly visible on images displaying gridded Nd residence maps (Figure 5.4). Based on these observed correlations, other regions with potential for such deposits can be suggested. These include the Ordovician rocks of the Netherwood region in north Queensland (Figure 3.20, Figure 3.23; southwest of Cairns on Figure 5.4), and Proterozoic rocks in the Warumpi Province and the Halls Creek Orogen (both in the NAE, Figure 3.8). All of these are in or close to regions suggested to have a tectonic history including island arcs (e.g., Sheppard et al., 1999, 2001; Scrimgeour et al., 2005b; Henderson et al., 2011). All are readily evident on regional gridded images even where the numbers of analysed samples are low. Of course, the Nd data only identify the locations of potentially juvenile terranes; they do not convey any information on additional important factors, such as depth of current crustal exposure (and degree of preservation of porphyry and epithermal mineralisation). It is also noted that these mineralisation styles are also found in continental arcs though the delineation of these on the basis of their isotopic signature is more problematical given the non-unique isotopic signature of such rocks.

Unfortunately, the converse is not the case, i.e., felsic magmatic rocks associated with Sn, W and intrusion-related gold mineralisation, have a demonstrably wide range of isotopic signatures. Blevin et al. (1996) and Champion et al. (2010) clearly showed this for Sn- and IRG-associated granites of the New England Orogen and north Queensland region, whose isotopic signatures range from ε_{Nd} of +5 (and over) to -7 (and lower), respectively. Champion et al. (2010) showed that magmatism associated with Sn mineralisation in both regions is of very similar chemistry despite the large isotopic differences.

5.5. General comments

The Nd T_{2DM} maps can also be used with more general models, such as those that relate mineralisation styles to general or specific tectonic settings, such as continental arcs, backarcs etc. One simple example is the identification of possible accretionary orogens and their associated mineralisation, such as gold, copper-gold etc. (e.g., Hronsky et al., 2012). As discussed for the Tasman Element, one apparent indicator of accretionary margins is a strong trend to increasingly juvenile isotopic signatures with both geography and age, as exemplified in the Delamerian-Lachlan and New England orogens of the Tasman Element (e.g., Kemp et al., 2009; Figure 3.22, Figure 3.23). Based on the Tasman analogy, the regional isotopic variation evident in the southern North Australian Element (Figure 3.8, Figure 3.11) also suggests an accretionary margin origin (see section 3.3.3.3) and, thus can also be considered to have potential for arc- and back-arc-related mineralisation. The calc-alkaline trondhjemite suite of Zhao and McCulloch (1995) may indeed represent part of such an arc. It should be noted, however, that pinpointing the location of actual arcs in such regions is not always straight forward, as witnessed by the controversy over the Lachlan Orogen. Recently, Collins et al. (2011) have suggested that different types of orogens (circum-Pacific = accretionary versus Eurasian = dominantly collisional) can also be discriminated on the basis of isotopic signature. They used Lu-Hf isotopic signatures from in-situ measurements in zircon, which has the advantage of being able to detect isotopic components in a magmatic rock (see section 6). Their results, however, are also transferrable to the whole rock Sm-Nd system as long as there is sufficient Nd whole-rock data to sample the range of isotopic signatures within a region (e.g., compare Sm-Nd and Lu-Hf plots in Kemp et al., 2009). Accordingly, regional Sm-Nd model ages maps can also be used to identify not just these different orogenic systems but differing mineral associations associated with such orogens.

Finally, although we can see from the previous examples in this section that there is a role for regional isotopic signatures and metallogeny, it is noted that the mineral system approach is predicated on using a wide range of geological information across a range of scales, and isotopic maps, such as the Sm-Nd images presented within this report, are just another layer to be integrated with other data.

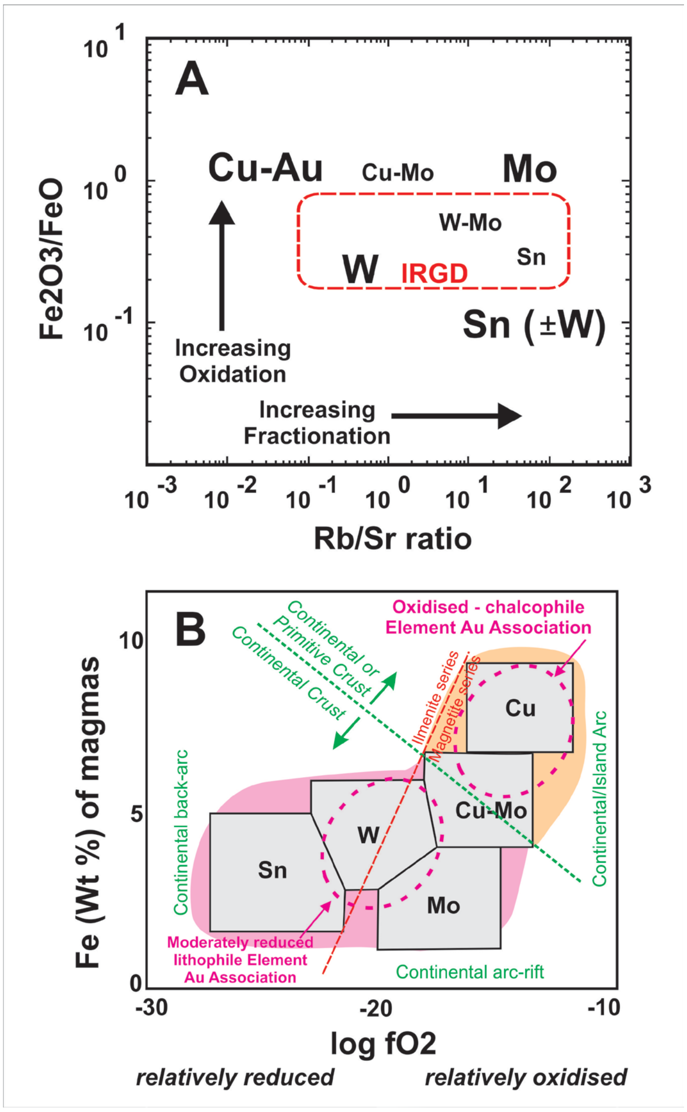


Figure 5.3 (A). Rb/Sr ratio versus Fe_2O_3/FeO ratio plot of Blevin et al. (1996). The plot illustrates the relationship between the degree of oxidation and compositional evolution of the magma (based on whole-rock compositions) and the dominant commodities in related mineralisation. Intrusion related gold deposit (IRGD) field from Blevin (2004). (B). Plot of oxygen fugacity versus amount of total Fe in the magma. Plot modified after Thompson et al. (1999) and Lang et al. (2000).

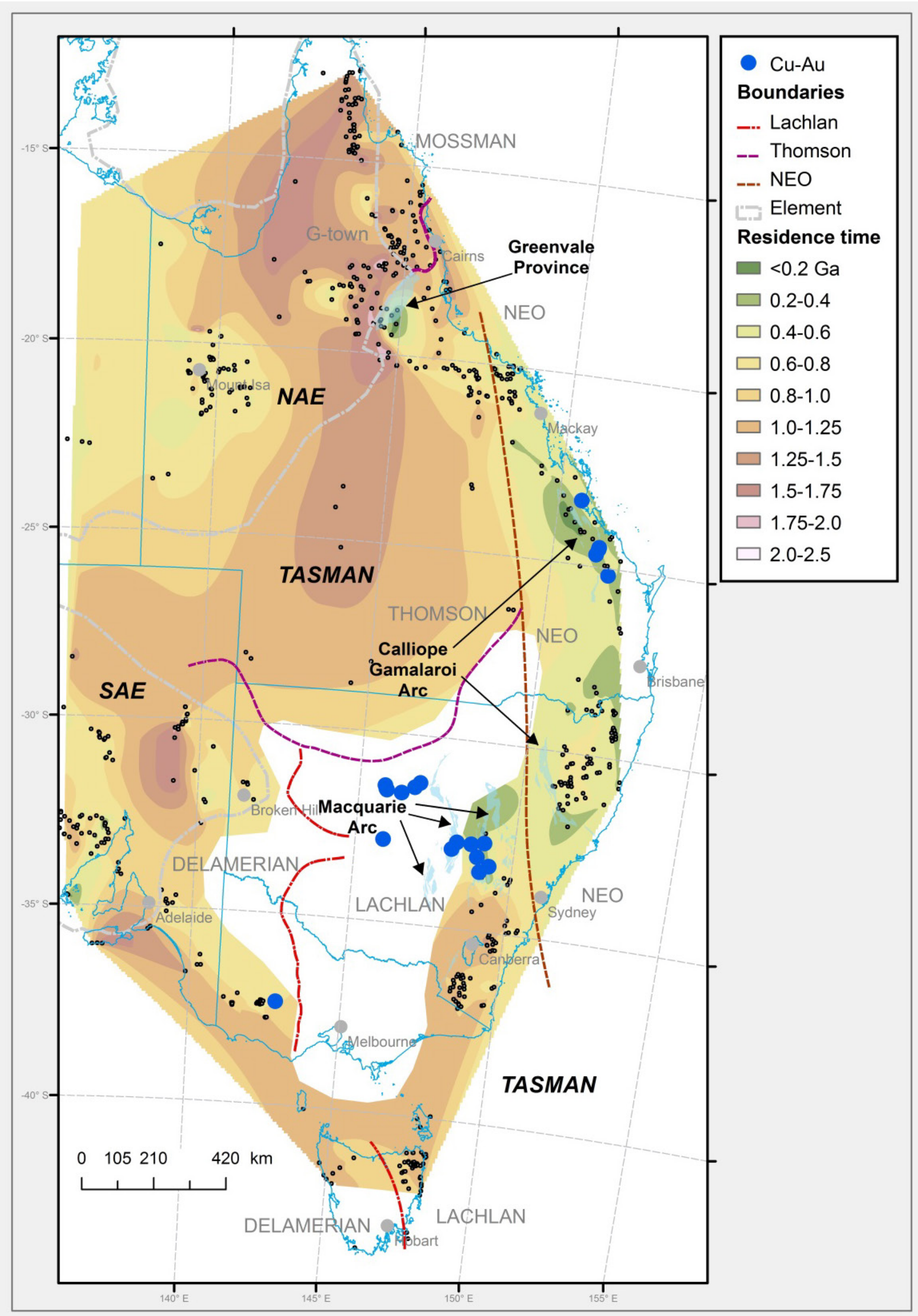


Figure 5.4 Location of copper-gold deposits superimposed on the gridded Nd residence age map for the Tasman Element and surrounding regions (South (SAE) and North (NAE) Australian elements). Copper-gold deposits (from the Australian Mines Atlas; http://www.australianminesatlas.gov.au/) are shown as blue circles. Also shown are the Delamerian, Lachlan, Thomson and Mossman orogens of the Tasman Element, as well as, (in light blue shading), the current locations of interpreted island arc rocks, the 'Netherwood' arc in the Greenvale Province, and the Macquarie and Calliope-Gamilaroi arcs. There is a good correlation between many copper-gold deposits and zones with young residence ages, notably in the Macquarie arc and the northern part of the Calliope-Gamilaroi arc. Copper-gold deposits outside of these two zones are almost exclusively not magmatic-related. Location of Nd samples used to create the grid are shown as black circles. Data and data sources are given in Appendix B and Appendix C. The grid was created in ArcMap® (see main text). Grid constructed from 635 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. These areas have been partially masked.

6. Conclusions and future work

6.1. Conclusions

A database of Sm-Nd isotopic data, and associated metadata, for >2650 samples of Australian rocks was compiled from published and unpublished sources. This included location, unit, geochronology and bibliographic data and metadata for all data points; this dataset is available for download at www.ga.gov.au. Data were compiled for a range of lithologies, including felsic and mafic igneous rocks, sedimentary rocks, as well as some mineral data. Just over 1630 of these data points were from felsic igneous rocks which had reliable locational details and a reasonable estimated or known magmatic age. A comparison of the magmatic ages from these samples with compilations of Australian igneous rock ages showed a generally good agreement confirming the representative nature of the compiled Nd data set.

Isotopic data were standardised and used to calculate epsilon Nd (ε_{Nd}) and two-stage depleted mantle model ages (T_{2DM}). Values of the latter from just over 1490 of the data points (samples from S-type magmatism were excluded) were used to generate (in ArcMap®) a gridded T_{2DM} map of Australia. Subsets of the data were also used to generate T_{2DM} maps of northern, western, southern and eastern Australia, basically covering the six crustal elements (West Australian, North Australian, Central Australian, South Australian, Pinjarra and Tasman elements; see Blewett et al., 2012) and their constituent crustal blocks (e.g., cratons, orogens, geological terranes, geological provinces and subprovinces). These maps, plus ε_{Nd}-time and T_{2DM}-time plots were used, along with known geological and geophysical data and interpretations, to analyse the isotopic signatures of the crustal elements and their major crustal blocks, and place constraints on their possible nature and crustal evolution.

Calculated model ages (T_{2DM}) for Australian felsic magmatism range from ~4.0 Ga in the Yilgarn and Pilbara cratons of the West Australian Element, to ca. 0.3 Ga in the New England Orogen of the Tasman Element in eastern Australia. Importantly, and despite the possible complexities of the Nd signal in granites, there is a generally well correlated distribution of model ages with the known geology of Australia and these crustal elements (with significant changes in model ages across, or close to, element boundaries). Overall there is a broad eastward trend in decreasing model ages across the Australian continent, punctuated by the Central Australian Element with younger model ages separating the North, South and West Australian elements. The majority of Australian model ages are Proterozoic in age, in agreement with the known geology. Archean model ages are best expressed in the Archean Pilbara and Yilgarn cratons of the West Australian Element, but also occur in both the North and South Australian elements. Youngest model ages are restricted to the Tasman Element, chiefly within the New England Orogen.

Within all elements there is obvious internal isotopic zonation. Of most importance are regions characterised by either major and/or sharp changes over narrow zones or more diffuse general gradients. Many of these breaks and gradients correspond to known crustal boundaries or changes in geology, suggesting that Sm-Nd whole rock signatures can be used to identify crustal changes. Such breaks are often best delineated using widespread broadly contemporaneous magmatism, e.g., late granites in the Pilbara Craton, Kennedy Igneous Association magmatism in north Queensland. Transects of Sm-Nd isotopic signatures across crustal elements provide useful informative, good examples being both north-south and east-west changes across the North Australian Element which appear to match well with inferred geological boundaries and interpreted geodynamic processes. The strongly increasing juvenile isotopic signature in the southern half of the Northern Territory, for example, is strongly suggestive of an accretionary margin, similar to that observed in the Tasman Orogen.

A major part of this study was to document and discuss the general applicability (or otherwise) of the Sm-Nd isotopic system for such studies. As outlined above, there are many cases where (for a variety of reasons) the isotopic data is mapping crustal changes or responses to geodynamic environments. There are areas, however, where this does not appear to be the case. These include regions where the signature is noisy (often areas of either wide age ranges or lower data density), or regions where apparent crustal changes are not mirrored in the Sm-Nd data (such as in Tasmania). The greatest difficulty with interpretation arises from the involvement of sedimentary components, particularly where the sedimentary component may not be locally derived. For this reason Sm-Nd data from S-type granites were not used in the present work. In regions with widespread thick metasedimentary sequences, such as in the Tasman Element, or where S-type granites are present, Sm-Nd data should be interpreted with caution. This illustrates the potential importance and value of using other isotope systems (e.g., oxygen isotopes) in conjunction with Sm-Nd data. It is evident even in the Tasman Element, however, that changes in Nd (and Hf) isotopic signatures are present, can be mapped at a regional scale, and have geological and geodynamic implications.

Despite these potential difficulties, demonstrable empirical relationships between the regional isotopic pictures (as depicted on gridded T_{2DM} maps) and a number of mineralisation styles, e.g., komatiite nickel sulphides, Archean VHMS, iron-oxide copper gold deposits and intrusion-related copper-gold deposits exist. These relationships, although not completely understood, appear to be related to aspects of the crustal architecture, geodynamic environment, and/or ground preparation. In at least one case (Archean VHMS deposits) there is a very good relationship between mineral fertility and isotopic signature that can be used as a predictive tool for metallogenic analysis. The same is probably true for intrusion-related copper-gold deposits.

The Sm-Nd data were also used to calculate a crustal growth curve for Australia, updating the earlier crustal growth curve of McCulloch (1987). The new curve shows a more even growth-rate for the continent, suggesting 20% of the Australian continent had formed 3 billion years ago, 40% by 2.5 billion, 60% by 2 billion and ~75% by 1.5 billion years ago. Both growth curves show a peak around 2.6–2.3 Ga which corresponds to ~21% of the Australia crustal growth (compared with the background rate of ~10% per 300 Myr period). Consideration of secular changes in Australian granite geochemistry, and data from other isotopic studies, suggest that the calculated growth curve should be adjusted, particularly to account for high degrees of crustal reworking in the late Archean to Mesoproterozoic. This has the effect of increasing growth rates in the Archean, and indicates that ~40–70% of the Australian crust was in place by the end of the Archean, and ~70–85% by the end of the Mesoproterozoic. These results lend credence to the overall general picture of the Australian crust based on Sm-Nd data and, in combination with geological data, allow broad basement ages to be inferred for regions of Australia and the construction of a basement age map of Australia. Although clearly speculative, this preliminary map provides a working hypothesis that is directly amenable to comparison (and testing) with geological, geophysical and other data sets. This map and the T_{2DM} maps not only highlight areas with interesting isotopic zonation, e.g., in the Tanami region of the North Australian Element, but also areas (not all undercover) with little or no data, e.g., Lachlan Orogen in Victoria, which would benefit from additional data.

6.2. Future work

Potential future work includes a number of approaches, including:

- Additional Nd isotopic data, particularly to fill gaps in the coverage and/or targeted at known or inferred boundaries.
- Additional isotopic systems, both whole rock and in-situ mineral analysis. This will not only provide potential tests of results presented in this Record but also provide greater understanding of what the isotope signatures may or may not mean. These additional systems will also provide additional constraints on the degree of involvement of sedimentary rocks (see below).
- Integration of Nd results, especially the speculative basement age map (Figure 4.4) with other data sets, e.g., geological, geophysical, and geochronological data sets.

Most of these are largely obvious and self-explanatory. Investigation of Figure 3.2, Figure 3.5, Figure 3.8, Figure 3.14, and Figure 3.20, for example, immediately identifies gaps in the data collection and highlight areas for future work. Potential examples include investigating the inferred northern boundary (crustal suture?) of the Aileron Province, the extent of Mesoarchean crust in the Gawler Craton, testing for isotopic zonation in the Yilgarn Craton, and investigating the Albany-Fraser Orogen and further east for extents of Archean basement. Figure 4.4 also highlights some interesting (and in part unexpected) results. These include, for example, the apparent ridge of older crust in the Tanami region. Greater use of drill hole samples is also required to map extents of cratons, etc. under cover, e.g., what happens between the Gawler Craton and Albany-Fraser Orogen, and between the Mount Isa orogen and the Georgetown region?

The Nd isotopic data, calculated model ages and basement maps clearly need to be integrated with other data sets, both for testing and for further insight. The Nd data have already been used with geological data, for example to redefine crustal terranes in the Yilgarn Craton (Cassidy et al., 2006), and the mineralisation examples referred to in Section 5. The Nd data have also previously been used to assist with interpreting potential crustal breaks identified in the seismic data (e.g., Korsch et al., 2012), and the speculative basement age map would benefit from integration with the large amount of seismic data now available (e.g., Kennett et al., 2013). Similarly, U-Pb isotopic data, in the form of calculated μ (mu) values, have been used to generate regional maps of Pb isotope signatures (e.g., Huston et al., 2005, 2013). As shown in Huston et al. (2013), these often agree closely to Nd model age maps over the same regions. Integration with additional isotopic systems would be beneficial, especially in-situ measurements within minerals, such as Lu-Hf (directly comparable to Sm-Nd) and oxygen.

6.3. The problem of sediments

This report has shown that the Sm-Nd isotopic signature, especially when considered on a regional or secular basis, can identify (for a variety of reasons) geological terranes, crustal breaks, and old continental margins, despite the apparent complexity of granite genesis. The advantage of using whole rock Sm-Nd, and its ability to provide a large-scale average isotopic signature, is also one of its main disadvantages, however, particularly the potential for the whole rock signature to actually represent, and hence mask, a mix of components. As outlined in Section 2.5 and summarised in Table 2.2 and Table 2.3, for the purposes used here (i.e., crustal mapping, identifying crustal breaks), the most worrisome component in a granite are sedimentary rocks which may bias the Nd isotopic signature, i.e., the signature represents the sediment provenance and not that of the basement. The problem of mixing with juvenile (mantle melt) material is largely eliminated with use of larger whole rock data sets.

The problem of possible sediment input into granite is not only a difficulty for Sm-Nd but also for Lu-Hf, even when analyses are in-situ, such as in zircon (e.g., Dhuime et al., 2012), as the latter cannot unequivocally identify a role for sediments without ancillary evidence, e.g., when dealing with S-type magmatism or, for example, when U-Pb zircon studies indicate age distribution patterns of xenocrystic zircons match those in local country rock sediments (e.g., Black et al., 2010). While this latter approach is perfectly valid, it too suffers from being unable to unequivocally identify supracrustal contributions. Lu-Hf in zircon does have the advantage over whole-rock Sm-Nd, however, in that it can (and commonly does) indicate a range of isotopic signatures consistent with at least two components in the granite; commonly interpreted as mixing between crustal and juvenile components (though this advantage is somewhat lost when larger Nd data sets are available). More recently, in-situ oxygen isotope analyses ($^{18}O/^{16}O$, expressed as $\delta^{18}O$) of zircons have become more routine (e.g., Kemp et al., 2006, 2007, 2008, 2009b). As outlined by numerous workers, oxygen isotopes have the advantage in being able to readily identify surficial processes (which result in heavy oxygen signatures) and therefore potential sedimentary input, particularly useful when dealing with I-type (and A-type) felsic magmatism. This is at its most advantageous when combined with other in-situ isotopic analysis, such as Lu-Hf and U-Pb, allowing one to not just identify components, but place constraints on their pre-history, in particular the degree of exposure to supercrustal processes. A recent example of this is demonstrated in Kemp et al. (2009). By analysing zircons from granites of the Lachlan Orogen for $\delta^{18}O$ and ε_{Hf} they were able to identify correlated $\delta^{18}O$-ε_{Hf} isotopic signatures. These included a high $\delta^{18}O$-low ε_{Hf} end-member component, which they interpreted as sedimentary input into the respective magmas (though compare with Williams et al., 2011; see section 3.3.5.2). What that study (and such studies in general) could not unequivocally quantify was the nature of the low $\delta^{18}O$ – high ε_{Hf} end-member component, i.e., potentially derived from one or more of the following: direct mantle input, reworked juvenile input or infracrustal (though in Kemp et al. (2009) the occurrence of mafic rocks with similar isotopic signatures was used to imply a direct mantle input). Regardless, this ‘non-sedimentary’ end-member provides a potential ‘crustal’ end-member that could be used for regional crustal mapping as undertaken in this record for Sm-Nd. Like Sm-Nd, this Hf-$\delta^{18}O$ end-member still potentially records a crust-mantle mix, though one essentially free from sedimentary input complications. One potential complexity in this approach is the occurrence of rapid reworking such that inherited zircons and cores may be present that are indistinguishable on the basis of U-Pb dating from magmatic zircons (i.e., within the precision of the U-Pb dating). This was demonstrated by Bindeman et al. (2008) for felsic volcanics at Yellowstone, U.S.A. In those rocks, cores and rims were recognisable based on contrasting properties – whether this would always be the case is not certain. Bryan et al. (2008) also documented somewhat similar antecrystic zircons in rhyolites of the Sierra Madre Occidental Province, Mexico and suggested they may be up to 10 Myr older than the host magma.

7. Acknowledgements

I would like to acknowledge the support and contributions of colleagues from Geoscience Australia and state and territory geological surveys. In particular, Andrew Barnicoat, Richard Blewett, John Claoue-Long, Andrew Cross, Geoff Fraser, David Huston, Russell Korsch, Natalie Kositcin and Keith Sircombe (all Geoscience Australia), and Phil Blevin (Geological Survey of New South Wales), Hugh Smithies (Geological Survey of Western Australia), Bob Bultitude and Ces Murray (Geological Survey of Queensland), John Everard (Mineral Resources Tasmania) and Dot Close and Eloise Beyer (Northern Territory Geological Survey), for discussions on regional geology and geodynamics and interpretation of the Nd isotopic data. I would also like to acknowledge Ollie Raymond, Simon Bodorkos, Robyn Gallagher, and Weiping Zhang (Geoscience Australia), for discussions and assistance with data standards, data structures and metadata. David Huston and Natalie Kositcin are thanked for reviewing draft versions of this Record. I would also like to thank Ian Scrimgeour and Dot Close of the Northern Territory Geological Survey for allowing me access to their unpublished isotopic data and providing permission to release it as part of the accompanying data sets. Finally, the unpublished Geoscience Australia data presented here was collected by numerous geoscientists over the last 30 years (including a significant portion by the late Shen-Su Sun), much of which was in collaboration with relevant state and territory surveys—the contributions of these personnel are gratefully acknowledged.

References

Ahmad, M. and McCready, A, 2001. Rum Jungle region and the Pine Creek Orogen: Synthesis and evaluation of existing data. In *Annual Geoscience Exploration Seminar (AGES) 2001. Record of Abstracts*. Northern Territory Geological Survey, Record 2001-006.

Allen, C.M., 2000. *Evolution of a post-batholith dike swarm in central coastal Queensland, Australia: arc-front to backarc?* Lithos 51, 331–349

Allen, C.M., Williams, I.S., Stephens, C.J. and Fielding, C.R., 1998. *Granite genesis and basin formation in an extensional setting: the magmatic history of the northernmost New England Orogen*. Australian Journal of Earth Sciences 45, 875–888.

Allen, C.M., Wooden, J.L. and Chappell, B.W., 1997. *Late Paleozoic crustal history of central coastal Queensland interpreted from geochemistry of Mesozoic plutons: the effects of continental rifting*. Lithos 42, 67–88.

Armstrong, R.L., 1981. *Radiogenic isotopes: The case for crustal recycling on a steady-state no-continental growth Earth*. Philosophical Transactions of the Royal Society of London, ser. A, Mathematical and Physical Sciences 301, 443–472.

Arndt, N., Bruzak, G. and Reischmann, T., 2001. The oldest continental and oceanic plateaus: Geochemistry of basalts and komatiites of the Pilbara Craton, Australia. In Ernst, R.E. and Buchan, K.L. (eds.), *Mantle Plumes: Their identification through time*. Geological Society of America, Special Paper 352, p. 359–387.

Arndt, N.T. and Jenner, G.A., 1986. Crustally contaminated komatiites and basalts from Kambalda, Western Australia. Chemical Geology 56, 229—255.

Arndt, N.T., Nelson, D.R., Compston, W., Trendall, A.F. and Thorne, A.M., 1991. *The age of the Fortescue Group, Hamersley Basin, Western Australia, from ion microprobe zircon U–Pb results*. Australian Journal of Earth Sciences 38, 261–281.

Ashley, P.M., Cook, N.D.J. and Fanning, C.M., 1996. *Geochemistry and age of metamorphosed felsic igneous rocks with A-type affinities in the Willyama Supergroup, Olary Block, South Australia, and implications for mineral exploration*. Lithos 38, 167–184.

Bagas, L., 2004. *Proterozoic evolution and tectonic setting of the northwest Paterson Orogen, Western Australia*. Precambrian Research 128, 475–496.

Bagas, L., Bierlein, F.P., English, L., Anderson, J.A.C., Maidment, D. and Huston, D.L., 2008. *An example of a Palaeoproterozoic back-arc basin: Petrology and geochemistry of the ca. 1864 Ma Stubbins Formation as an aid towards an improved understanding of the Granites–Tanami Orogen, Western Australia*. Precambrian Research 166, 168–184.

Bagas, L., Bierlein, F.P., Anderson, J.A.C. and Maas, R. 2010. *Collision-related granitic magmatism in the Granites–Tanami Orogen, Western Australia*. Precambrian Research 177, 212–226

Bain, J.H.C. and Draper, J.J (eds.), 1997. *North Queensland Geology*. Bulletin of the Australian Geological Survey Organisation 240, and Queensland Department of Mines and Energy Geology 9.

Bajwah, Z.U., 2001., Metallogenic significance of Palaeoproterozoic granites (S- and I-type) in the Pine Creek Orogen, Northern Territory, Australia. In B.W. Chappell and P.D. Fleming (eds.), *S-type granites and related rocks*, Australian Geological Survey Organisation Record 2001/2, p.17–18.

Barley, M. E. and Pickard, A. L., 1999. *An extensive, crustally-derived, 3325 to 3310 Ma silicic volcanoplutonic suite in the eastern Pilbara Craton: evidence from the Kelly Belt, McPhee Dome and Corunna Downs Batholith*. Precambrian Research 96, p. 41–62.

Barley, M.E., Eisenlohr, B., Groves, D.I., Perring, C.S. and Vearncombe, J.R., 1989. *Late Archaean convergent margin tectonics and gold mineralization: a new look at the Norseman-Wiluna Belt*. Geology 17, 826–829.

Barley, M.E., Brown, S.J.A, Cas, R.A.F, Cassidy, K.F., Champion, D.C., Gardoll, S.J. and Krapež, B., 2003. *AMIRA Project P624. An integrated geological and metallogenic framework for the eastern Yilgarn Craton: Developing geodynamic models of highly mineralised Archean granite-greenstone terranes Final Report April 2003*. AMIRA Project P624 Report.

Barley, M.E., Brown, S.J.A, Krapež, B. and Kositcin, N., 2008. *Physical volcanology and geochemistry of a Late Archaean volcanic arc: Kurnalpi and Gindalbie Terranes, Eastern Goldfields Superterrane, Western Australia.* Precambrian Research 161,53–76.

Barnes, S.J. and Fiorentini, M.L., 2010a. Komatiite-hosted nickel sulphide deposits: what's so special about the Kalgoorlie Terrane. In Tyler, I.M. and Knox-Robinson, C.M. (eds.), *Fifth International Archean Symposium Abstracts*, Geological Survey of Western Australia Record 2010/18, 281–283.

Barnes, S.J. and Fiorentini, M.L., 2010b. Comparative lithogeochemistry of komatiites in the Eastern Goldfields Superterrane and the Abitibi Greenstone Belt, and implications for distribution of nickel sulphide deposits. In Wyche, S. (compiler), *Yilgarn-Superior workshop-Abstracts, Fifth International Archean Symposium 10 September 2010*. Geological Survey of Western Australia Record 2010/20, 23–26.

Bateman, R., Costa, S., Swe, T. and Lambert, D., 2001. *Archaean mafic magmatism in the Kalgoorlie area of the Yilgarn Craton, Western Australia: a geochemical and Nd isotopic study of the petrogenetic and tectonic evolution of a greenstone belt*. Precambrian Research 108, 75–112.

Beakhouse, G.P., 2007. Gold, granite and Late Archean tectonics: A Superior Province perspective. In Bierlein, F.P. and Knox-Robinson, C.M. (eds.) *Proceedings of Geoconferences (WA) Inc. Kalgoorlie '07 Conference, 25–27 September 2007, Kalgoorlie, Western Australia*. Geoscience Australia Record 2007/14, 191–196.

Begg, G.C., Hronsky, J.A.M., Arndt, N.T., Griffin, W.L., O'Reilly, S.Y. and Hayward, N., 2010. *Lithospheric, cratonic, and geodynamic setting of Ni-Cu-PGE sulfide deposits*. Economic Geology 105, 1057–1070.

Bennett, V.C. and DePaolo, D.J., 1987. *Proterozoic crustal history of the western United States as determined by neodymium isotopic mapping*. Bulletin of the Geological Society of America 99, 674–685.

Belousova, E.A., Kostitsyn, Y.A., Griffin, W.L., Begg, G.C., O'Reilly, S.Y. and Pearson, N.J., 2010. *The growth of the continental crust: Constraints from zircon Hf-isotope data.* Lithos 119, 457–466.

Berry, R.F. and Bull, S.W., 2012. *The pre-Carboniferous geology of Tasmania*. Episodes 35, 195–204.

Betts, P.G., Giles, D., Foden, J., Schaefer, B.F., mark, G., Pankhurst, M.J., Forbes, C.J., Williams, H.A., Chalmers, N.C. and Hills, Q., 2009. *Mesoproterozoic plume-modified orogenesis in eastern Precambrian Australia*. Tectonics 28, TC3006, doi:10.1029/2008TC002325.

Betts, P.G., Giles, D., Lister, G.S. and Frick. L.R., 2002. *Evolution of the Australian lithosphere*. Australian Journal of Earth Sciences 49, 661–695.

Bickle, M. J., Bettenay, L. F., Chapman, H. J., Groves, D. I., McNaughton, N. J., Campbell, I. H. and De Laeter, J. R., 1989. *The age and origin of younger granitic plutons of the Shaw Batholith in the Archaean Pilbara Block, Western Australia*. Contributions to Mineralogy and Petrology, v. 101, p. 361–376.

Bickle, M. J., Bettenay, L. F., Chapman, H. J., Groves, D. I., McNaughton, N. J., Campbell, I. H. and De Laeter, J. R., 1993. *Origin of the 3500–3300 Ma calc-alkaline rocks in the Pilbara Archaean: isotopic and geochemical constraints from the Shaw Batholith*. Precambrian Research 60, 117–149.

Bierlein, F.P. and Betts, P.G., 2004. *The Proterozoic Mount Isa Fault Zone, northeastern Australia: is it really a ca. 1.9 Ga terrane-bounding suture*? Earth and Planetary Science Letters 225, 279– 294.

Bierlein, F.P., Maas, R. and Woodhead, J., 2011. *Pre-1.8 Ga tectono-magmatic evolution of the Kalkadoon–Leichhardt Belt: implications for the crustal architecture and metallogeny of the Mount Isa Inlier, northwest Queensland, Australia*. Australian Journal of Earth Sciences 58, 887–915.

Bindeman, I.N., Fu, B., Kita, N.T. and Valley, J.W., 2008. *Origin and evolution of silicic magmatism at Yellowstone based on ion microprobe analysis of isotopically zoned zircons*. Journal of Petrology 49, 163–193.

Black, L.P. and McCulloch, M.T., 1984. *Sm-Nd ages of the Arunta, Tennant creek, and Georgetown inliers of Northern Australia*. Australian Journal of Earth Sciences 31, 49–60.

Black, L.P. and McCulloch, M.T., 1990. *Isotopic evidence for the dependence of recurrent felsic magmatism on new crust formation; an example from the Georgetown region of northeastern Australia*. Geochimica et Cosmochimica Acta 54, 183–196.

Black, L.P. and Shaw, R.D., 1992. *U-Pb zircon age of prograde Proterozoic events in the Central and Southern Provinces of the Arunta Block, central Australia*. Australian Journal of Earth Sciences 39, 153–171.

Black, L.P. and Shaw, R.D., 1995. *An assessment, based on U-Pb zircon data, of Rb-Sr dating in the Arunta Inlier, central Australia*. Precambrian Research 71, 3–15.

Black, L.P. and Withnall, I.W., 1993. *The ages of Proterozoic granites in the Georgetown Inlier of northeastern Australia, and their relevance to the dating of tectonothermal events*. AGSO Journal of Australian Geology and Geophysics 14 (4), 331–341.

Black, L.P., 1994. Appendix 2: U-Pb zircon geochronology. In Oversby, B.S., Mackenzie, D.E., McPhie, J., Law, S.R. and Wyborn, D., *The Geology of Palaeozoic Volcanic and Associated Rocks in the Burdekin Falls Dam - "Conway" Area, Northeastern Queensland*, Australian Geological Survey Organisation Record 1994/21, pp. 163-168.

Black, L.P., Gregory, P., Withnall, I.W. and Bain, J.H.C., 1998. *U-Pb zircon age for the Etheridge Group, Georgetown region, north Queensland: Implications for relationship with the Broken Hill and Mt Isa sequences*. Australian Journal of Earth Sciences 45, 925–935.

Black, L.P., Calver, C.R., Seymour, D.B. and Reed, A., 2004. *SHRIMP U-Pb detrital zircon ages from Proterozoic and early Palaeozoic sandstones and their bearing on the early geological evolution of Tasmania*. Australian Journal of Earth Sciences 51, 885–900.

Black, L.P., McClenaghan, M.P., Korsch, R.J., Everard, J.L. and Foudoulis, C., 2005. *Significance of Devonian-Carboniferous igneous activity in Tasmania as derived from U-Pb SHRIMP dating of zircon*. Australian Journal of Earth Sciences 52, 807–829.

Black, L. P., Everard, J. L., McClenaghan, M. P., Korsch, R.J., Calver, C.R., Fioretti, A.M., Brown, A.V. and Foudoulis, C., 2010. *Controls on Devonian–Carboniferous magmatism in Tasmania, based on inherited zircon age patterns, Sr, Nd and Pb isotopes, and major and trace element geochemistry*. Australian Journal of Earth Sciences 57, 933–968.

Blake, D.H., 1978. *The Proterozoic and Palaeozoic rocks of The Granites-Tanami region, Western Australia and Northern Territory, and interregional correlations*. Bureau of Mineral Resources, Journal of Australian Geology and Geophysics, 3, 35–42.

Blake, D.H., Hodgson, I.M. and Muhling, P.C., 1973. *The geology of The Granites-Tanami Region, Northern Territory and Western Australia*. Bureau of Mineral Resources, Geology and Geophysics, Bulletin, 197, 91 pp.

Blevin, P., 2004. *Redox and compositional parameters for interpreting the granitoid metallogeny of eastern Australia: Implications for gold-rich ore systems*. Resource Geology 54, 241–252.

Blevin, P.L. and Chappell, B.W., 1992. *The role of magma sources, oxidation states and fractionation in determining the granitoid metallogeny of eastern Australia.* Transactions of the Royal Society of Edinburgh: Earth sciences, 83, 305–316.

Blevin, P.L., Chappell, B.W. and Allen, C. M., 1996. *Intrusive metallogenic provinces in eastern Australia based on granite source and composition*. Transactions of the Royal Society of Edinburgh: Earth sciences 87, 281–290.

Blevin, P.L., 2010. Old friends in a whole new light: A new chronology for the igneous metallogeny of the southern New England orogen, New South Wales. In: Buckman, S. and Blevin, P.L. (eds). *NEO 2010. New England Orogen 2010 - proceedings of a conference held at the University of New England, Armidale, New South Wales, Australia, November 2010*. University of New England, pp. 45–48.

Blewett, R.S., Denaro, T.J., Knutson, J., Wellman, P., Mackenzie, D.E., Cruikshank, B.I., Wilford, J.R., von Gnielinski, F.E., Pain, C.F., Sun, S.S. and Bultitude, R.J., 1997, Coen region. In Bain, J.H.C. and Draper, J.J. (eds.), *North Queensland Geology*, Australian Geological Survey Organisation Bulletin 240, and Queensland Department of Mines and Energy Queensland Geology 9, pp. 117–38.

Blewett, R.S., Kennett, B.L.N. and Huston, D.L., 2012. Australia in time and space. In Blewett, R.S. (ed.), *Shaping a Nation: A Geology of Australia*. Geoscience Australia and ANU E Press, Canberra, 46–119.

Brandon, A.D. and Draper, D.S., 1996. *Constraints on the origin of the oxidation state of mantle overlying subduction zones: An example from Simcoe, Washington, USA*. Geochimica et Cosmochimica Acta 60, 1739–1749.

Brauhart, C. W. and Morant, P., 2000. *Discussion on 'Geochemistry and geodynamic setting of volcanic and plutonic rocks associated with early Archean volcanogenic massive sulfide mineralisation, Pilbara Craton' by Vearncombe, S.E., Kerrich, R., 1999*. Precambrian research 98, 243–270. Precambrian Research 104, 95–99.

Brauhart, C. W., Huston, D. L. and Andrew, A. S., 2000. *Oxygen isotope mapping in the Panorama VMS district, Pilbara Craton, Western Australia: applications to estimating temperatures of alteration and to exploration*. Mineralium Deposita, v. 35, 727–740.

Bryant, C.J., Arculus, R.J. and Chappell, B.W., 1997. *Clarence River Supersuite: 250 Ma Cordilleran Tonalitic I-type Intrusions in Eastern Australia*. Journal of Petrology 38, 975–1001.

Bryan, S.E., Ferrari, L., Reiners, P.W., Allen, C.M., Petrone, C.M., Ramos-Rosique, A. and Campbell, I.H., 2008. *New insights into crustal contributions to large-volume rhyolite generation in the mid-Tertiary Sierra Madre Occidental province, Mexico, revealed by U–Pb geochronology*. Journal of Petrology 49, 47–77.

Bryan, S.E., Cook, A.G., Allen, C.M., Siegel, C., Purdy, D.J., Greentree, J.S. and Uysal, I.T., 2012. *Early-mid Cretaceous tectonic evolution of eastern Gondwana: from silicic LIP magmatism to continental rupture*. Episodes 35, 142-152.

Budd, A.R., 2006. *The Tarcoola goldfield of the central Gawler gold province, and the Hiltaba Association Granites, Gawler craton, South Australia*. Unpublished Ph.D. thesis, Canberra, ACT, Australian National University, 507 p.

Budd, A.R. and Skirrow, R.G., 2007. *The Nature and Origin of Gold Deposits of the Tarcoola Goldfield and Implications for the Central Gawler Gold Province, South Australia*. Economic Geology 102, 1541–1563.

Budd, A.R., Wyborn, L.A.I. and Bastrakova, I.V., 2001. *The metallogenic potential of Australian Proterozoic Granites*. Geoscience Australia Record, 2001/12.

Buick, R., Brauhart, C. W., Morant, P., Thornett, J. R., Maniw, J. G., Archibald, N. J., Doepel, M. G., Fletcher, I. R., Pickard, A. L., Smith, J. B., Barley, M. E., Mcnaughton, N. J., and Groves, D. I., 2002. *Geochronology and stratigraphic relationships of the Sulphur Springs Group and Strelley Granite: a temporally distinct igneous province in the Archaean Pilbara Craton, Australia.* Precambrian Research 114, 87–120.

Buick, R., Thornett, J. R., McNaughton, N. J., Smith, J. B., Barley, M. E. and Savage, M., 1995. *Record of emergent continental crust ~3.5 billion years ago in the Pilbara Craton of Australia*. Nature 375, 574–577.

Bultitude, R.J., Champion, D.C., 1992. *Granites of the eastern Hodgkinson Province—their field and petrographic characteristics*. Queensland Resource Industries Record 1992/6.

Bultitude, R.J., Garrad, P.D., Donchak, P.J.T., Domagala, J., Champion, D.C., Rees, I.D., Mackenzie, D.E., Wellman, P., Knutson, J., Fanning, C.M., Fordham, B.G., Grimes, K.G., Oversby, B.S., Rienks, I.P., Stephenson, P.J., Chappell, B.W., Pain, C.F., Wilford, J.R., Rigby, J.F. and Woodbury, M.J., 1997b. Cairns Region. In Bain, J.H.C. and Draper, J.J. (eds.), *North Queensland Geology*, Australian Geological Survey Organisation Bulletin 240, and Queensland Department of Mines and Energy Queensland Geology 9, pp. 225–325.

Burtt, A., Conor, C. and Robertson, S., 2004. *Broken Hill Curnamona–an emerging Cu-Au province*. MESA Journal 33, 9-17.

Campbell, I.H. and Allen, C.M., 2008. *Formation of supercontinents linked to increases in atmospheric oxygen*. Nature Geoscience 1, 554–558.

Carson, C.J., von Gnielinski, F.E. and Bultitude, R.J., 2007. *Results of the joint GSQ-GA geochronology project, New England Orogen, ROSEDALE, MOUNT PERRY and GLADSTONE 1:100 000 Sheet Areas, March 2006 - December 2006*. Queensland Geological Record 2006/01, 58p.

Carson, C.J., Worden, K.E., Scrimgeour, I.R. and Stern R.A., 2008.*The Palaeoproterozoic tectonic evolution of the Litchfield Province, western Pine Creek Orogen: Insight from recent U-Pb zircon and in-situ monazite geochronology*. Precambrian Research 166, 145–167.

Carson, C.J., Hutton, L.J., Withnall, I.W. and Perkins, W., 2009. *Summary of results: Joint GSQ-GA NGA geochronology project Mount Isa Region URANDANGI, CLONCURRY, DUCHESS and DOBBYN 1:250 000 Sheet areas August 2007 - June 2008*. Geoscience Australia Record 69.

Cassidy, K.F., Champion, D.C., Krapež, B., Barley, M.E., Brown, S.J.A., Blewett, R.S., Groenewald P.B. and Tyler, I.M., 2006. *A revised geological framework for the Yilgarn Craton, Western Australia*. Western Australia Geological Survey Record 2006/8.

Cassidy K.F., Champion D.C. and Huston D.L., 2005. Crustal evolution constraints on the metallogeny of the Yilgarn Craton. In: Mao J. and Bierlein, F.P., eds., *Mineral Deposit Research: Meeting the Global Challenge*. Springer, Berlin/Heidelberg, 901–904.

Cassidy, K., Czarnota, K., Huston, D., Maidment, D., McIntyre, A., Meixner, T., Neumann, N. and Potter, A., 2006. *New data and new concepts for the Paterson Orogen - presentation for the 2006 Geological Survey of Western Australia open day*. Geoscience Australia web release; https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=68412

Cawood, P.A., 2005. *Terra Australis Orogen: Rodinia breakup and development of the Pacific and Iapetus margins of Gondwana during the Neoproterozoic and Palaeozoic.* Earth Science Reviews 69, 249–279.

Cawood, P.A. and Korsch, R.J., 2008. *Assembling Australia: Proterozoic building of a continent*. Precambrian Research 166, 1–38.

Cawood, P.A. and Tyler, I.M., 2004. *Assembling and reactivating the Proterozoic Capricorn Orogen: Lithotectonic elements, orogenies, and significance.* Precambrian Research, 128, 201–218.

Cawood, P.A.; Leitch, E.; Merle, R.; and Nemchin, A., 2010. *Earliest Permian non-collisional orogeny and basin formation in the southern New England fold belt sector of the Terra Australis Orogen*. Abstracts - Geological Society of Australia, Vol.98, p.70; 20th Australian geological convention (AESC 2010), Canberra, A.C.T., Australia, July 4–8, 2010.

Cawood, P.A., Hawkesworth, C.J. and Dhuime, B., 2013. *The continental record and the generation of continental crust*. Geological Society of America Bulletin 125, 14–32.

Cayley, R.A., 2011. *Exotic crustal block accretion to the eastern Gondwanaland margin in the Late Cambrian–Tasmania, the Selwyn Block, and implications for the Cambrian–Silurian evolution of the Ross, Delamerian, and Lachlan orogens*. Gondwana Research 19, 628–649.

Cayley, R. A., Taylor, D. H., VandenBerg, A. H. M. and Moore, D. H. 2002. *Proterozoic – Early Palaeozoic rocks and the Tyennan Orogeny in central Victoria: the Selwyn Block and its tectonic implications*. Australian Journal of Earth Sciences 49, 225 – 254.

Cayley, R.A., Korsch, R.J., Moore, D.H., Costelloe, R.D., Nakamura, A., Willman, C.E., Rawling, T.J., Morand, V.J., Skladzien, P.B. and O'Shea, P.J., 2011. *Crustal architecture of central Victoria: results from the 2006 deep crustal reflection seismic survey*. Australian Journal of Earth Sciences 58, 113–156.

Champion, D.C., 1991. *Petrogenesis of the felsic granitoids of far north Queensland*. PhD Thesis, Australian National University, Canberra, 361 pp.

Champion, D.C. and Bultitude, R.J., 1994. *Granites of the eastern Hodgkinson Province. II. Their geochemical and Nd\Sr isotopic characteristics and implications for petrogenesis and crustal structure in north Queensland*. Queensland Geological Record 1994/1.

Champion, D.C. and Bultitude, R.J., 2013a. Kennedy Igneous Association. In P.A. Jell (ed.) *Geology of Queensland*. Geological Survey of Queensland, pp. 473–514.

Champion, D.C. and Bultitude, R.J., 2013b. *The geochemical and Sr-Nd isotopic characteristics of Paleozoic fractionated S-types granites of north Queensland: Implications for S-type granite petrogenesis*. Lithos 162–163, 37–56.

Champion, D.C. and Cassidy, K.F., 2007. An overview of the Yilgarn Craton and its crustal evolution. In Bierlein, F.P. and Knox-Robinson, C.M. (eds.) *Proceedings of Geoconferences (WA) Inc. Kalgoorlie '07 Conference, 25-27 September 2007, Kalgoorlie, Western Australia.* Geoscience Australia Record 2007/14, 8–13.

Champion, D.C. and Cassidy, K.F., 2008. Using geochemistry and isotopic signatures of granites to aid mineral systems studies: an example from the Yilgarn Craton. In: Korsch, R.J. and Barnicoat, A. C., eds., *2008. New perspectives: The foundations and future of Australian exploration.* Abstracts for the June 2008 pmd*CRC Conference. Geoscience Australia, Record 2008/09, 7–16.

Champion, D.C. and Cassidy, K.F., 2010. Granitic magmatism in the Yilgarn Craton: implications for crustal growth and metallogeny. In Wyche, S. (compiler), *Yilgarn-Superior workshop-Abstracts, Fifth International Archean Symposium 10 September 2010*. Geological Survey of Western Australia Record 2010/20, 23–26.

Champion D. C. and Chappell B. W., 1992. *Petrogenesis of felsic I-type granites: an example from northern Queensland*. Transactions of the Royal Society of Edinburgh: Earth Sciences, 83, 115–126.

Champion, D.C. and Smithies, R.H., 2000. *The geochemistry of the Yule Granitoid Complex, East Pilbara Granite–Greenstone Terrane; evidence for early felsic crust*. Geological Survey of Western Australia 1999–2000 Annual Review, 42–48.

Champion, D.C. and Smithies, R.H., 2007. Geochemistry of Paleoarchean granites of the East Pilbara Terrane, Pilbara Craton, Western Australia: implications for early Archean crustal growth. In M.J. Van Kranendonk, R.H. Smithies and V.C. Bennett, eds., *Earth's Oldest Rocks*. Developments in Precambrian Geology Volume 15, Elsevier, 369–409.

Champion, D.C. and Sheraton, J.W., 1997. *Geochemistry and Nd isotope systematics of Archaean granites of the Eastern Goldfields, Yilgarn Craton, Australia; implications for crustal growth processes*. Precambrian Research 83, 109–132.

Champion, D.C., Kositcin, N., Huston, D.L., Mathews, E. and Brown, C., 2009. *Geodynamic synthesis of the Phanerozoic of eastern Australia and implications for metallogeny*. Geoscience Australia Record 2009/18.

Champion, D.C., Bultitude, R.J. and Blevin, P.L., 2010. Geochemistry and isotope systematics of Carboniferous to Triassic felsic magmatism in northeastern Australia—putting the New England Orogen in its place. In S. Buckman and P.L. Blevin (eds.) *New England Orogen 2010. Proceedings of a conference held at the University of New England, Armidale, New South Wales, Australia, November 2010*. University of New England, Armidale, pp. 112–18.

Champion, D.C., Van der Wielen, S. and Wyborn, L.A., 2012. Deep heat—Australia's energy future? In Blewett, R.S. (ed.), *Shaping a Nation: A Geology of Australia*. Geoscience Australia and ANU E Press, Canberra, 482–525.

Chappell, B.W., 1996. *Compositional variation within granite suites of the Lachlan Fold Belt: its causes and implications for the physical state of granite magma.* Transactions of the Royal Society of Edinburgh Earth Sciences 87, 171–182.

Chappell, B.W., White, A.J.R. and Wyborn, D., 1987. *The importance of residual source material (restite) in granite petrogenesis*. Journal of Petrology 28, 1111–1138.

Chappell, B.W., White, A.J.R. and Hine, R., 1988. *Granite provinces and basement terranes in the Lachlan Fold Belt, southeastern Australia*. Australian Journal of Earth Sciences 35, 505–521.

Chappell, B.W., Williams, I.S., White, A.J.R. and McCulloch, M.T., 1990. *Seventh International Conference on Geochronology, Cosmochronology and Isotope Geology Excursion Guide A-2. Granites of the Lachlan Fold Belt 18–22 September, 1990*. Bureau of Mineral Resources, geology and Geophysics Record 1990/48.

Chauvel, C., Dupré, B. and Jenner, G.A., 1985. *The Sm-Nd age of Kambalda volcanics is 500 Ma too old*. Earth and Planetary Science Letters 74, 315–324.

Claoué-Long, J., 2006. Arunta-Tennant-Tanami: the early evolution to *ca* 1700 Ma. In: Lyons, P. and Huston, D.L. (Eds.), Evolution and metallogenesis of the North Australian Craton, Conference Abstracts. Geoscience Australia Record 2006/16.

Claoué-Long, J.C., Thirlwall, M.F. and Nesbitt, R.W., 1984. Revised Sm-Nd systematics of Kambalda greenstones, Western Australia. Nature 307, 697–701.

Clemens, J.D. and Stevens, G., 2012. *What controls chemical variation in granitic magmas*? Lithos 134–135, 317–329.

Clemens, J.D., Stevens, G. and Farina, F., 2011. *The enigmatic sources of I-type granites: The peritectic connexion*. Lithos 126, 174–181.

Close, D.F., Scrimgeour, I.R., Edgoose, C.J., Cross, A., Claoué-Long, J., Kinny, P. and Meixner, T., 2003. Redefining the Warumpi Province. In *Annual Geoscience Exploration Seminar (AGES) 2003. Record of abstracts*, Northern Territory Geological Survey Record 2003-001.

Close, D., Scrimgeour, I., Edgoose, C., Frater, M. and Close, A., 2004. New insights into geology and prospectivity of the southwestern Arunta region. In *Annual Geoscience Exploration Seminar (AGES) 2004.Record of abstracts*, Northern Territory Geological Survey Record 2004-001.

Close, D., Scrimgeour, I. and Edgoose, C., 2006. Evolution and mineral potential of the Palaeoproterozoic Warumpi Province. In: Lyons, P. and Huston, D.L. (Eds.), *Evolution and metallogenesis of the North Australian Craton, Conference Abstracts*. Geoscience Australia Record 2006/16.

Collins, W.J., 1996. *Lachlan Fold Belt granitoids: products of three-component mixing*. Transactions of the Royal Society of Edinburgh Earth Sciences 87, 183–192.

Collins, W.J. and Richards, S.W. 2008. *Geodynamic significance of S-type granites in Circum-Pacific orogens*. Geology 36, 559–562.

Collins, W.J. and Shaw, R.D., 1995. *Geochronological constraints on orogenic events in the Arunta Inlier—a review*. Precambrian Research 71, 315–346.

Collins, W.J., Belousova, E.A., Kemp, A.I.S. and Murphy, J.B., 2011. *Two contrasting Phanerozoic orogenic systems revealed by hafnium isotope data*. Nature Geoscience 4, 333-337.

Compston, D.M., 1995. *Time constraints on the evolution of the Tennant Creek Block, northern Australia*. Precambrian Research 71, 107–129.

Compston, W., Williams, I.S. and McCulloch, M.T., 1986. *Contrasting zircon U-Pb and model Sm-Nd ages for the Archaean Logue Brook Granite*. Australian Journal of Earth Sciences 33, 193–200.

Condie, K.C. and Aster, R.C., 2010. *Episodic zircon age spectra of orogenic granitoids: The supercontinent connection and continental growth*. Precambrian Research 180, 227–236.

Condie. K.C., Belousova, E., Griffin, W.L. and Sircombe, K.N., 2009. *Granitoid events in space and time: Constraints from igneous and detrital zircon age spectra*. Gondwana Research 15, 228–242.

Coney, P.J., 1992. *The Lachlan belt of eastern Australia and Circum-Pacific tectonic evolution*. Tectonophysics, 14, l–25.

Conor, C.H.H. and Preiss, W.V., 2008. *Understanding the 1720-1640 Ma Palaeoproterozoic Willyama Supergroup, Curnamona Province, Southeastern Australia: Implications for tectonics, basin evolution and ore genesis*. Precambrian Research, 166, 297–317.

Cooke, D.R., Wilson, A.J., House, M.J., Wolfe, R.C., Walshe, J L., Lickfold, V. and Crawford, A.J., 2007. *Alkalic porphyry Au - Cu and associated mineral deposits of the Ordovician to Early Silurian Macquarie Arc, New South Wales*. Australian Journal of Earth Sciences 55, 445–463.

Cooper, J.A., Mortimer, G.E. and James. P.R., 1988. *Rate of Arunta Inlier evolution at the eastern margin of the Entia Dome, central Australia*. Precambrian Research 40/41, 217–231.

Cowley, W.M. and Fanning, C.M., 1992. *Low-grade Archaean Metavolcanics in the northern Gawler Craton*. South Australia Geological Survey Quarterly Geological Notes 119, 2–17.

Crawford, A. J. and Berry, R. F., 1992. *Tectonic implications of Late Proterozoic - Early Palaeozoic igneous rock associations in western Tasmania*. Tectonophysics 214, 37–56.

Crawford, A.J., Meffre, S. and Symonds, P.A., 2003. 120 to 0 Ma tectonic evolution of the southwest Pacific and analogous geological evolution of the 600–220 Ma Tasman Fold Belt System. In Hillis, R.R. and Müller, R. D. (eds.), *Evolution and Dynamics of the Australian Plate*, Geological Society of Australia Special Publication 22 and Geological Society of America Special Paper 372, pp. 383–403.

Creaser, R.A. and Cooper, J.A., 1993. U-Pb geochronology of Middle Proterozoic felsic magmatism surrounding the Olympic Dam Cu-U-Au-Ag and Moonta Cu-Au-Ag deposits South Australia. Economic Geology 88, 186–197.

Creaser, R.A., 1989. The geology and petrology of Middle Proterozoic felsic magmatism of the Stuart Shelf, South Australia. Unpublished Ph.D. Thesis, La Trobe University, Victoria.

Creaser, R.A., 1995. Neodymium isotopic constraints for the origin of Mesoproterozoic felsic magmatism, Gawler Craton, South Australia. Canadian Journal of Earth Sciences 32, 460–471.

Crispe, A.J., Vandenberg, L.C. and Scrimgeour, I.R., 2007. Geological framework of the Archean and Paleoproterozoic Tanami Region, Northern Territory. Mineralium Deposita 42, 3–26.

Cross AJ, Claoué-Long JC, Scrimgeour IR, Ahmad M and Kruse PD, 2005. *Summary of results. Joint NTGS GA geochronology project: Rum Jungle, basement to southern Georgina Basin and eastern Arunta Region 2001–2003*. Northern Territory Geological Survey, Record 2005-006.

Cross, A. and Blevin, P.L., 2010. *Summary of results for the joint GSNSW - GA geochronology project: New England Orogen and Sydney-Gunnedah Basin April - July 2008*. New South Wales Geological Survey Report GS2010/0778.

Cross, A., Claoué-Long, J., Scrimgeour, I.R., Close, D.F. and Edgoose, C.J., 2004. *Summary of results. Joint NTGS-GA geochronology project: southern Arunta Region 2000-2003*. Northern Territory Geological Survey Record 2004-003.

Cross, A.J. and Crispe, A.J., 2007. *SHRIMP U–Pb analyses of detrital zircon: a window to understanding the Paleoproterozoic development of the Tanami Region, northern Australia*. Mineralium Deposita 42, 27–50.

Cross, A.J., Bultitude, R.J. and Purdy, D.J., 2012. *Summary of results for the joint GSQ–GA geochronology project: Ayr, Bowen, Eulo, Mount Coolon, Proserpine and Warwick 1:250 000 sheet areas*. Geological Survey of Queensland Record 2012/19.

Cross, A.J., Claoué-Long, J.C., Scrimgeour, I.R., Ahmad, M. and Kruse, P.D., 2005. *Summary of results. Joint NTGS-GA geochronology project: Rum Jungle, basement to southern Georgina Basin and eastern Arunta Region 2001–2003*. Northern Territory Geological Survey Record 2005–006.

Czarnota, K., Gerner, E., Maidment, D.W., Meixner, A. and Bagas, L., 2009. *Paterson area 1:250 000-scale solid geology interpretation and depth to basement model – explanatory notes*. Geoscience Australia Record, 2009/16.

Czarnota, K., Champion, D.C., Goscombe, B., Blewett, R.S., Henson, P.A., Cassidy, K.F., Groenewald, P.B., 2010. *Geodynamics of the eastern Yilgarn Craton*. Precambrian Research 183, 175–202.

De Laeter, J.R., Fletcher, I.R., Bickle, M.J., Myers, J.S., Libby, W.G. and Williams, I.R., 1985. *Rb-Sr, Sm-Nd and Pb-Pb geochronology of ancient gneisses from Mt Narryer, Western Australia*. Australian Journal of Earth Sciences 32, 349–358

DePaolo, D.J. and Wasserburg, G.J., 1976. *Nd isotopic variations and petrogenetic models.* Geophysical Research letters 3, 249–252.

DePaolo, D.J., 1981. *Neodymium isotopes in the Colorado Front Range and crust–mantle evolution in the Proterozoic*. Nature 291, 193–196.

DePaolo, D.J., 1988. *Neodymium isotope geochemistry: An introduction.* Springer-Verlag, Berlin, 187p.

Dhuime, B., Hawkesworth, C.J., Cawood, P.A. and Storey, C.D., 2012. *A Change in the Geodynamics of Continental Growth 3 Billion Years Ago*. Science 1334–1336.

Direen, N. G. and Crawford, A.J. 2003. *The Tasman Line; where is it, what is it, and is it Australia's Rodinian breakup boundary?* Australian Journal of Earth Sciences 50, 491–502.

Donchak, P.J.T., Bultitude, R.J., Purdy, D.J. and Denaro, T.J., 2007. *Geology and mineralisation of the Texas Region, south-eastern Queensland*. Queensland Geology, 11.

Dunphy, J.M., Fletcher, I.R., Cassidy, K.F. and Champion, D.C., 2003. *Compilation of SHRIMP U–Pb geochronological data, Yilgarn Craton, Western Australia, 2001–2002*. Geoscience Australia, Record 2003/15.

Edgoose, C.J., Scrimgeour, I.R. and Close, D.F. 2004. *Geology of the Musgrave Block, Northern Territory*. NTGS Report 15.

Elburg, M.A., Bons, P.D., Foden, J. and Brugger, J., 2003. *A newly defined Late Ordovician magmatic-thermal event in the Mt Painter Province, northern Flinders Ranges, South Australia.* Australian Journal of Earth Sciences 50, 611–631.

Elburg, M.A., Andersen, T., Bons, P.D., Weisheit, A., Simonsen, S.L. and Smet, I., 2012. *Metasomatism and metallogeny of A-type granites of the Mt Painter–Mt Babbage Inliers, South Australia*. Lithos 151, 83–104

Etheridge, M.A., Rutland, R.W.R. and Wyborn, L.A.I., 1987. Orogenesis and tectonic process in the early to middle Proterozoic of northern Australia. In A. Kroner, ed., *Proterozoic Lithosphere Evolution*, Geodynamics Series, Vol. 17. AGU, Washington, D. C., pp. 131 –147.

Fanning, C.M., 2012. *U–Pb zircon dating (SHRIMP)*. Queensland Geology 13, pp. 525–65.

Fanning, C.M., Oliver, R.L. and Cooper, J.A., 1981. *The Carnot Gneisses, southern Eyre Peninsular*. South Australia Geological Survey Quarterly Geological Notes 80, 7–12.

Fanning, C.M., Withnall, I.W., Hutton, L.H., Bultitude, R.J., von Gnielinski, F. and Rienks, I.P., 2009. Appendix: SHRIMP U–Pb zircon ages from central Queensland. In Withnall, I.W., Hutton, L.J., Bultitude, R.J., von Gnielinski, F. and Rienks, I.P., *Geology of the Auburn Arch, southern Connors Arch and adjacent parts of the Bowen basin and Yarrol Province, central Queensland*. Queensland Geology, 12, pp. 463–573.

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

Farmer, G.L. and DePaolo, D.J., 1983. *Origin of Mesozoic and Tertiary granite in the western United States and implications for pre-Mesozoic crustal structure I. Nd and Sr isotopic studies in the geocline of the northern Great Basin*. Journal of Geophysical Research 88, 3379–3401.

Farmer, G.L. and DePaolo, D.J., 1984. *Origin of Mesozoic and Tertiary granite in the western United States and implications for pre-Mesozoic crustal structure II. Nd and Sr isotopic studies of unmineralised and Cu- and Mo-mineralized granite in the Precambrian craton.* Journal of Geophysical Research 89, 10141–10160.

Ferris, G.M., Schwarz, M.P. and Heithersay, P., 2002. The geological framework, distribution and controls of Fe-oxide Cu-Au mineralisation in the Gawler Craton, South Australia. Part I – Geological and tectonic framework. In T.M. Porter, ed., *Hydrothermal Iron Oxide Copper-Gold and Related Deposits: A Global Perspective, Volume 2*. PGC Publishing, Adelaide, 9–31.

Fitzsimons, I.C.W. and Buchan, C., 2005. *Geology of the western Albany–Fraser Orogen, Western Australia — a field guide*. Western Australia Geological Survey Record 2005/11, 32p.

Fletcher, I.R., Williams, S.J., Gee, R.D. and Rosman, K.J.R., 1983a. *Sm-Nd model ages across the margins of the Archaean Yilgarn Block, Western Australia; northwest transect into the Proterozoic Gascoyne Province*. Australian Journal of Earth Sciences 30, 167–174.

Fletcher, I. R., Wilde, S. A., Libby, W. G. and Rosman, K. J. R., 1983b. *Sm-Nd model ages across the margins of the Archaean Yilgarn Block, Western Australia—II; southwest transect into the Proterozoic Albany-Fraser Province*. Australian Journal of Earth Sciences 30, 333–340.

Fletcher, I.R., Rosman, K.J.R., Williams, I.R., Hickman, A.H. and Baxter, J.L., 1984. *Sm-Nd geochronology of greenstone belts in the Yilgarn block, Western Australia*. Precambrian Research 26, 333–361.

Fletcher, I.R., Wilde, S.A. and Rosman, K.J.R., 1985. *Sm-Nd model ages across the margins of the Archaean Yilgarn Block, Western Australia; III, The western margin*. Australian Journal of Earth Sciences 32, 73–82.

Fletcher, I.R., Libby, W.G. and Rosman, K.J.R., 1994. *Sm-Nd model ages of granitoid rocks in the Yilgarn Craton*. Geological Survey of Western Australia Professional Papers Report 37, 61–74.

Fletcher, I.R., Dunphy, J.M., Cassidy, K.F. and Champion, D.C., 2001. *Compilation of SHRIMP U–Pb geochronological data, Yilgarn Craton, Western Australia, 2000-2001*. Geoscience Australia, Record 2001/47.

Fletcher, I.R. and McNaughton, N.J., 2002a. *Granitoid geochronology: SHRIMP zircon and titanite data. In Cassidy et al. 2002 Characterisation and metallogenic significance of Archean granitoids of the Yilgarn Craton, Western Australia.* Project No. M281. Minerals and Energy research Institute if Western Australia Report 222. AMIRA P482.

Fletcher, I.R. and McNaughton, N.J., 2002b. *Sm-Nd and Pb/Pb isotope geochemistry of Yilgarn granitoids. In Cassidy et al. 2002. Characterisation and metallogenic significance of Archean granitoids of the Yilgarn Craton, Western Australia.* Project No. M281. Minerals and Energy research Institute if Western Australia Report 222. AMIRA P482.

Foden, J.D., Buick, I.S. and Mortimer, G.E., 1988. *The petrology and geochemistry of granitic gneisses from the east Arunta Inlier, central Australia—Implications for Proterozoic crustal development*. Precambrian Research 40/41, 233–259.

Foden J., Mawby, J., Kelley S., Turner, S. and Bruce, D., 1995. *Metamorphic events in the eastern Arunta Inlier. 2. Nd–Sr–Ar isotopic constraints*. Precambrian Research 71, 207–227.

Foden, J., Sandiford, M., Dougherty-Page, J. and Williams, I. 1999. *Geochemistry and geochronology of the Rathjen Gneiss: implications for the early tectonic evolution of the Delamerian Orogen*. Australian Journal of Earth Sciences 46, 377–389

Foden, J.D., Elburg, M.A., Turner, S.P., Sandiford, M., O'Callaghan, J. and Mitchell, S., 2002. *Granite production in the Delamerian Orogen, South Australia*. Journal of the Geological Society, London 159, 557–575.

Foden, J.D., Elburg, M.A., Dougherty-Page, J. and Burtt, A., 2006. *The Timing and Duration of the Delamerian Orogeny: Correlation with the Ross Orogen and Implications for Gondwana Assembly*. Journal of Geology 114, 189–210.

Fraser, G. L., Huston, D. L., Gibson, G. M., Neumann, N. L., Maidment, D., Kositcin, N., Skirrow, R. G., Jaireth, S., Lyons, P., Carson, C., Cutten, H. and Lambeck, A.. 2007. *Geodynamic and Metallogenic Evolution of Proterozoic Australia from 1870 – 1550 Ma: a discussion*. Geoscience Australia Record 2007/16, 76 p.

Fraser, G., McAvaney, S., Neumann, N., Szpunar, M. and Reid, A., 2010. *Discovery of early Mesoarchean crust in the eastern Gawler Craton, South Australia*. Precambrian Research 179, 1–21.

Fraser, G.L. and Neumann, N.L. 2010. *New SHRIMP U-Pb zircon ages from the Gawler Craton and Curnamona Province, South Australia, 2008 – 2010*. Geoscience Australia Record, 2010/16.

Fraser, G.L., Blewett, R.S., Reid, A.J., Korsch, R.J., Dutch, R., Neumann, N.L., Meixner, A.J., Skirrow, R.G., Cowley, W.M., Szpunar, M., Preiss, W.V., Fomin, T., Holzschuh, J., Thiel, S., Milligan, P.R. and Bendall, B.R., 2010. Geological interpretation of deep seismic reflection and magnetotelluric line 08GA-G1: Eyre Peninsula, Gawler Craton, South Australia. In R.J. Korsch and N. Kositcin, eds., *South Australian Seismic and MT Workshop 2010*. *Geoscience Australia, Record,* 2010/10, 81–95.

Gibson, G.M., Rubenach, M.J., Neumann, N.L., Southgate, P.N. and Hutton, L.J., 2008. *Syn- and post-extensional tectonic activity in the Palaeoproterozoic sequences of Broken Hill and Mount Isa and its bearing on reconstructions of Rodinia*. Precambrian Research 166, 350–369.

Gibson, G. M., Morse, M. P., Ireland, T. R. and Nayak, G. K., 2011. *Arc-continent collision and orogenesis in western Tasmanides: Insights from reactivated basement structures and formation of an ocean-continent transform boundary off western Tasmania.* Gondwana Research 19, 608–627.

Gibson, G.M., Henson, P.A., Neumann, N.L., Southgate, P.N. and Hutton, L.J., 2012. *Paleoproterozoic-earliest Mesoproterozoic basin evolution in the Mount Isa region, northern Australia and implications for reconstructions of the Nuna and Rodinia supercontinents*. Episodes 35, 131–141.

Giles, D., Betts, P.G. and Lister, G.S., 2002. *Far-field continental backarc setting for the 1.80 –1.67 Ga basins of northeastern Australia*. Geology 30, 823–826.

Giles, D., Betts, P. and Lister, G., 2004. *1.8 – 1.5-Ga links between the North and South Australian Cratons and the Early Middle Proterozoic configuration of Australia*. Tectonophysics 380, 27–41.

Glass, L.M., 2007. Geochemistry of mafic rocks in the Litchfield Province, western Pine Creek Orogen; evidence for a Palaeoproterozoic arc-related setting and links to the Halls Creek Orogen. In: Annual Geoscience Exploration Seminar (AGES) 2007, Record of Abstracts. Northern Territory Geological Survey Record 2007-001, p.23–26.

Glass, L.M., Hollis, J.A. and Carson, C.J., 2009. Geochemical and isotopic discrimination methods for Neoarchaean and Palaeoproterozoic rocks in western Arnhem Land, Pine Creek Orogen: Applications for uranium exploration. In *Annual Geoscience Exploration Seminar (AGES) 2009. Record of Abstracts*. Northern Territory Geological Survey Record 2009-002.

Glass, L.M., Hollis, J.A., Carson, C.J., Yaxley, G.M. and Armstrong, R. 2010. *Archaean and Palaeoproterozoic crustal evolution processes in the Pine Creek Orogen; U-Pb, Hf, O, Nd isotopic data and geochemistry*. Annual Geoscience Exploration Seminar (AGES) 2010. Northern Territory Geological Survey Record 2010-002, p.39–44.

Glen, R. A., 2005. The Tasmanides of eastern Australia. In: Vaughan, A.P.M., Leat, P.T. and Pankhurst R.J. (eds.), *Terrane Processes at the Margins of Gondwana*. Geological Society of London Special Publication 246, 23–96

Glen, R.A., Quinn, C.D. and Cooke, D.R., 2012. *The Macquarie Arc, Lachlan Orogen: its evolution, tectonic setting and mineral deposits*. Episodes 35, 177–186.

Glen, R.A., 2013. *Refining accretionary orogen models for the Tasmanides of eastern Australia*. Australian Journal of Earth Sciences 60, 315-370.

Goleby, B.R., Huston, D.L., Lyons, P., Vandenberg, L., Bagas, L., Davies, B.M., Jones, L.E.A., Gebre-Mariam, M., Johnson, W., Smith, T. and English, L., 2009. *The Tanami deep seismic reflection experiment: An insight into gold mineralization and Paleoproterozoic collision in the North Australian Craton*. Tectonophysics 472, 169–182.

Glikson, A.Y., Stewart, A.J., Ballhaus, C.G., Clarke, G.L., Feeken, E.H.J., Leven, J.H., Sheraton, J.W. and Sun, S-S., 1996. *Geology of the western Musgrave Block, central Australia, with particular reference to the mafic-ultramafic Giles Complex*. AGSO Bulletin 239.

Gray, D.R. and Foster, D.A. 2004. *Tectonic review of the Lachlan Orogen, southeast Australia: historical review, data synthesis and modern perspectives*. Australian Journal of Earth Sciences 51, 773–817.

Gray, D.R., Foster, D.A., Morand, V.J., Willman, C.E., Cayley, R.A., Spaggiari, C.V., Taylor, D.H., Gray, C.M., VandenBerg, A.H.M., Hendrickx, M.A. and Wilson, C.J.L., 2003. Structure, metamorphism, geochronology and tectonics of Palaeozoic rocks – interpreting a complex, long lived orogenic Geodynamic Synthesis of the Phanerozoic of eastern Australia and Implications for metallogeny system. In Birch, W.D. (ed.), *Geology of Victoria*, Geological Society of Australia Special Publication 23, pp. 15–71.

Griffin, T.J., Page, R.W., Sheppard, S. and Tyler, I.M., 2000. *Tectonic implications of Palaeoproterozoic post-collisional, high-K felsic igneous rocks from the Kimberley region of northwestern Australia*. Precambrian Research 101, 1–23.

Groves, D.I. and Batt, W.D., 1984. Spatial and temporal variations of Archaean metallogenic associations in terms of evolution of granitoid-greenstone terrains with particular emphasis on the Western Australian shield. In Kroner, A., Hanson, G.N. and Goodwin, A.M. (Eds.), *Archaean Geochemistry*, Springer- Verlag, Berlin, pp. 73-98.

Groves, D.I., Bierlein, F.P., Meinert, L.D. and Hitzman, M.W., 2010. *Iron Oxide Copper-Gold (IOCG) deposits through Earth history: Implications for origin, lithospheric setting, and distinction from other epigenetic Iron Oxide deposits*. Economic Geology 105, 641–654.

Hand, M., Mawby, J., Kinny, P.D. and Foden, J., 1999. *U–Pb ages from the Harts Range, central Australia: evidence for early Ordovician extension and constraints on Carboniferous metamorphism*. Journal of the Geological Society of London 156, 715–730.

Hand, M., Reid, A. and Jagodzinski, E., 2007. *Tectonic framework and evolution of the Gawler craton, southern Australia*. Economic Geology 102, 1377–1395.

Handler, M.R., Bennett, V.C. and Esat, T.M., 1997. *The persistence of off-cratonic lithospheric mantle: Os isotopic systematics of variably metasomatised southeast Australian xenoliths*. Earth and Planetary Science Letters 151, 61–75.

Harrington, H.J., 1974. The Tasman Geosyncline in Australia. In Denmead, A.K., Tweedale, G.W. and Wilson, A.F. (eds.), *The Tasman geosyncline—a symposium in honour of Professor Dorothy Hill, Brisbane 1974*, Geological Society of Australia, Queensland Division, pp. 383–407.

Hawkesworth, C.J., Dhuime, B., Pietranik, A.B., Cawood, P.A., Kemp. A.I.S. and Storey, C.D., 2010. *The generation and evolution of the continental crust.* Journal of the Geological Society of London 167, 229–248.

Healy, B., Collins, W.J. and Richards, S.W., 2004. *A hybrid origin for Lachlan S-type granites: the Murrumbidgee Batholith example*. Lithos 78, 197–216.

Henderson, R.A., Innes, B.M., Fergusson, C.L., Crawford, A.J. and Withnall, I.W., 2011. *Collisional accretion of a Late Ordovician oceanic island arc, northern Tasman Orogenic Zone, Australia*. Australian Journal of Earth Sciences 58, 1–19.

Hensel, H.D., McCulloch, M.T. and Chappell, B.W., 1985. *The New England Batholith: constraints on its derivation from Nd and Sr isotopic studies of granitoids and country rocks*. Geochimica Cosmochimica Acta 49, 369–384.

Hergt, J., Woodhead, J. and Schofield, A., 2007. *A-type magmatism in the Western Lachlan Fold Belt? A study of granites and rhyolites from the Grampians region, Western Victoria*. Lithos 97, 122–139.

Hergt, J.M., Chappell, B.W., McCulloch, M.T., McDougall, I. and Chivas, A.R., 1989. *Geochemical and isotopic constraints on the origin of the Jurassic dolerites of Tasmania*, Journal of Petrology 30, 841–883.

Hickman, A.H. and Van Kranendonk, M.V., 2012. *Early Earth evolution: evidence from the 3.5-1.8 Ga geological history of the Pilbara region of Western Australia*. Episodes 35, 283–297.

Hill, R.I., Chappell, B.W. and Campbell, I.H., 1992. *Late Archaean granites of the southeastern Yilgarn Block, Western Australia: age, geochemistry, and origin*. Transactions of the Royal Society of Edinburgh, Earth Sciences 83, 211–226.

Hoatson, D.M., Sun, S. and Claoue-Long, J.C., 2005. *Proterozoic mafic-ultramafic intrusions in the Arunta Region, central Australia Part 1: Geological setting and mineral potential*. Precambrian Research 142, 93–133.

Hollis, J.A., Carson, C.J. and Glass, L.M., 2009a. *Extensive exposed Neoarchaean crust in Arnhem Land, Pine Creek Orogen: U-Pb zircon SHRIMP geochronology*. Annual Geoscience Exploration Seminar (AGES) 2009. Record of Abstracts. Northern Territory Geological Survey Record 2009-002.

Hollis, J.A., Scherstén, A., Glass, L.M. and Carson, C.J., 2009b.*Stratigraphic and tectonic evolution of the Nimbuwah Domain: A separate terrane to the rest of the Pine Creek Orogen?* Annual

Geoscience Exploration Seminar (AGES) 2009. Record of Abstracts. Northern Territory Geological Survey Record 2009-002.

Hollis, J.A., Carson, C.J. and Glass, L.M., 2009c. *SHRIMP U-Pb zircon geochronological evidence for Neoarchean basement in western Arnhem Land, northern Australia*. Precambrian Research 174, 364–380.

Hollis, J.A.; Glass, L.M.; Carson, C.J.; Kemp, A.I.S.; Yaxley, G.; Armstrong, R.A.; Scherstén, A., 2010. U-Pb-Hf-O character of Neoarchean basement to the Pine Creek Orogen, North Australian Craton. In I.M. Tyler and C.M. Knox-Robinson (eds), *5IAS, Fifth international Archean symposium, Perth, West. Aust., Australia, Sept. 5-9, 2010*. Geological Survey of Western Australia, Record 2010/18, p.65–67.

Hollis, J.A., Glass, L.M., Carson, C.J., Armstrong, R., Yaxley, G., Kemp, A.I.S., Scherstén, A. and Phillips, D., 2011. *The geological evolution of the Pine Creek Orogen: New pieces in the puzzle on orogen and craton scale*. Annual Geoscience Exploration Seminar (AGES) 2011, p. 18–25.

Howard, K.E., Hand, M., Barovich, K.M., Payne, J.L., Cutts, K.A. and Belousova, E.A., 2011. *U–Pb zircon, zircon Hf and whole-rock Sm–Nd isotopic constraints on the evolution of Paleoproterozoic rocks in the northern Gawler Craton.* Australian Journal of Earth Sciences 58, 615–638

Hronsky, J.M.A., Groves, D.I., Loucks, R.R. and Begg, G.C., 2012. *A unified model for gold mineralisation in accretionary orogens and implications for regional-scale exploration targeting methods*. Mineralium Deposita 47, 339–358.

Hurley, P.M. and Rand, J.R., 1969. *Predrift continental nuclei*. Science 164, 1229–1242.

Huston D.L., Champion D.C. and Cassidy K.F., 2005. Tectonic controls on the endowment of Archean cratons in VHMS deposits: evidence from Pb and Nd isotopes. In: Mao J. and Bierlein, F.P., eds., *Mineral Deposit Research: Meeting the Global Challenge*. Springer, Berlin/Heidelberg, 15–18.

Huston D.L., Champion D.C. and Cassidy K.F., 2013. *Tectonic controls on the endowment of Neoarchean cratons in volcanic-hosted massive sulfide deposits: Evidence from lead and neodymium isotopes*. Economic Geology, in press.

Huston, D., Scrimgeour, I., Tyler, I. and Hutton, L., 2008. The geodynamics and metallogenesis of the North Australian Craton. In *Annual Geoscience Exploration Seminar (AGES) 2008. Record of abstracts*. Northern Territory Geological Survey, Record 2008–002, 2–4.

Huston, D.L., Blewett, R.S. and Champion, D.C., 2012. *Australia through time: a summary of its tectonic and metallogenic evolution*. Episodes 35, 23–43.

Hutton, L.J., Draper, J.J., Rienks, I.P., Withnall, I.W. and Knutson, J., 1997. Charters Towers region. In Bain, J.H.C. and Draper, J.J. (eds.), *North Queensland Geology*, Australian Geological Survey Organisation Bulletin 240, and Queensland Department of Mines and Energy Queensland Geology 9, pp. 165–224.

Ickert, R.B. and Williams, I.S., 2011. *U-Pb zircon geochronology of Silurian-Devonian granites in southeastern Australia: implications for the timing of the Benambran Orogeny and I-S dichotomy*. Australian Journal of Earth Sciences 58, 501–516.

Iizuka, T., Komiya, T., Rino, S., Maruyama, S. and Hirata, T., 2010. *Detrital zircon evidence for Hf isotopic evolution of granitoid crust and continental growth*. Geochimica et Cosmochimica Acta 74, 2450–2472.

Ireland, T.; Morand, V. J.; and Gibson, G. 2002. *Results from some recent SHRIMP U-Pb zircon dating of rocks from the Glenelg Zone of western Victoria*. Geological Survey of Victoria Technical Record 2002/2, 23p.

Ishihara, S., 1977. *The magnetite-series and ilmenite-series granitic rocks*. Mining geology 27, 293–305.

Ishihara, S., 1981. *The granitoid series and mineralization*. Economic Geology 75th Anniversary volume, 458–484.

Jackson, M.J., Southgate, P., Black, L. and Domagala, J., 2005. *Overcoming Proterozoic quartzite sandbody miscorrelations: integrated sequence stratigraphy and SHRIMP U-Pb dating of the*

Surprise Creek Formation, Torpedo Creek and Warrina Park Quartzites, Mt Isa Inlier. Australian Journal of Earth Sciences 52, 1–25.

Jagodzinski, E.A.; Wyborn, L.A.I., 1997. *The Cullen Event: a major felsic magmatic episode in the Proterozoic Pine Creek Inlier of northern Australia*. Australian Geological Survey Organisation Record 1997/44, p.65–66.

Jahn, B-M., Glikson, A.Y., Peucat, J.J. and Hickman, A.H., 1981. *REE geochemistry and isotopic data of Archean silicic volcanics and granitoids from the Pilbara Block, Western Australia: implications for the early crustal evolution*. Geochimica et Cosmochimica Acta 45, pp. 1633–1652.

Jégo, S., Pichavant, M. and Mavrogenes, J.A., 2010. *Controls on gold solubility in arc magmas: An experimental study at 1000 °C and 4 kbar*. Geochimica et Cosmochimica Acta 74, 2165–2189.

Johnson, J.P. and Cross, K.C., 1995. *U-Pb geochronological constraints on the genesis of the Olympic Dam Cu-U-Au-Ag Deposit, South Australia*. Economic Geology 90, 1046–1063.

Johnson, J.P. and McCulloch, M.T., 1995. *Sources of mineralising fluids for the Olympic Dam deposit (South Australia): Sm-Nd isotopic constraints*. Chemical Geology 121, 177–199.

Johnson, J.P., 1993. *The geochronology and radiogenic isotope systematics of the Olympic Dam copper-uranium-gold-silver deposit, South Australia*. Unpublished Ph.D. Thesis, Australian National University, Canberra.

Johnson, S.P., Sheppard, S., Wingate, M.T.D., Kirkland, C.L. and Belousova, E.A., 2011. *Temporal and hafnium isotopic evolution of the Glenburgh Terrane basement: an exotic crustal fragment in the Capricorn Orogen.* Geological Survey of Western Australia Report 110.

Johnson, R.W., Knutson, J. and Taylor, S.R. (eds.), 1989. *Intraplate volcanism in eastern Australia and New Zealand*. Cambridge University Press, Cambridge, United Kingdom, 408 p.

Kemp, A.I.S, Whitehouse, M.J., Hawkesworth, C.J. and Alarcon, M.K., 2005. *A zircon U-Pb study of metaluminous (I-type) granites of the Lachlan Fold Belt, southeastern Australia: implications for the high/low temperature classification and magma differentiation processes*. Contributions to Mineralogy and Petrology 150, 230–249.

Kemp, A.I.S., Hawkesworth, C.J., Foster, G.L., Paterson, B.A., Woodhead, J.D., Hergt, J.M., Gray, C.M. and Whitehouse, M.J., 2007. *Magmatic and crustal differentiation history of granitic rocks from Hf-O isotopes in zircon*. Science 315, 980–983.

Kemp, A.I.S., Hawkesworth, C.J., Paterson, B.A., Foster, G.L., Kinny, P.D., Whitehouse, M.J., Maas, R. and EIMF, 2008. *Exploring the plutonic–volcanic link: a zircon U–Pb, Lu–Hf and O isotope study of paired volcanic and granitic units from southeastern Australia*. Transactions of the Royal Society of Edinburgh: Earth Sciences 97, 337–355 [2008 (for 2006)]

Kemp, A.I.S, Hawkesworth, C.J., Collins, W.J., Gray, C.M., Blevin, P.L. and EIMF, 2009. *Isotopic evidence for rapid continental growth in an extensional accretionary orogen: The Tasmanides, eastern Australia*. Earth and Planetary Science Letters 284, 455–466.

Kennett, B.L.N, Saygin, E., Fomin, T. and Blewett, R., 2013. *Deep Crustal Seismic Reflection Profiling: Australia, 1978-2011*. ANU E Press and Geoscience Australia, Canberra.

Kinny, P.D., Williams, I.S., Froude, D.O., Ireland, T.R. and Compston, W., 1988. Early Archaean zircon ages from orthogneisses and anorthosites at Mt. Narryer, Western Australia. Precambrian Research 38, 325–341.

Korsch, R.J., Adams, C.J., Black, L.P., Foster, D.A., Fraser, G.L., Murray, C.G., Foudoulis, C. and Griffin, W.L., 2009. *Geochronology and provenance of the Late Paleozoic accretionary wedge and Gympie Terrane, New England Orogen, eastern Australia*. Australian Journal of Earth Sciences 56, 655–685,

Korsch, R.J., Kositcin, N. and Champion, D.C., 2011. *Australian island arcs through time: Geodynamic implications for the Archean and Proterozoic*. Gondwana Research 19, 716–734.

Korsch, R.J., Huston, D.L., Henderson, R.A., Blewett, R.S., Withnall, I.W., Fergusson, C.L., Collins, W.J., Saygin, E., Kositcin, N., Meixner, A.J., Chopping, R., Henson, P.A., Champion, D.C., Hutton, L.J., Wormald, R., Holzschuh, J. and Costelloe, R.D., 2012. *Crustal architecture and geodynamics* *of North Queensland, Australia: Insights from deep seismic reflection profiling*. Tectonophysics, doi:10.1016/j.tecto.2012.02.022

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.

Lambeck, A., Barovich, K., Gibson, G., Huston, D. and Pisarevsky, S., 2012. *An abrupt change in Nd isotopic composition in Australian basins at 1655 Ma: Implications for the tectonic evolution of Australia and its place in NUNA*. Precambrian Research 208– 211, 213– 221.

Lang, J.R., Baker, T., Hart, C.J.R. and Mortensen, J.K., 2000. *An exploration model for intrusion-related gold systems*. Society of Economic Geology Newsletter 40, 6–15.

Leitch, E., Cawood, P.A., Merle, R. and Nemchin, A., 2010. A chapter in the orogenic history of an accretionary orogen: the Early Earliest Permian transition in the southern New England fold belt. In: Buckman, S. and Blevin, P.L. (eds), *NEO 2010. New England Orogen 2010 - proceedings of a conference held at the University of New England, Armidale, New South Wales, Australia, November 2010*. University of New England, pp. 207–212.

Lesher, C.M. and Arndt, N.T., 1995. *REE and Nd isotope geochemistry, petrogenesis and volcanic evolution of contaminated komatiites at Kambalda, Western Australia*. Lithos 34, 127–157.

Li, Z.X. and Powell, C.M., 2001. *An outline of the Palaeogeographic evolution of the Australasian region since the beginning of the Neoproterozoic*. Earth-Science Reviews 53, 237–277.

Liew, T.C. and McCulloch, M.T., 1985. *Genesis of granitoid batholiths of Peninsular Malaysia and implications for models of crustal evolution: Evidence from a Nd-Sr isotopic and U-Pb, zircon study*. Geochimica Cosmochimica Acta 49, 587–600.

Maas, R. and McCulloch, M.T., 1991. *The provenance of Archaean clastic metasediments in the Narryer Gneiss Complex, Western Australia: Trace element chemistry, Nd isotopes, and U-Pb ages for detrital zircons*. Geochimica Cosmochima Acta 55, 1915–1932.

Maas, R., McCulloch, M.T., Campbell, I.H. and Page, R.W., 1987. *Sm-Nd isotope systematics in uranium-rare earth element mineralization at the Mary Kathleen uranium mine, Queensland*. Economic Geology 82, 1805–1826.

Mackenzie, D.E., 1993. *Geology of the Featherbed Cauldron Complex, north Queensland: Part 1—eruptive rocks and post-volcanic sediments*. Australian Geological Survey Organisation Record 1993/82.

Maidment, D.W., Williams, I.S. and Hand, M., 2004. The Harts Range Metamorphic Complex – a Neoproterozoic to Cambrian metamorphosed rift sequence in the eastern Arunta Region. In: *Annual Geoscience Exploration Seminar (AGES) 2004. Record of abstracts*. Northern Territory Geological Survey Record 2004-001.

Maidment, D.W., Hand, M. and Williams, I.S., 2005. *Tectonic cycles in the Strangways Metamorphic Complex, Arunta Inlier, central Australia: geochronological evidence for exhumation and basin formation between two high-grade metamorphic events*. Australian Journal of Earth Sciences 52, 205–215.

Maidment, D.W., Huston, D.L. and Heaman, L., 2010. *The age of the Telfer Au-Cu deposit and its relationship with granite emplacement, Paterson province*. Geoscience Australia Professional Opinion 2010/05.

Mark, G., 2001. *Nd isotope and petrogenetic constraints for the origin of the Mount Angelay igneous complex: implications for the origin of intrusions in the Cloncurry district, NE Australia*. Precambrian Research 105, 17–35.

Mawby, J., Hand, M. and Foden, J., 1999. *Sm-Nd evidence for high-grade Ordovician metamorphism in the Arunta Block, central Australia*. Journal of Metamorphic Geology 17, 653–658.

McCulloch, M. T., 1987, Sm–Nd isotopic constraints on the evolution of Precambrian crust in the Australian continent. In Kroner, A. (ed.), *Proterozoic lithospheric evolution*. American Geophysical Union Geodynamics Series, v. 17.

McCulloch, M. T., 1987, Sm–Nd isotopic constraints on the evolution of Precambrian crust in the Australian continent. I Kroner, A. (ed.), *Proterozoic lithospheric evolution*, American Geophysical Union Geodynamics Series 17, 115–130.

McCulloch, M.T. and Chappell, B.W., 1982. *Nd isotopic characteristics of S- and I-type granites*. Earth and Planetary Science letters 58, 51–64

McCulloch, M.T. and Compston, W., 1981. *Sm-Nd age of Kambalda and Kanowna greenstones and heterogeneity in the Archaean mantle*. Nature 294, 322–327.

McCulloch, M.T. and Wasserburg, G.J., 1978. *Sm-Nd and Rb-Sr chronology of continental crust formation*. Science 200, 1003–1011.

McCulloch, M.T. and Woodhead, J.D., 1993. *Lead isotopic evidence for deep crustal-scale fluid transport during granite petrogenesis*. Geochimica Cosmochimica Acta 57, 659-674.

McCulloch, M.T.; Compston, W. and Froude, D., 1983a. *Sm-Nd and Rb-Sr dating of Archaean gneisses, eastern Yilgarn Block, Western Australia*. Journal of the Geological Society of Australia 30, 149–153.

McCulloch, M.T., Collerson, K.D. and Compston, W., 1983b. *Growth of Archean crust within the western gneiss terrain, Yilgarn Block, Western Australia.* Australian Journal of Earth Sciences 30, 155–160.

McDonald, G.D., Collerson, K.D. and Kinny, P.D., 1997. *Late Archean and Early Proterozoic crustal evolution of the Mount Isa Block, northwest Queensland, Australia*. Geology 25 1095–1098.

Michaut, C. and Jaupart, C., 2011. *Two models for the formation of magma reservoirs by small increments*. Tectonophysics 500, 34–49.

Morand, V.J. 1993. *Stratigraphy and tectonic setting of the Calliope Volcanic Assemblage, Rockhampton area, Queensland*. Australian Journal of Earth Sciences 40, 15–30.

Morand, V.J., Wohlt, K.E., Cayley, R.A., Taylor, D.H., Kemp, A.I.S., Simons, B.A. and Magart, A.P.M., 2003. *Glenelg special map area geological report*. Geological Survey of Victoria Report 123, Geological Survey of Victoria.

Mortimer, G.E., Cooper, J.A. and Oliver, R.L., 1988. *The geochemical evolution of Proterozoic granitoids near Port Lincoln in the Gawler orogenic domain of South Australia*. Precambrian Research 40/41, 387–406.

Murgulov, V., 2006. *Lithosphere evolution and metallogeny in the Georgetown Inlier and the adjacent Tasman Fold Belt, north Queensland, Australia*. Ph.D. Thesis, Macquarie University, North Ryde, 302 pp.

Murgulov, V., Beyer, E., Griffin, W.L., O'Reilly, S.Y., Walters, S.G. and Stephens, D., 2007. *Crustal evolution in the Georgetown Inlier, North Queensland, Australia: a detrital zircon grain study*. Chemical Geology 245, 198–218

Murray, C.G., 1986. *Metallogeny and tectonic development of the Tasman Fold Belt System in Queensland*. Ore Geology Reviews 1, 315–400.

Murray, C.G., 1997. From geosyncline to fold belt: a personal perspective on the development of ideas regarding the tectonic evolution of the New England Orogen. In Ashley, P. M. and Flood, P. G. (eds.), *Tectonics and metallogenesis of the New England Orogen*. Geological Society of Australia, Special Publication 19, 1–28.

Murray, C.G., 2007. *Devonian suprasubduction zone setting for the Princhester and Northumberland serpentinites: implications for the tectonic evolution of the northern New England Orogen*. Australian Journal of Earth Sciences 54, 899–925.

Murray, C.G. and Blake, P.R., 2005. *Geochemical discrimination of tectonic setting for Devonian basalts of the Yarrol Province of the New England Orogen, central coastal Queensland: An empirical approach*. Australian Journal of Earth Sciences 52, 993–1034.

Murray, C. G., Fergusson, C. L., Flood, P. G., Whitaker, W. G. and Korsch, R. J., 1987. *Plate tectonic model for the Carboniferous evolution of the New England Fold Belt*. Australian Journal of Earth Sciences 34, 213–236.

Myers, J. S. 1994. *Late Proterozoic high-grade gneiss complex between Cape Leeuwin and Cape Naturaliste*. Geological Society of Australia (WA Division) Excursion Guidebook 6, 26p.

Myers, J. S., Shaw, R.D. and Tyler, I.M., 1996. *Tectonic evolution of Proterozoic Australia*. Tectonics 15, 1431–1446.

Needham, R.S., Crick, I.H. and Stuart-Smith, P.G., 1980. Regional geology of the Pine Creek Geosyncline. In: Ferguson, J., Goleby, A.B. (Eds.), *Proceedings of International Uranium Symposium on the Pine Creek Geosyncline*. International Atomic Energy Agency, Vienna, pp. 1–22.

Needham, R.S., Stuart-Smith, P.G. and Page, R.W., 1988. *Tectonic evolution of the Pine Creek Inlier, Northern Territory*. Precambrian Research, 40/41, 543–564.

Nelson, D.R., 1997. *Evolution of the Archaean granite-greenstone terranes of the Eastern goldfields, Western Australia: SHRIMP U-Pb zircon constraints*. Precambrian Research 83, 57–81.

Nelson, D.R., Black, L.P. and McCulloch, M.T. 1989. *Nd-Pb isotopic characteristics of the Mordor Complex, Northern Territory: Mid-Proterozoic potassic magmatism from an enriched mantle source*. Australian Journal of Earth Sciences 36. 541–551.

Nelson, D.R., Myers, J.S. and Nutman, A.P., 1995. *Chronology and evolution of the Middle Proterozoic Albany-Fraser Orogen, Western Australia*. Australian Journal of Earth Sciences 42, 481–495.

Neumann, N. 2001. *Geochemical and isotopic characteristics of South Australian Proterozoic granites: implications for the origin and evolution of high heat-producing terrains*. Unpublished PhD thesis, University of Adelaide, Adelaide.

Neumann, N., Southgate, P., Gibson, G., McIntyre, A., 2006. *New SHRIMP geochronology for the western fold belt of the Mt Isa inlier: Developing a 1800–1650 Ma event framework*. Australian Journal of Earth Sciences 53, 1023–1039.

Neumann, N.L, Southgate, P.N. and Gibson, G.M., 2009. *Defining unconformities in Proterozoic sedimentary basins using detrital geochronology and basin analysis-An example from the Mount Isa Inlier, Australia*. Precambrian Research 168, 149–166.

Neumann, N.L. and Kositcin, N., 2011. *New SHRIMP U-Pb zircon ages from north Queensland, 2007–2010*. Geoscience Australia Record, 2011/38.

Nieuwland, D.A. and Compston, W., 1981. *Crustal evolution in the Yilgarn Black near Perth, W.A*. Geological Society of Australia Special Publication 7, 159–71.

Nutman, A.P.; Bennett, V.C.; Kinny, P.D. and Price, R., 1993. *Large-scale crustal structure of the northwestern Yilgarn Craton, Western Australia; evidence from Nd isotopic data and zircon geochronology*. Tectonics 12, 971–981.

Oliver, B., 1999. *Granitoids of the Mount Mulgine and Noongal areas*. Unpublished B.Sc (honours) thesis, University of Western Australia.

Page, R.W., 1981. *Depositional ages of the stratiform base metal deposits at Mount Isa and McArthur River, Australia, based on U-Pb zircon dating of concordant tuff horizons*. Economic Geology 76, 648–658.

Page, R.W., 1983. *Timing of superposed volcanism in the Proterozoic Mount Isa Inlier Australia*. Precambrian Research 21, 223–245.

Page, R.W. and Laing, W.F., 1992. *Felsic metavolcanic rocks related to the Broken Hill Pb – Zn –Ag ore body, Australia*. Economic Geology 87, 2138 – 2168.

Page, R.W. and Sun, S.-S., 1988. *Geochronology and Sm–Nd provenance studies in the Eastern fold belt, Mount Isa inlier*. Australian Journal of Earth Sciences 45, 343– 362.

Page, R.W. and Williams, I.S., 1988. Age of the Barramundi orogeny in northern Australia by means of ion microprobe and conventional U–Pb zircon studies. Precambrian Research 40/41, 21– 36.

Page RW, Compston W and Needham RS, 1980. Geochronology and evolution of the late-Archaean basement and Proterozoic rocks in the Alligator Rivers uranium field, Northern Territory, Australia. In: Ferguson, J. and Goleb,y A.B. (eds), *Uranium in the Pine Creek Geosyncline*. International Atomic Energy Agency, Vienna, 39–68.

Page, R.W., Sun, S.-S. and Blake, D.H. 1995. *Geochronology of an exposed late Archaean basement terrane in The Granites-Tanami region*. Australian Geological Survey Organisation Research Newsletter, 22, 19–20.

Page, R.W., Jackson, M.J. and Krassay, A.A., 2000. *Constraining sequence stratigraphy in northern Australia basins: SHRIMP U-Pb zircon geochronology between Mt Isa and McArthur River*. Australian Journal of Earth Sciences 47, 431–459.

Page, R.W., Stevens, B.P.J. and Gibson, G.M., 2005a. *Geochronology of the sequence hosting the Broken Hill Pb–Zn–Ag orebody, Australia*. Economic Geology 100, 633–661.

Page, R.W., Conor, C.H.H., Stevens, B.P.J., Gibson, G.M, Preiss, W.V. and Southgate, P.N., 2005b. *Correlation of Olary and Broken Hill Domains, Curnamona Province: Possible relationship to Mount Isa and other north Australian Pb-Zn-Ag-bearing successions*. Economic Geology 100, 663–676.

Parkinson, I.J. and Arculus, R.J., 1999. *The redox state of subduction zones: insights from arc-peridotites*. Chemical Geology 160, 409–423.

Payne, J.L., Ferris, G., Barovich, K.M. and Hand, M., 2010. *Pitfalls of classifying ancient magmatic suites with tectonic discrimination diagrams: An example from the Paleoproterozoic Tunkillia Suite, southern Australia*. Precambrian Research 177, 227–240.

Phillips, G., Landenberger, B. and Belousova, E.A., 2011. *Building the New England Batholith, eastern Australia—Linking granite petrogenesis with geodynamic setting using Hf isotopes in zircon*. Lithos 122, 1–12.

Powell, W. and O'Reilly, S., 2007. *Metasomatism and sulfide mobility in lithospheric mantle beneath eastern Australia: Implications for mantle Re–Os chronology*. Lithos 94, 132–147.

Preiss, W.V., 2000. *The Adelaide Geosyncline of South Australia and its significance in Neoproterozoic continental reconstruction*. Precambrian Research 100, 21–63.

Raveggi, M., Giles, D., Foden, J., Raetz, M. and Ehlers, K., 2008. *Source and significance of the felsic magmatism in the Paleoproterozoic to Mesoproterozoic Broken Hill Block, New South Wales*. Australian Journal of Earth Sciences 55, 531–553.

Raymond, O.L., Liu, S., Gallagher, R., Highet, L.M. and Zhang, W., 2012. *Surface Geology of Australia, 1:1 000 000 scale, 2012 edition [Digital Dataset]*. Geoscience Australia, Commonwealth of Australia, Canberra. http://www.ga.gov.au

Reid, A.J. and Hand, M., 2012. *Mesoarchean to Mesoproterozoic evolution of the southern Gawler Craton, South Australia*. Episodes 35, 216–225.

Reid, A.J., Fricke, C.E. and Cowley, W.M., 2009. *Extent of low-grade Archaean metavolcanics in the northeastern Gawler Craton: new evidence and definition of the Devils Playground Volcanics*. Primary Industries and Resources South Australia, MESA Journal 54, 9–20.

Rich, B., 2000. *An investigation of the Archaean Wangary Gneiss and its relevance to the evolution of the southern Gawler Craton*. Unpublished Honours Thesis. University of Adelaide, SA, Australia.

Richards, D.N.G., 1980. Palaeozoic granitoids of Northeastern Australia. In R.A. Henderson and P.J. Stephenson (eds,), *The Geology and Geophysics of Northeastern Australia*. Geological Society of Australia, Queensland Division, pp. 229–246.

Rowe, M.C., Kent, A.J.R. and Nielsen, R.L., 2009. *Subduction Influence on oxygen fugacity and trace and volatile elements in basalts across the Cascade Volcanic Arc*. Journal of Petrology 50, 61–91.

Rudnick, R. L. and Gao, S., 2004. Composition of the continental crust. In Rudnick (ed.),*Treatise on Geochemistry, volume 3, The Crust*. Elsevier, New York, pp. 1–64.

Rutherford, L., Barovich, K., Hand, M. and Foden, J., 2006. *Continental ca 1.7 – 1.69 Ga Fe-rich metatholeiites in the Curnamona Province, Australia: a record of melting of a heterogeneous, subduction-modified lithospheric mantle*. Australian Journal of Earth Sciences 53, 501–519.

Rutherford, L., Burtt, A.C., Barovich, K.M., Hand, M. and Foden, J., 2007. Billeroo North alkaline magmatic complex: geology and economic significance. MESA Journal 45, 33–39.

Salters, V. J. M. and Stracke, A., 2004. *Composition of the depleted mantle*. Geochemistry, Geophysics, Geosystems 5, Q05B07, doi:10.1029/2003GC000597.

Schaefer, B., 1998. Insights into Proterozoic Tectonics from the southern Eyre Peninsula, South Australia. Unpublished Ph.D. Thesis. University of Adelaide, SA, Australia.

Scheibner, E. and Basden, H. (eds,), 1998. *Geology of New South Wales: synthesis. Vol. 2. Geological evolution*. Geological Survey of New South Wales, 666 p.

Scott, D.L., Rawlings, D.J., Page, R.W., Tarlowski, C.Z., Idnurm, M., Jackson, M.J. and Southgate, P.N., 2000. *Basement framework and geodynamic evolution of the Palaeoproterozoic superbasins of north-central Australia: an integrated review of geochemical, geochronological and geophysical data*. Australian Journal of Earth Sciences 47, 341–480.

Scrimgeour, I. and Raith, J. 2001. *Tectonic and thermal events in the northeastern Arunta Province*. NTGS Report 12.

Scrimgeour, I.R., Close, D.F. and Edgoose, C.J., 1999. *Petermann Ranges, Northern Territory (Second Edition). 1:250 000 geological map series explanatory notes, SG 52-07*. Northern Territory Geological Survey, Darwin.

Scrimgeour, I.R., Close, D.F. and Edgoose, C.J. 2005a. *Mount Liebig, Northern Territory. 1:250000 geological map series explanatory notes, SF 52-16*. Northern Territory Geological Survey, Darwin and Alice Springs.

Scrimgeour, I.R., Kinny, P.D., Close, D.F. and Edgoose, C.J., 2005b. *High-T granulites and polymetamorphism in the southern Arunta Region, central Australia: evidence for a 1.64 Ga accretional event.* Precambrian Research 142, 1–27.

Seymour, D.B. and Calver, C.R (compilers), 1995. *Explanatory notes for the time-space diagram and stratotectonic elements map of Tasmania: TASGO NGMA project, sub-project 1: geological synthesis*. Mineral Resources Tasmania. Tasmanian Geological Survey record 1995/01, 62p.

Shaw, R.D., Wellman, P., Gunn, P., Whitaker, A.J., Tarlowski, C. and Morse, M., 1995. *Australian crustal elements (1:5,000,000 scale map) based on the distribution of geophysical domains (v 1.0).* Australian Geological Survey Organisation, Canberra.

Shaw S.E., Flood, R.H. and Pearson, N.J., 2011. *The New England Batholith of eastern Australia: Evidence of silicic magma mixing from zircon $^{176}Hf/^{177}Hf$ ratios*. Lithos 126, 115–126.

Sheppard, S., Griffin, T.J., Tyler, I.M. and Taylor, W.R., 1999. *Palaeoproterozoic subduction-related and passive margin basalts in the Halls Creek Orogen, northwest Australia*. Australian Journal of Earth Sciences 46, 679–690.

Sheppard, S., Griffin, T.J., Tyler, I.M. and page, R.W., 2001. *High- and low-K granites and adakites at a Palaeoproterozoic plate boundary in northwestern Australia*. Journal of the Geological Society of London 158, 547-560.

Sheppard, S., Occhipinti, S.A. and Tyler, I.M., 2003. *The relationship between tectonism and composition of granitoid magmas, Yarlarweelor Gneiss Complex, Western Australia*. Lithos 66, 133–154.

Sheppard, S., Occhipinti, S.A. and Tyler, I.M., 2004. *A 2005–1970 Ma Andean-type batholith in the southern Gascoyne Complex, Western Australia*. Precambrian Research 128, 257–277.

Sheppard, S., Bodorkos, S., Johnson, S.P., Wingate, M.T.D. and Kirkland, C.L., 2010a. *The Paleoproterozoic Capricorn Orogeny: Intracontinental reworking not continent–continent collision*. Geological Survey of Western Australia Report 108, 33 pp.

Sheppard, S., Johnson, S.P., Wingate, M.T.D., Kirkland, C.L. and Pirajno, F., 2010b. *Explanatory Notes for the Gascoyne Province*. Geological Survey of Western Australia, 336p.

Sircombe, K.N., Cassidy, K.F., Champion, D.C. and Tripp, G., 2007. Compilation of SHRIMP U-Pb geochronological data, Yilgarn Craton, Western Australia, 2004-2006. Geoscience Australia Record 2007/01.

Sivell, W.J. and McCulloch, M.T. 1997. Origin of anorthosites: relation to subduction at an early Proterozoic continetal margin in central Australia. Proceedings of the 30th International Geological Congress, Beijing, China, 4-14 August 1996. Vol. 17, 271–284.

Sivell, W.J., Foden, J.D. and Lawrence, R.W. 1985. The Entire anorthositic gneiss, eastern Arunta Inlier, Central Australia: geochemistry and petrogenesis. Australian Journal of Earth Sciences 32, 449–465.

Skirrow, R.G., Bastrakov, E.N., Barovich, K., Fraser, G.L., Creaser, R.A., Fanning, C.M., Raymond, O.L. and Davidson, G.J., 2007. *Timing of Iron Oxide Cu-Au-(U) Hydrothermal Activity and Nd Isotope Constraints on Metal Sources in the Gawler Craton, South Australia*. Economic Geology 102, 1441–1470.

Skirrow, R.G., 2013. *Australia's iron oxide Cu-Au provinces: World-class opportunities*. Presentation given at Prospectors and Developers Association of Canada (PDAC) Convention, Toronto, Canada, 3-6 March 2013.

Smith J, 2001. *Summary of results. Joint NTGS – AGSO age determination program 1999-2001*. Northern Territory Geological Survey Record 2001-007.

Smith, J. B., Barley, M. E., Groves, D. I., Krapez, B., McNaughton, N. J., Bickle, M. J. and Chapman, H. J., 1998. *The Sholl Shear Zone, West Pilbara: evidence for a domain boundary structure from integrated tectonic analyses, SHRIMP U–Pb dating and isotopic and geochemical data of granitoids*. Precambrian Research, v. 88, p. 143–171.

Smithies, R.H. and Champion, D.C., 2000. *The Archaean high-Mg diorite suite: links to tonalite–trondhjemite–granodiorite magmatism and implications for early Archaean crustal growth*. Journal of Petrology 41, 1653–1671.

Smithies, R.H., Champion, D.C. Van Kranendonk, M.J., Howard, H.M. and Hickman, A.H., 2005. *Modern-style subduction processes in the Mesoarchaean: geochemical evidence from the 3.12 Ga Whundo intra-oceanic arc*. Earth Planetary Science Letters 231, 221– 237.

Smithies, R. H., Champion, D. C., Van Kranendonk, M. J. and Hickman, A. H., 2007. *Geochemistry of volcanic rocks of the northern Pilbara Craton, Western Australia*. Western Australia Geological Survey Report 104, 47p.

Smithies, R.H., Howard, H.M., Evins, P.M., Kirkland, C.L., Kelsey, D.E., Hand, M., Wingate, M.T.D., Collins, A.S., Belousova, E. and Allchurch, S., 2010. *Geochemistry, geochronology, and petrogenesis of Mesoproterozoic felsic rocks in the west Musgrave Province, central Australia, and implications for the Mesoproterozoic tectonic evolution of the region*. Geological Survey of Western Australia Report 106, 73p.

Spaggiari, C.V., Bodorkos, S., Barquero-Molina, M., Tyler, I.M. and Wingate, M.D.T. 2009. *Interpreted bedrock geology of the South Yilgarn and central Albany–Fraser Orogen, Western Australia*. Geological Survey of Western Australia, Record 2009/10, 84p.

Stevens, G., Villaros, A. and Moyen, J.F., 2007. *Selective peritectic garnet entrainment as the origin of geochemical diversity in S-type granites*. Geology 35, 9–12.

Stevens, B.P.J., Page, R.W. and Crooks, A., 2008. *Geochronology of Willyama Supergroup metavolcanics, metasediments and contemporaneous intrusions, Broken Hill, Australia*. Australian Journal of Earth Sciences 55, 301–330.

Stewart, A.J., Raymond, O.L., Gallagher, R., Zhang, W. and Totterdell, J., in prep. *Australian Geological Provinces, 2013.01 edition [Digital Dataset]*. Geoscience Australia, Commonwealth of Australia, Canberra. http://www.ga.gov.au

Stolz, A.J., 1995. *Geochemistry of the Mount Windsor Volcanics: implications for the tectonic setting of Cambro-Ordovician volcanic-hosted massive sulphide mineralization in northeastern Australia*. Economic Geology 90, 1080–1097.

Stolz, A.J. and Morrison, R.S. 1994. *Proterozoic igneous activity in the Tennant Creek region, Northern Territory, Australia, and its relationship to Cu-Au-Bi mineralisation*. Mineralium Deposita, 29, 261–274.

Stuart-Smith, P.G., Wills, K., Crick, .I and Needham, R.S., 1980. Evolution of the Pine Creek Geosyncline. In: Ferguson, J. and Goleby, A.B. (eds), *Uranium in the Pine Creek Geosyncline*. International Atomic Energy Agency, Vienna, 23–34.

Sun, S-.S. and Higgins, N.C., 1996. *Neodymium and strontium isotope study of the Blue Tier Batholith, NE Tasmania, and its bearing on the origin of tin-bearing alkali feldspar granites*. Ore Geology Reviews 10, 339–365.

Sun, S-.S. and McDonough, W.F., 1989. Chemical and isotopic systematics of oceanic basalts: Implications for mantle composition and processes. In Saunders, A.D. and Norry, M. J. (eds.), *Magmatism in the Ocean Basins*. Geological Society of London Special Publication 42, 313–345.

Sun, S-.S., Warren, R.G. and Shaw, R.D., 1995. *Nd isotope study of granites from the Arunta Inlier, central Australia: constraints on geological models and limitation of the method*. Precambrian Research 71, 301–314.

Sun, S-.S. and Hoatson, M., 1992. Chemical and isotopic characteristics of parent magmas of the west Pilbara layered intrusions: implications for petrogenesis, magma mixing, and PGE mineralization in layered intrusions. In Hoatson, D.M., Wallace, D.A. and Sun, S-S. (eds.), *Petrology and Platinum-Group-Element geochemistry of Archaean layered mafic–ultramafic intrusions, West Pilbara Block, Western Australia*. Australian Geological Survey Organisation Bulletin 242.

Swain, G., Woodhouse, A., Handa, M., Barovich, K., Schwarz, M. and Fanning, C.M., 2005. *Provenance and tectonic development of the late Archaean Gawler Craton, Australia; U–Pb zircon, geochemical and Sm–Nd isotopic implications*. Precambrian Research 141, 106–136.

Swain, G., Barovich, K., Handa, M., Ferris, G. and Schwarz, M., 2008. *Petrogenesis of the St Peter Suite, southern Australia: Arc magmatism and Proterozoic crustal growth of the South Australian Craton*. Precambrian Research 166, 283–296.

Szpunar, M. and Fraser, G., 2010. *Age of deposition and provenance of Palaeoproterozoic basins on northeastern Eyre Peninsula*. South Australia Department of Primary Industries and Resources. Report Book 2010/00008.

Taylor, S.R. and McLennan, S.M., 1985. *The Continental Crust: Its Composition and Evolution*. Oxford, Blackwell Scientific Publications, 312 p.

Thompson, J.F.H., Sillitoe, R.H., Baker, T., Lang, J.R. and Mortensen, J.K., 1999. *Intrusion-related gold deposits associated with tungsten-tin provinces*. Mineralium Deposita 34: 323–334.

Turner, S.P., Foden, J.D. and Morrison, R.S. 1992. *Derivation of an A-type magma by fractionation of basaltic magma: an example from the Padthaway Ridge South Australia*. Lithos 28, 151–179.

Turner, S.P., Foden, J.D., Sandiford, M. and Bruce, D. 1993a. *Sm–Nd isotopic evidence for the provenance of sediments from the Adelaide Foldbelt and southeastern Australia with implications for crustal growth models*. Geochimica et Cosmochimica Acta, 57, 1837–1856.

Turner, S.P., Adams, C.J., Flöttmann, T. and Foden, J.D. 1993b. *Geochemical and geochronological constraints on the Glenelg River Complex, western Victoria*. Australian Journal of Earth Sciences 40, 275–292.

Tyler, I. M., Fletcher, I. R., De Laeter, J. R., Williams, I. R. and Libby, W. G., 1992. *Isotope and rare earth element evidence for a late Archaean terrane boundary in the southeastern Pilbara Craton, Western Australia*. Precambrian Research 54, 211–229.

van Kranendonk, M. J., Hickman, A. H., Smithies, R. H., Williams, I. R., Bagas, L. and Farrell, T. R., 2006. *Revised lithostratigraphy of Archean supracrustal and intrusive rocks in the northern Pilbara Craton, Western Australia*. Western Australia Geological Survey Record 2006/15, 57p.

Van Kranendonk, M.J., Smithies, R.H., Hickman, A.H. and Champion, D.C., 2007. Paleoarchean development of a continental nucleus: the East Pilbara Terrane of the Pilbara Craton, Western Australia. In Van Kranendonk, M.J., Smithies, R.H. and Bennett, V.C. (eds.), *Earth's Oldest Rocks*. Developments in Precambrian Geology Volume 15, Elsevier, 307–337.

VandenBerg, A.H.M., Willman, C.E., Maher, S., Simons, B.A., Cayley, R.A., Taylor, D.H., Morand, V.J., Moore, D.H and Radojkovic, A. 2000 (eds.). *The Tasman Fold Belt in Victoria*. Geological Survey of Victoria Special Publication, Melbourne, 462 pp.

Veevers, J.J., 2004. *Gondwanaland from 650–500 Ma assembly through 320 Ma merger in Pangea to 185–100 Ma breakup: supercontinental tectonics via stratigraphy and radiometric dating*. Earth-Science Reviews 68, 1 –132.

Voice, P.J., Kowalewski, M. and Eriksson, K.A., 2011. *Quantifying the timing and rate of crustal evolution: global compilation of radiometrically dated detrital zircon grains*. Journal of Geology 119, 109–126.

Vos, I.M.A., Bierlein, F.P., Webb, J., 2006. *Geochemistry of Early Palaeozoic basalts in the Hodgkinson Province: a key to tectonomagmatic evolution of the Tasman Fold Belt System in northeastern Queensland, Australia.* International Journal of Earth Sciences. Online First (doi:10.1007/s00531-005-0053-7).

Wade, B.P., Barovich, K.M., Hand, M., Scrimgeour, I.R. and Close, D.F., 2006. *Evidence for early Mesoproterozoic arc magmatism in the Musgrave Block, central Australia: Implications for Proterozoic crustal growth and tectonic reconstructions of Australia*. The Journal of Geology 114, p. 43–63.

Wade, B.P., Payne, J.L., Hand, M. and Barovich, K.M., 2007. *Petrogenesis of ca 1.50 Ga granitic gneiss of the Coompana Block: filling the 'magmatic gap' of Mesoproterozoic Australia*. Australian Journal of Earth Sciences 54, 1089–1102.

Wade, B.P., Hand, M., Maidment, D.W., Close, D.F. and Scrimgeour, I.R., 2008. *Origin of metasedimentary and igneous rocks from the Entia Dome, eastern Arunta region, central Australia: a U – Pb LA-ICPMS, SHRIMP and Sm – Nd isotope study.* Australian Journal of Earth Sciences 55, 703–719.

Wade, C.E., Reid, A.J., Wingate, M.T.D., Jagodzinski, E.A. and Barovich, K., 2012. *Geochemistry and geochronology of the c. 1585 Ma Benagerie Volcanic Suite, southern Australia: Relationship to the Gawler Range Volcanics and implications for the petrogenesis of a Mesoproterozoic silicic large igneous province*. Precambrian Research 206–207, 17– 35

Watkins, K.P. and Hickman, A.H., 1990. *Geological evolution and mineralisation of the Murchison Province, Western Australia*. Geological Survey of Western Australia Bulletin 137.

Webb, A.W. and McDougall, I., 1968. *The geochronology of the igneous rocks of eastern Queensland*. Journal of the Geological Society of Australia 15, 313–46.

Webby, B.D., 1978. *History of the Ordovician continental platform shelf margin of Australia*. Journal of the Geological Society of Australia 25, 41–63.

Whelan, J.A, Webb, G., Close, D.F., Kositcin, N., Bodorkos, S., Huston, D.L., Armstrong, R. and Allen, C., 2011. *New geochronological and geochemical data from the Limbla 1:100 000 map area: implications for mineralisation in the eastern Arunta Region*. Annual Geoscience Exploration Seminar (AGES) 2011. Record of abstracts. Northern Territory Geological Survey, Record 2011-003. 40–43.

Whelan, J., Hergt, J. and Woodhead, J., 2007. *Granite – greenstone connection in western Victoria: an example from the Bushy Creek Igneous Complex*. Australian Journal of Earth Sciences 54, 975–990.

Wiedenbeck, M. and Watkins, K. P., 1993. *A time scale for granitoid emplacement in the Archaean Murchison Province, Western Australia, by single zircon geochronology*. Precambrian Research 61, 1–26.

Wilde, S.A., 2001. *Jimperding and Chittering Metamorphic Belts, southwestern Yilgarn Craton, Western Australia — a field guide*. Geological Survey of Western Australia Record 2001/12, 24p.

Wilde, S.A. and Murphy, D.M.K., 1990. The nature and origin of Late Proterozoic high-grade gneisses of the Leeuwin Block, Western Australia. Precambrian Research 47, 251–270.

Wilde, S.A. and Nelson, D.R., 2001. *Geology of the Western Yilgarn Craton and Leeuwin Complex, Western Australia — a field guide*. Geological Survey of Western Australia Record 2001/15, 41p.

Williams, I.S. and Compston W., 1983. Ion microprobe U-Pb dating of zircons from granitoids recovered in core from drill holes P4/1D, P11/1, P12/11 and P14/1, Woolner, Northern Territory. In: Manning, E.R., Richardson, B.R. and Starkey, L.J., *Annual Report for EL 3478 'Woolner' ,Appendix*

3. Mobil Energy Minerals Australia Inc. Northern Territory Geological Survey, Open File Company Report CR1983-0231.

Williams, I.S., Beams, S.D. and Chappell, B.W., 2011. Granite petrogenesis in the Bega Batholith, southeastern Australia: new perspectives from zircon U-Pb, O and Hf isotopes. In Molina, J.F., Scarrow, J.H., Bea, F. and Montero, P. (eds.), *Seventh Hutton Symposium on Granites and Related Rocks, Avila, Spain, July 409 2011*. Abstracts Book with Attendees Addresses. p163–164.

Windrim, D.P. and McCulloch, M.T. 1986. *Nd and Sr isotopic systematics of central Australian granulites: chronology of crustal development and constraints on the evolution of lower continental crust*. Contributions to Mineralogy and Petrology 94, 289–303.

Windrim, D.P., McCulloch. M.T., Chappell, B.W. and Cameron, W.E., 1984. *Nd isotopic systematics and chemistry of Central Australian sapphirine granulites: an example of rare earth element mobility.* Earth and Planetary Science Letters 70, 27–39.

Withnall, I.W. and Henderson, R.A., 2012. *Accretion on the long-lived continental margin o northeastern Australia*. Episodes 35, 166–176.

Withnall, I.W., Mackenzie, D.E., Denaro, T.J., Bain, J.H.C., Oversby, B.S., Knutson, J., Donchak, P.J.T., Champion, D.C., Wellman, P., Cruikshank, B.I., Sun, S.S. and Pain, C.F., 1997. Georgetown Region. In Bain, J.H.C. and Draper, J.J. (eds.), *North Queensland Geology*, Australian Geological Survey Organisation Bulletin 240, and Queensland Department of Mines and Energy Queensland Geology 9, pp. 19–116.

Withnall, I.W., Nieuwenberg, A., Blight, R.L. and YARROL-SCAG Project Teams, 2005. *Central Queensland Geoscience Dataset*. Geological Survey of Queensland, Department of Natural Resources and Mines, digital data released on CD-ROM.

Woodhouse, A.J., 2002. *Provenance of Late Archaean metasedimentary rocks on the southern Gawler Craton: implications for its early crustal development*. Unpublished Honours Thesis. University of Adelaide, South Australia, Australia.

Woods, B.K., 1997. *Petrogenesis and geochronology of felsic dykes in the Kalgoorlie Terrane, Kalgoorlie, Western Australia*. Unpublished BSc. Honours Thesis, Curtin University of Technology.

Worden, K.E., 2006. Geology and geochronology of the Palaeoproterozoic Pine Creek Orogen. In Lyons, P. and Huston, D.L. (eds.), *Evolution and metallogenesis of the North Australian Craton, Alice Springs, Northern Territory, Australia, June 20-22, 2006*, Geoscience Australia Record 2006/16, p.53–56

Worden, K.E., Carson, C.J., Close, D.F., Donnellan, N. and Scrimgeour, I.R., 2008a. *Summary of results. Joint NTGS-GA geochronology: Tanami Region, Arunta Region, Pine Creek Orogen and Halls Creek Orogen correlatives, January 2005–March 2007*. *Northern Territory Geological Survey, Record* 2008–003, 180p.

Worden, K.E., Carson, C.J., Scrimgeour, .I.R, Lally, J. and Doyle N., 2008b. *A revised Palaeoproterozoic chronostratigraphy for the Pine Creek Orogen, northern Australia: Evidence from SHRIMP U-Pb zircon geochronology*. Precambrian Research 166, 122–144.

Wyborn, D. and Sun, S-.S., 1993. Nd-isotopic "fingerprinting" of Cu/Au mineralisation in the Lachlan Fold Belt. AGSO Research Newsletter 19, 13–14.

Wyborn, L, Hazell, M, Page, R, Idnurm, M and Sun, S, 1998. *A newly discovered major Proterozoic granite-alteration system in the Mount Webb region, central Australia, and implications for Cu–Au mineralisation*. AGSO Research Newsletter, 28, 5p.

Wyborn, L.A.I., Page, R,W. and McCulloch, M.T., 1988. *Petrology, geochronology and isotope geochemistry of the post-1820 Ma granites of the Mount Isa Inlier: mechanisms for the generation of Proterozoic anorogenic granites*. Precambrian Research 40/41, 509–541.

Wyborn, L.A.I., Page, R.W. and Parker, A.J., 1987. Geochemical and geochronological signatures in Australian Proterozoic igneous rocks. In Pharaoh, T.C., Beckinsale, R.D. and Rickard, D. (eds.), *Geochemistry and Mineralization of Proterozoic Volcanic Suites*, Geological Society Special Publication 33, 377 – 394.

Wyborn, L.A.I, 1997. *Australian mineral systems; a National Geoscience Mapping Accord Project*. Australian Geological Survey Organisation Record 1997/56.

Xue, Y., Campbell, I., Ireland, T.R., Holden, P. and Armstrong, R., 2013. *No mass-independent sulfur isotope fractionation in auriferous fluids supports a magmatic origin for Archean gold deposit*. Geology 41, 791–794.

Young, D.N., Duncan, N., Camacho, A., Ferenczi, P.A. and Madigan, T.L.A., 2002. *Ayers Rock, Northern Territory (Second Edition)*. 1:250 000 geological map series, explanatory notes, SG52-08. Northern Territory. Geological Survey, Darwin.

Zhao, J. and Bennett, V.C., 1995. *SHRIMP U-Pb zircon geochronology of granites in the Arunta Inlier, central Australia: implications for Proterozoic crustal evolution*. Precambrian Research 71, 17–43.

Zhao, J. and McCulloch, M.T. 1993. Melting of a subduction-modified continental lithospheric mantle: Evidence from Late Proterozoic mafic dike swarms in central Australia. Geology 21. 463–466.

Zhao, J. and McCulloch, M. T., 1995. *Geochemical and Nd isotopic systematics of granites from the Arunta Inlier, central Australia: implications for Proterozoic crustal evolution*. Precambrian Research 71, 265–299.

Zhao, J-.X. and Cooper, J.A., 1992. *The Atnarpa Igneous Complex, southeast Arunta Inlier, central Australia: implications for subduction at an Early-Mid Proterozoic continental margin*. Precambrian Research 56, 227–253.

Zhao, J.X. McCulloch, M.T. and Bennett, V.C. 1993. *Sm-Nd and U-Pb zircon isotopic constraints on the provenance of sediments from the Amadeus Basin, central Australia: evidence for REE fractionation*. Geochimica et Cosmochimica Acta 56, 921–940.

Appendix A. Compiled Sm-Nd isotopic data and metadata

A.1. Data Sources

Samarium-Neodymium isotopic data was compiled from both published and unpublished datasets. Published data (including that in State and Territory Survey publications) was collected based on prior knowledge and searches of reference databases, though given the nature of the project, data searches were not exhaustive. The sources of all published data are attributed (Appendix Table A.1). Unpublished data was sourced from that undertaken by Geoscience Australia (alone or in collaboration with State and Territory Surveys) and from the Northern Territory Geological Survey. All effort was made to ascertain whether this data had been previously published and if so attributed accordingly. The database may, however, contain data shown as unpublished that has actually been published. Structure and metadata of the data fields for the Sm-Nd isotopic data set are listed and described in Appendix Table A.1.

Data fields fall into five main data and metadata types: sample location; sample lithology; sample province data; sample age; and sample isotopic data (including standardised and derived data). Data was primarily collected for whole rock samples but does include some mineral data (recorded in the 'Sample type' field).

A.2. Non-isotopic data and metadata

A variety of data and metadata have been compiled for each sample. These include (from the original source) sample numbers, unit name, rock type, location, age and geological province (where supplied). Where possible, unit names have been updated to recognised unit names and their associated STRATNO (unique unit identifier from Geoscience Australia's STRATNAMES database) is provided (Appendix Table A.1). Information on rock type is given in a number of fields as these have been used to determine whether an individual analysis was used in the Australia-wide map (recorded in the 'Felsic_Ign' field; Appendix Table A.1). Each sample has a designated geological region, province and element, following accepted usage. Details regarding the relationship between region, province and element are provided in Appendix Table A.2.

Sample locations have been converted to GDA94 and are given as longitude and latitude. A number of samples have required either the datum of published sample locations to be assumed (potential location errors of 200 m), or the locations (because they were not supplied) to be 'estimated'. The latter were calculated using either points on published figures or, where figures were not available, estimated more arbitrarily using the unit name and the known distribution of that unit. Potential location errors for these samples are more significant and may be upwards of 10+km. Any assumptions and estimations regarding the location are listed in the 'Loc_Comm' field.

Where possible and applicable, age data (from the original isotopic data sources) were updated to more recent U-Pb age determinations. References are provided for all age determinations. For many samples ages have not been determined precisely or (for some) are not well constrained. Estimates and inferences for these ages are based on local and regional geology. Reasons for assigned ages are given in the 'Age_Comm' field.

A.3. Isotopic data, metadata and standardisation

In addition to Sm, Nd, $^{147}Sm/^{144}Nd$, $^{143}Nd/^{144}Nd$, and errors, values for the Nd isotopic standards – La Jolla, nNd-1 and BCR-1 – were compiled where possible. These latter values were used to standardise sample result data as follows:

$$^{144}Nd/^{143}Nd\_corr = {}^{144}Nd/^{143}Nd\_meas * Standard_{(ANU)}/Standard_{(other\ lab)}$$

Both the original measured and corrected $^{144}Nd/^{143}Nd$ values ('Nd143_144M' and 'Nd143_144C', respectively), are included in the compiled data tables. In a few cases Standard information was not available. For these a value for La Jolla was assumed such that calculated ε_{Nd} values were as close as possible to those reported in the publication in question. Samples standardised this way are readily evident by non-null values in the relevant Standard field (Appendix Table A.1).

A small component of the compiled Nd isotopic data (largely pre-1990's data) were analysed using different mass fractionation correction values ($^{146}Nd/^{142}Nd = 0.636151$, e.g., McCulloch, 1987). Results from these have been normalised to the present day mass fractionation correction ($^{146}Nd/^{144}Nd=0.7219$) using the following equation:

$$^{144}Nd/^{143}Nd\_corr = {}^{144}Nd/^{143}Nd\_meas * 1.001595 \text{ (renormalisation factor)}$$

Again both original measured and corrected $^{144}Nd/^{143}Nd$ values are included in the compiled data tables. Samples modified this way are signified in the 'Isot_Comm' field (Appendix Table A.1).

Most laboratory metadata has not been captured as it is available in the original references. The only exception to this is for unpublished data where laboratory and analyst (where known) are given, also in the 'Isot_Comm' field (Appendix Table A.1).

A.4. Derived isotopic calculations

Values for epsilon Nd (ε_{Nd}), single stage (T_{DM}) and two-stage model (T_{2DM}) depleted mantle model ages have all been recalculated for this Australian-wide study using the corrected $^{144}Nd/^{143}Nd$ values ($^{144}Nd/^{143}Nd\_corr$). Epsilon Nd values (ε_{Nd}, e.g., DePaolo, 1988) – deviations in parts per 10000 from the chondritic Sm/Nd reservoir (CHUR = Chondritic Uniform Reservoir) – have been calculated according to the formula:

$$\varepsilon_{Nd}(T) = 10^4\ [^{143}Nd/^{144}Nd_{Sample}(T) - {}^{143}Nd/^{144}Nd_{CHUR}(T)]\ /\ {}^{143}Nd/^{144}Nd_{CHUR}(T)$$

using CHUR values of $^{147}Sm/^{143}Nd = 0.1967$ and $^{143}Nd/^{144}Nd = 0.51265$.

All ε_{Nd} values reported here are calculated for T equals the magmatic age.

Depleted mantle model ages have been calculated using depleted mantle (DM) values of $^{147}Sm/^{144}Nd$ = 0.2136 and $^{143}Nd/^{144}Nd$ = 0.513163. Both single stage model ages (derived from intersection of the isotope trajectory of each sample with the DM growth curve) and two-stage model ages (calculated with a two-stage isotope trajectory assuming a $^{147}Sm/^{143}Nd$ ratio of 0.1100 for all T older than the magmatic age) have been calculated. The DM growth curve used for both calculations assumes a present day (T = 0) ε_{Nd} of +10.0 and linear mantle depletion (ε_{Nd} of 0) at T = 4.56 Ga. Model ages calculated in this manner will be older than those calculated by McCulloch (1987) who undertook the first isotopic study of Australia. He used a model growth curve based on mantle depletion beginning at 2.7 Ga. As indicated by Sun et al. (1995), the latter results in model ages around 200 Ma younger for Proterozoic granites.

Two-stage model ages have been used for the Nd model age map of Australia. Unlike the single stage model age, the former is sensitive to the age of the rock (T), so well constrained ages are desirable. It is noted, however, that large changes in T are typically required for significant changes in T_{2DM}.

Residence ages (T_{Res} = Two-stage depleted mantle model age minus crystallisation age, in million years) have also been calculated and results gridded for I- and A-type felsic magmatism (data from S-type granites have not been used). These provide an indication of the relative age of the protolith of the granite in question, i.e., the time between when specific crust was created and its reworking to produce the granite. Granite formed by the reworking of largely juvenile crust, such as Carboniferous granites in the New England Orogen, will have young residence ages, whilst those forming in older crust, such as Carboniferous granites in the Georgetown region, will have old residence ages (e.g., see Champion et al., 2010). The combination of T_{2DM}, T_{Res} with geochronological data (magmatic and xenocrystic ages) is particularly powerful in that it not only provides an indication of the age of the crust in a region and when that crust was reworked, but provide additional constraints on the protolith and components within individual granite units. This approach has been used to great effect in combined U-Pb, Lu-Hf in zircon studies (e.g., Belousova et al., 2010).

It should be noted, however, that model (and residence) ages are just that — a model. As outlined by many workers (e.g., DePaolo, 1988) the origin of the isotopic signature of a rock can be complex. This is just as applicable to granites and related rocks, particularly as open systems and mixing/assimilation etc. may (or may not) be involved (see discussion by Champion and Cassidy, 2008), as demonstrated by single crystal isotopic analysis (e.g., Kemp et al., 2007). Even assuming a closed system and purely crustal melting for any particular granite unit, it is likely that more than one source component is being partially melted, i.e., the model age represents an approximation of the average age of the source, i.e., the crust. In a similar manner the residence age is best thought of as an average or minimum age. The latter is particularly true when a significant mantle component is involved in granite genesis. This is discussed further in section 2.5.

Appendix Table A.1 Structure and metadata of the data fields for the Sm-Nd isotopic data as compiled for this record. The Alias field records the full field name, while the Item field records the truncated (10 character) name.

Item	Alias	Explanation
Siteid	Siteid	Location/field site identifier
Sampleid	sampleid	Sample Identifier
Fieldid	Fieldid	Field number (if supplied)
Drillhole	drillhole	Drill hole name. Only filled where it is certain sample is from drill core. [substitutes for npm.wells.uno where Entity_type = drillhole]
Upperdepth	upper_depth	Upper drill hole depth (in metres) isotopic sample taken from. Typically taken as depth down the drill hole (so will not equal true depth for inclined holes)
Lowerdepth	lower_depth	Lower drill hole depth (in metres) sample taken from. Typically taken as depth down the drill hole (so will not equal true depth for inclined holes)
Longitude	Longitude	X location in decimal degrees
Latitude	Latitude	Y location in decimal degrees (negative for southern hemisphere)
Datum	Datum	Datum system used for location (longitude-latitude, easting-northing). All GDA94 unless specified otherwise
Loc_Comm	Location_Comments	Information on location, such as source reference (where not Geoscience Australia) and whether assumptions have had to be made regarding the Datum, or whether locations have had to be estimated
Accuracy	Locational_Accuracy	Accuracy, in metres, of the longitude and latitude location
Stratno	Stratno	Unique identifier (from Geoscience Australia's Stratigraphic Names database) for Australian stratigraphic units
Unitname	Unitname	Unit name: stratigraphic unit name. Unit names with no STRATNO should be regarded as informal
Lithology	Lithname	Lithological rock type of the sample, e.g., Granite, Tonalite. Names follow Geoscience Australia's 'Lithology Type' look-up tables
Descr	Description	Description of rock type
LithGroup	LithGroup	Broad classification of lithology, e.g., felsic intrusive, felsic extrusive, gneiss. Names follow Geoscience Australia's 'Lithology Group' look-up tables
ModeOcc	Occurrence_mode	Mode of occurrence for sample. Values include: dyke, sill, vein, enclave, mineral, or clast
Sampletype	Sampletype	Sample type the Sm-Nd analysis is for, either whole rock, or mineral
Felsic_Ign	Felsic_Igneous_rock	Y or N field. Y signifies analysis used in the model age map of Australia, N – not used (because sample is from mafic, sedimentary, metamorphic, or extensively altered unit). Question marks indicate degree of uncertainty, Y?, Y??
Rocktype	Granite_Rock_Type	Igneous rock type (I, S, A, M) where known. Also Seds for sedimentary rocks
Unit_Comm	Unit_Comments	General comments on the sample, including classification (suite/supersuite)
State	State	State or Territory of Australia (QLD, ACT, SA, NT, WA, TAS, VIC)
Region	Region	Generalised location corresponding to broad geological regions or geological provinces. Values are listed in Appendix Table A.2, along with the relationships between Region, Province and Element

Item	Alias	Explanation
Province	Province	Broad scale geological province. Values listed in Appendix Table A.2, along with the relationships between Region, Province and Element
Element	Element	Crustal element the sample belongs to. Six crustal elements are defined for Australia: West Australian Element (WAE), North Australian Element (NAE), South Australian Element (SAE), Central Australian Element (CAE), Pinjarra Element (Pinjarra), and the Tasman Element (Tasman). Refer to Appendix Table A.2 for relationships between Region, Province and Element
Source	Isotope_Data_Source	Source of the Sm-Nd isotopic data, largely references that correspond to the bibliography. Refer to bibliography for full reference. Unpublished data denoted by 'Unpublished' and data source, e.g., GA unpublished
NumAge	Numeric_Age	Intrusive or extrusive age (in Ma) of the unit for igneous units, estimated depositional age for sedimentary units. Ages based as much as possible on U-Pb zircon ages
NumAgeErr	Numeric_Age_Error	Two sigma error in age (in Ma). Only supplied if age used represents a geochronological age determination with reported errors. Errors not shown for assumed or other ages estimates
Age_source	Numeric_Age_source	Reference source of the cited age, where published. Refer to bibliography for full reference.
Age_comm	Age_comments	An explanation on how assumed/estimated ages were assigned
Sm_ppm	Sm_ppm	Concentration of Sm in ppm
Nd_ppm	Nd_ppm	Concentration of Nd in ppm
Sm147Nd144	Sm147_Nd144	Reported ^{147}Sm/^{143}Nd value
Nd143_144m	Nd143_Nd144_Meas	^{144}Nd/^{143}Nd value, as reported (prior to any normalisation)
Nd143_144_err	Nd143_Nd144_Error	Reported two sigma error for Nd143Nd144_meas. Where values are not available they have been substituted with 30.123 (a general upper limit for modern analyses)
Std_nNd1	Std_nNd1	Laboratory value for the nNd-1 standard - where reported used to standardise sample results to match reported nNd-1 value from ANU (0.512170)
Std_LaJol	Std_LaJolla	Laboratory value for La Jolla standard - where reported used to standardise sample results to match the reported La Jolla value from ANU (0.511872). This is the preferred standard
Std_BCR1	Std_BCR1	Laboratory value for BCR-1 standard - where reported used to standardise sample results to match the reported BCR-1 value from ANU (0.512653)
Isot_Comm	Isotope_comments	Includes analyst and laboratory (where known) for unpublished data; also whether the old normalisation for mass fractionation was used (^{146}Nd/^{142}Nd = 0.636151, as against ^{146}Nd/^{144}Nd = 0.72190 used nowadays)
Nd143_144C	Nd143_Nd144_Corr	Corrected ^{144}Nd/^{143}Nd value. Values corrected by adjusting for variations in reported values of standards (LaJolla or BCR1 (more rarely nNd-1)) to bring the reported laboratory values for these standards equal to those from ANU. ^{144}Nd/^{143}Nd_corr = ^{144}Nd/^{143}Nd_meas * Std (ANU)/Std (other lab) For analyses undertaken using the older mass fractionation ratios, the corrected ^{144}Nd/^{143}Nd value is: ^{144}Nd/^{143}Nd_corr = ^{144}Nd/^{143}Nd_meas * 1.001595 (renormalisation factor)

Item	Alias	Explanation
Eps_Nd	Epsilon_Nd	Epsilon Nd (εNd) value at time of time T (=Geological age). Calculated with CHUR values of $^{147}Sm/^{143}Nd$ = 0.1967 and $^{143}Nd/^{144}Nd$ = 0.51265. Calculated using ND143ND144_corr
Eps_Err	Epsilon_Nd_Error	Error in ε_{Nd} based solely on the reported two sigma error. Does not take into account any of the error in the age of the unit
TDM	TDM	Depleted mantle model age (T_{DM}), in billions of years, calculated using depleted mantle values of $^{147}Sm/^{143}Nd$ = 0.2136 and ^{143}Nd ^{144}Nd = 0.513163. Note that errors in ages have no effect on T_{DM}. T_{DM} only calculated where $^{147}Sm/^{143}Nd$ < 0.15
TDM_err	TDM_error	Error in T_{DM} and T_{2DM} based solely on the reported two sigma errors. For T_{2DM} does not take into account errors to do with the age of the unit
T2DM	T2DM	Two-stage depleted mantle Model age (T_{2DM}), in billions of years, calculated as for T_{DM} but modified by assuming a $^{147}Sm/^{143}Nd$ value of 0.11 prior to the geological age of the unit
TRES	Residence_Time	Model dependent 'crustal residence' age (Ma). Calculated as Two-stage depleted mantle Model age minus crystallisation age

Appendix Table A.2 Relationships between regions, provinces and crustal elements, as used in Appendix Table A.1.

	Province	Region
Central Australian Element (CAE)	Albany-Fraser Orogen	Albany-Fraser region
	Musgrave Province	Musgrave Province
	Paterson Orogen	Paterson region
		Yeneena Basin
		Rudall Province
North Australian Element (NAE)	Amadeus Basin	Amadeus Basin
	Arunta Orogen	Aileron Province
		Arunta region
		Irindina Province
		Warumpi Province
	Davenport Province	Davenport Province
	Georgetown-Coen region	Coen region
		Georgetown region
	Pama Igneous Province	Coen region
		Georgetown region
	Mount Isa Orogen	Isa-east region
		Millungera Basin
		Murphy Region
		South Nicholson Region
		Isa-west region
		McArthur Basin
	Kennedy Igneous Province	Georgetown-Coen-Mount Isa region
		Tate Subprovince
		Jardine Subprovince
		Kidston Subprovince
	Kimberley region	Kimberley region
		Halls Creek Orogen
		King Leopold Orogen
	Ngalia Basin	Ngalia Basin
	Pine Creek Orogen	Pine Creek Orogen
		Central Domain
		Nimbuwah Domain
	Tanami Orogen	Tanami Orogen
	Warramunga Province	Tennant Creek region
	Victoria Basin	Victoria River Region

	Province	Region
Pinjarra Element	Pinjarra Orogen	Darling Zone region
		Leeuwin Complex
South Australian Element (SAE)	Gawler Craton	Coompana region
	Curnamona Craton	Broken Hill region
		Curnamona Craton
		Mount Painter region
	Gawler Craton	Cleve-Spencer-Coulta region
		Gawler Craton
		Mount Woods Domain
		Mulgathing Complex
		Nawa Domain
		Nuyts Domain
		Olympic Domain
		Sleaford Complex
		Christie Domain
		Fowler Domain
		Wilgena Domain
Tasman Element	Delamerian Orogen	Adelaide fold belt
		Delamerian Orogen
		Grampians-Stavely Zone
		Tasmania West region
	Pama Igneous Province	Millungera Basin region
	Kennedy Igneous Province	Burdekin Falls Subprovince
		Daintree Subprovince
		Herberton Subprovince
		Kangaroo Hills Subprovince
		Paluma Subprovince
	Lachlan Orogen	Lachlan Orogen
		Macquarie Igneous Province
		Tasmania East region
	Mossman Orogen	Hodgkinson Province
	New England Orogen	northern New England region
		southern New England region
	Sydney Basin	Sydney Basin
	Great Divide Igneous Province	Great Divide Igneous Province
	Thomson Orogen	Anakie Province
		Barnard Province

	Province	Region
		Charters Towers Province
		Drummond region
		Eromanga region
		Greenvale Province
West Australian Element (WAE)	Gascoyne Province	Gascoyne Province
		Glenburgh Terrane
	Pilbara Craton	Pilbara Craton
		East Pilbara Terrane
		East Pilbara Terrane (west)
		Fortescue Group region
		Kurrana Terrane
		West Pilbara Superterrane
		West Pilbara Superterrane (central region)
		Karratha Terrane
		Sholl Terrane
		Sholl Terrane (Whundo region)
	Yilgarn Craton	Burtville Terrane (EGST)
		Kalgoorlie Terrane (EGST)
		Kurnalpi Terrane (EGST)
		Narryer Terrane
		Southwest Gneiss Terrane
		Murchison Domain (Youanmi Terrane)
		Youanmi Terrane/Western Gneiss Terrane
		Southern Cross Domain (Youanmi Terrane)

Appendix B. Tables of Nd data

Appendix Table B.1 Neodymium isotopic data for rocks of the Central Australia Element. Data sources specified in the Reference column. Refer to for Appendix Table A.2 full Province names.

Sampleid	Lithology Group	Province	Age (Ma)	εNd	T_{2DM} (Ga)	Source
56427	high grade metamorphic rock	Albany-Fraser	1330	-7.28	2.41	Fletcher et al 1983b
55813E	high grade metamorphic rock	Albany-Fraser	1330	-22.44	3.55	Fletcher et al 1983b
66804	high grade metamorphic rock	Albany-Fraser	1330	-20.21	3.39	Fletcher et al 1983b
56425	igneous felsic	Albany-Fraser	1310	-8.81	2.51	Fletcher et al 1983b
55811C	igneous felsic	Albany-Fraser	1310	-7.72	2.43	Fletcher et al 1983b
55812B	igneous felsic intrusive	Albany-Fraser	1180	-10.07	2.5	Fletcher et al 1983b
55815A	igneous felsic intrusive	Albany-Fraser	1180	-8.2	2.36	Fletcher et al 1983b
56426	high grade metamorphic rock	Albany-Fraser	1330	-9.24	2.56	Fletcher et al 1983b
87010010	igneous felsic	Albany-Fraser	1190	-8.99	2.42	GA Shen-Su Sun
87010001	igneous felsic intrusive	Albany-Fraser	1196	-15.27	2.9	GA Shen-Su Sun
87010008	igneous felsic intrusive	Albany-Fraser	1184	-8.77	2.4	GA Shen-Su Sun
87010009	igneous felsic	Albany-Fraser	1190	-8.79	2.41	GA Shen-Su Sun
87010002	high grade metamorphic rock	Albany-Fraser	3110	2.4	3.17	GA Shen-Su Sun
87010002A	igneous felsic	Albany-Fraser	1180	-17.45	3.05	GA Shen-Su Sun
83657A	igneous felsic intrusive	Albany-Fraser	1100	-8.48	2.31	Nelson et al. 1995
83696A	igneous felsic intrusive	Albany-Fraser	2640	-1.72	3.09	Nelson et al. 1995
112128	metasedimentary	Albany-Fraser	1550	-5.81	2.49	Nelson et al. 1995
83690	igneous felsic intrusive	Albany-Fraser	1299	-19.45	3.3	Nelson et al. 1995
83667	igneous felsic intrusive	Albany-Fraser	1135	-8.34	2.33	Nelson et al. 1995
83662	igneous felsic intrusive	Albany-Fraser	1330	-2.08	2.02	Nelson et al. 1995
83697	igneous felsic intrusive	Albany-Fraser	1299	-3.86	2.13	Nelson et al. 1995
83651	igneous felsic intrusive	Albany-Fraser	1671	-4.53	2.49	Nelson et al. 1995
83701A	igneous felsic intrusive	Albany-Fraser	2640	-1.5	3.07	Nelson et al. 1995
83691	igneous felsic intrusive	Albany-Fraser	2631	-3.14	3.19	Nelson et al. 1995
83666	igneous felsic intrusive	Albany-Fraser	1670	-3.77	2.43	Nelson et al. 1995
P89/433	igneous felsic intrusive	Musgrave	1144	-1.25	1.8	Edgoose et al. 2004
PR95DFC312	igneous mafic intrusive	Musgrave	1000	0.12	1.58	Edgoose et al. 2004

Sampleid	Lithology Group	Province	Age (Ma)	εNd	T_{2DM} (Ga)	Source
BR97CJE092B	igneous mafic volcanic	Musgrave	1000	-1.41	1.69	Edgoose et al. 2004
BR97CJE075	igneous mafic volcanic	Musgrave	1000	-5	1.97	Edgoose et al. 2004
BR97DFC120	igneous mafic intrusive	Musgrave	1080	-3.18	1.9	Edgoose et al. 2004
BR97DFC013	igneous mafic intrusive	Musgrave	1080	-1	1.73	Edgoose et al. 2004
PR95IRS375	igneous mafic intrusive	Musgrave	820	4.65	1.09	Edgoose et al. 2004
PR95IRS360A	igneous mafic intrusive	Musgrave	1080	-0.66	1.7	Edgoose et al. 2004
PR95DFC290	igneous mafic intrusive	Musgrave	1000	-0.52	1.63	Edgoose et al. 2004
PR96IRS714	igneous felsic intrusive	Musgrave	1175	-1.92	1.88	Edgoose et al. 2004
PR96IRS741	igneous felsic intrusive	Musgrave	1584	1.5	1.96	Edgoose et al. 2004
P88/34	igneous felsic intrusive	Musgrave	1192	-1.55	1.87	Edgoose et al. 2004
ND1	igneous mafic intrusive	Musgrave	820	2.83	1.23	Edgoose et al. 2004
A93/63	high grade metamorphic rock	Musgrave	1539	0.58	1.99	Edgoose et al. 2004
BJ96/280	high grade metamorphic rock	Musgrave	1563	0.13	2.05	Edgoose et al. 2004
PR96DFC535	igneous felsic intrusive	Musgrave	1071	-2.72	1.85	Edgoose et al. 2004
A92/10A	igneous felsic intrusive	Musgrave	1150	-0.91	1.78	Edgoose et al. 2004
A94/644	igneous felsic intrusive	Musgrave	1190	-1.18	1.84	Edgoose et al. 2004
BJ96/277A	igneous felsic intrusive	Musgrave	1182	-2.32	1.92	Edgoose et al. 2004
PR96IRS747	igneous felsic intrusive	Musgrave	1168	-2.46	1.91	Edgoose et al. 2004
MP97/43	high grade metamorphic rock	Musgrave	1554	0.97	1.98	Edgoose et al. 2004
90984017	igneous felsic	Musgrave	1073	-0.09	1.66	GA unpublished
90984015	igneous felsic intrusive	Musgrave	1078	-1.84	1.79	GA unpublished
91988062	igneous felsic	Musgrave	1068	-5.02	2.02	GA unpublished
91988030	high grade metamorphic rock	Musgrave	1200	-2.66	1.96	GA unpublished
90984007	igneous felsic	Musgrave	1300	-0.13	1.85	GA unpublished
90984009	igneous felsic	Musgrave	1300	-0.46	1.87	GA unpublished
91988062	igneous felsic	Musgrave	1068	-5.21	2.04	GA unpublished
91988087	igneous felsic	Musgrave	1550	2.16	1.88	GA unpublished
91988006	igneous felsic intrusive	Musgrave	1078	0.94	1.58	GA unpublished
91988066	igneous felsic intrusive	Musgrave	1188	-3.75	2.03	GA unpublished
90984011	high grade metamorphic rock	Musgrave	1300	-0.95	1.91	GA unpublished
91988099	igneous felsic intrusive	Musgrave	1300	-0.11	1.85	GA unpublished
91988098	igneous mafic intrusive	Musgrave	824	3.37	1.19	GA unpublished
91988002	igneous felsic volcanic	Musgrave	1078	0.72	1.6	GA unpublished

Sampleid	Lithology Group	Province	Age (Ma)	εNd	T_{2DM} (Ga)	Source
91988017	igneous mafic	Musgrave	1200	-2.03	1.91	GA unpublished
91988092	igneous felsic intrusive	Musgrave	1200	-2.09	1.91	GA unpublished
91988085	igneous mafic intrusive	Musgrave	1080	-1.9	1.8	GA unpublished
90984023	igneous mafic	Musgrave	1550	4.31	1.72	GA unpublished
91988098	igneous mafic intrusive	Musgrave	824	3.5	1.18	GA unpublished
91988085	igneous mafic intrusive	Musgrave	1080	-1.94	1.8	GA unpublished
90984025	igneous mafic	Musgrave	1550	1.32	1.95	GA unpublished
91988085	igneous mafic intrusive	Musgrave	1080	-1.67	1.78	GA unpublished
91988085	igneous mafic intrusive	Musgrave	1080	-1.61	1.78	GA unpublished
91988098	igneous mafic intrusive	Musgrave	824	3.05	1.21	GA unpublished
91988049	igneous mafic intrusive	Musgrave	820	3.81	1.15	GA unpublished
91988056	igneous mafic intrusive	Musgrave	1073	1.96	1.5	GA unpublished
91988056	igneous mafic intrusive	Musgrave	1073	2.49	1.46	GA unpublished
90984016	igneous mafic intrusive	Musgrave	1073	-1.44	1.76	GA unpublished
91988057	igneous felsic intrusive	Musgrave	1052	-1.73	1.76	Glikson et al. 1996
91988071	igneous felsic intrusive	Musgrave	1188	-3.85	2.04	Glikson et al. 1996
90984041	igneous felsic intrusive	Musgrave	1188	-2.36	1.92	Glikson et al. 1996
90984024	igneous felsic	Musgrave	1550	2.91	1.83	Glikson et al. 1996
90984004	metasedimentary	Musgrave	1550	-0.17	2.06	Glikson et al. 1996
91988039	igneous intermediate intrusive	Musgrave	1200	-2.03	1.91	Glikson et al. 1996
90984005	igneous felsic	Musgrave	1550	1.53	1.93	Glikson et al. 1996
91988102	igneous mafic volcanic	Musgrave	1078	-1.35	1.76	Glikson et al. 1996
90984008	igneous felsic	Musgrave	1300	-0.93	1.91	Glikson et al. 1996
91988083	igneous mafic intrusive	Musgrave	1176	-2.27	1.91	Glikson et al. 1996
91988097	igneous mafic intrusive	Musgrave	820	3.22	1.2	Glikson et al. 1996
91988085	igneous mafic intrusive	Musgrave	1080	-2.01	1.81	Glikson et al. 1996
91988093	igneous mafic intrusive	Musgrave	1050	-2.38	1.81	Glikson et al. 1996
91988056	igneous mafic intrusive	Musgrave	1073	2.34	1.47	Glikson et al. 1996
91988059	igneous felsic intrusive	Musgrave	1052	-2.49	1.82	Glikson et al. 1996
91988072	igneous intermediate intrusive	Musgrave	1188	-2.7	1.95	Glikson et al. 1996
91988073	igneous intermediate intrusive	Musgrave	1188	-2.8	1.96	Glikson et al. 1996
91988005	igneous felsic volcanic	Musgrave	1078	0.67	1.6	Glikson et al. 1996
90984014	igneous felsic volcanic	Musgrave	1078	0.31	1.63	Glikson et al. 1996

Sampleid	Lithology Group	Province	Age (Ma)	εNd	T_{2DM} (Ga)	Source
91989313B	igneous felsic intrusive	Musgrave	1078	-1.52	1.77	Glikson et al. 1996
91988064	igneous felsic intrusive	Musgrave	1068	-3.27	1.89	Glikson et al. 1996
91988098	igneous mafic intrusive	Musgrave	824	2.86	1.23	Glikson et al. 1996
90984010	igneous felsic	Musgrave	1300	-0.88	1.91	Glikson et al. 1996
90984001	igneous felsic	Musgrave	1550	3.36	1.79	Glikson et al. 1996
91988063	high grade metamorphic rock	Musgrave	1068	-2.65	1.84	Glikson et al. 1996
91988035	high grade metamorphic rock	Musgrave	1200	-2.21	1.92	Glikson et al. 1996
91988016	high grade metamorphic rock	Musgrave	1200	-2.26	1.93	Glikson et al. 1996
91988088	high grade metamorphic rock	Musgrave	1550	3.39	1.79	Glikson et al. 1996
PR95IRS507	igneous mafic intrusive	Musgrave	1050	1.14	1.54	NTGS unpublished unpublished
183440	igneous felsic intrusive	Musgrave	1320	-0.87	1.92	Smithies et al. 2010
174726	igneous felsic intrusive	Musgrave	1210	-2.04	1.92	Smithies et al. 2010
174558	igneous felsic intrusive	Musgrave	1215	-3.59	2.04	Smithies et al. 2010
174737	igneous felsic intrusive	Musgrave	1219	-3.15	2.01	Smithies et al. 2010
183459	igneous felsic intrusive	Musgrave	1195	-2.83	1.96	Smithies et al. 2010
174538	igneous felsic intrusive	Musgrave	1178	-2.29	1.91	Smithies et al. 2010
183492	igneous felsic intrusive	Musgrave	1322	-1.17	1.95	Smithies et al. 2010
180299	igneous felsic intrusive	Musgrave	1175	-2.48	1.92	Smithies et al. 2010
185581	igneous felsic intrusive	Musgrave	1314	-1.26	1.95	Smithies et al. 2010
180300	igneous felsic intrusive	Musgrave	1181	-2.37	1.92	Smithies et al. 2010
183496	igneous felsic intrusive	Musgrave	1321	-0.56	1.9	Smithies et al. 2010
180867	igneous felsic intrusive	Musgrave	1319	-0.59	1.9	Smithies et al. 2010
180256	igneous felsic intrusive	Musgrave	1176	-2.22	1.9	Smithies et al. 2010
184158	igneous felsic intrusive	Musgrave	1321	-1.84	2	Smithies et al. 2010
174766	igneous felsic intrusive	Musgrave	1075	-2.94	1.87	Smithies et al. 2010
185606	igneous felsic intrusive	Musgrave	1326	-2.4	2.04	Smithies et al. 2010
174589	igneous felsic intrusive	Musgrave	1074	-3.6	1.92	Smithies et al. 2010
174761	igneous felsic intrusive	Musgrave	1075	-3.42	1.91	Smithies et al. 2010
174765	igneous felsic intrusive	Musgrave	1075	-3.78	1.94	Smithies et al. 2010
183474	igneous felsic intrusive	Musgrave	1072	-4.36	1.98	Smithies et al. 2010
184150	igneous felsic intrusive	Musgrave	1317	-1.33	1.95	Smithies et al. 2010
180294	igneous felsic intrusive	Musgrave	1180	-2.39	1.92	Smithies et al. 2010
180262	igneous felsic intrusive	Musgrave	1180	-2.71	1.94	Smithies et al. 2010

Sampleid	Lithology Group	Province	Age (Ma)	εNd	T_{2DM} (Ga)	Source
185339	igneous felsic intrusive	Musgrave	1200	-3.54	2.02	Smithies et al. 2010
183509	igneous felsic intrusive	Musgrave	1165	-2.33	1.9	Smithies et al. 2010
183408	igneous felsic intrusive	Musgrave	1180	-2.85	1.95	Smithies et al. 2010
174800	igneous felsic intrusive	Musgrave	1180	-2.71	1.94	Smithies et al. 2010
185583	igneous felsic intrusive	Musgrave	1073	-2.47	1.84	Smithies et al. 2010
95_361	igneous felsic	Musgrave	1548	0.29	2.02	Wade et al. 2006
96_614	igneous felsic	Musgrave	1550	0.47	2.01	Wade et al. 2006
96_574a	igneous felsic	Musgrave	1550	0.17	2.03	Wade et al. 2006
95_598	igneous felsic	Musgrave	1550	-0.77	2.11	Wade et al. 2006
95_472	igneous felsic	Musgrave	1550	0.48	2.01	Wade et al. 2006
95_387	igneous felsic	Musgrave	1550	1.4	1.94	Wade et al. 2006
95_355a	igneous felsic	Musgrave	1550	0.91	1.98	Wade et al. 2006
95_168b	igneous felsic	Musgrave	1550	0.27	2.03	Wade et al. 2006
95_402c	igneous felsic	Musgrave	1550	0.5	2.01	Wade et al. 2006
MUG23	igneous mafic intrusive	Musgrave	1078	1.92	1.51	Zhao & McCulloch 1993
KDS-19	igneous mafic intrusive	Musgrave	1078	0.8	1.59	Zhao & McCulloch 1993
MUG32	igneous mafic intrusive	Musgrave	1078	-1.1	1.74	Zhao & McCulloch 1993
85-376	igneous mafic intrusive	Musgrave	1078	-3.02	1.88	Zhao & McCulloch 1993
KDS-15	igneous mafic intrusive	Musgrave	1078	0.42	1.62	Zhao & McCulloch 1993
I-3	igneous mafic intrusive	Musgrave	1078	0.87	1.59	Zhao & McCulloch 1993
KDS-30	igneous mafic intrusive	Musgrave	1078	0.09	1.65	Zhao & McCulloch 1993
2006670092	igneous felsic intrusive	Paterson	1590	-10.16	2.85	GA unpublished
2005670162_01	high grade metamorphic rock	Paterson	1780	-3.3	2.49	GA unpublished
2005670094_01	igneous	Paterson	1765	-7.43	2.79	GA unpublished
2005670129_01	igneous felsic intrusive	Paterson	1760	-1.35	2.32	GA unpublished
2005670110_01	metasedimentary	Paterson	1800	-5.92	2.7	GA unpublished
2005670100_01	metasedimentary	Paterson	1780	-22.98	3.97	GA unpublished
2006670087	metasedimentary	Paterson	2800	-10.89	3.08	GA unpublished
2005670188_01	igneous felsic intrusive	Paterson	1553	-6.41	2.53	GA unpublished

Sampleid	Lithology Group	Province	Age (Ma)	εNd	T_{2DM} (Ga)	Source
2006670119	igneous felsic intrusive	Paterson	1300	-1.51	1.95	GA unpublished
2005670186_01	igneous felsic intrusive	Paterson	1577	-5.38	2.48	GA unpublished
2006670093	igneous mafic	Paterson	1575	-4.15	2.38	GA unpublished
2006670110	igneous mafic	Paterson	1575	-4.64	2.42	GA unpublished
2006670099B	igneous mafic	Paterson	1575	-0.92	2.14	GA unpublished
2004679009	metasedimentary	Paterson	900	-7.96	2.1	GA unpublished
2005670080_01	high grade metamorphic rock	Paterson	1800	-6.4	2.74	GA unpublished
2005670187_01	igneous felsic intrusive	Paterson	1575	-3.68	2.35	GA unpublished
91470139	igneous felsic intrusive	Paterson	630	-4.97	1.65	GA unpublished
91470063	igneous felsic intrusive	Paterson	640	-6.19	1.75	GA unpublished
2004679001	sedimentary	Paterson	900	-10.51	2.3	GA unpublished
91470101	igneous felsic intrusive	Paterson	630	-6.74	1.79	GA unpublished
2004679008	sedimentary	Paterson	900	-7.53	2.07	GA unpublished
91476803	igneous felsic intrusive	Paterson	603	-13.89	2.3	GA unpublished
91476838	igneous felsic intrusive	Paterson	605	-13.84	2.3	GA unpublished
2006677001	igneous intermediate intrusive	Paterson	500	-8.59	1.82	GA unpublished
200567731022	igneous intermediate intrusive	Paterson	833	-4.56	1.79	GA unpublished
2006677025	igneous mafic intrusive	Paterson	830	7.53	0.88	GA unpublished
2006677183	igneous mafic intrusive	Paterson	830	4.02	1.14	GA unpublished
2006670073	igneous mafic volcanic	Paterson	830	-3.89	1.74	GA unpublished
2004679006	sedimentary	Paterson	900	-8.69	2.16	GA unpublished
2004679003	sedimentary	Paterson	900	-7.29	2.05	GA unpublished
2004679007	sedimentary	Paterson	900	-6.48	1.99	GA unpublished
91470084	igneous felsic intrusive	Paterson	640	-4.57	1.63	GA unpublished
48929E	igneous felsic	Paterson	1790	-6.55	2.74	McCulloch 1987
48929B	igneous felsic	Paterson	1790	-4	2.55	McCulloch 1987
48929F	igneous felsic	Paterson	1790	-3.9	2.54	McCulloch 1987

Appendix Table B.2 Neodymium isotopic data for rocks of the North Australia Element. Data sources specified in the Reference column. Refer to for Appendix Table A.2 for full Province names.

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
89-520	sedimentary	Amadeus	600	-9.23	1.95	Zhao et al. 1993
89-578	sedimentary	Amadeus	750	-3.1	1.61	Zhao et al. 1993
89521A	sedimentary	Amadeus	830	-7.69	2.03	Zhao et al. 1993
89-577	sedimentary	Amadeus	660	-9.7	2.04	Zhao et al. 1993
89-549	sedimentary	Amadeus	540	-9.56	1.92	Zhao et al. 1993
89-539	sedimentary	Amadeus	660	-9.11	1.99	Zhao et al. 1993
89-539	sedimentary	Amadeus	660	-8.1	1.91	Zhao et al. 1993
89-539	sedimentary	Amadeus	660	-9.36	2.01	Zhao et al. 1993
89-575	sedimentary	Amadeus	750	-8.31	2.01	Zhao et al. 1993
AO-7	sedimentary	Amadeus	660	-9.48	2.02	Zhao et al. 1993
89-528B	sedimentary	Amadeus	850	-10.92	2.29	Zhao et al. 1993
89-561	sedimentary	Amadeus	660	-9.52	2.02	Zhao et al. 1993
89-528B dupl.	sedimentary	Amadeus	850	-9.8	2.2	Zhao et al. 1993
89-520	sedimentary	Amadeus	600	-8.77	1.92	Zhao et al. 1993
89-579	sedimentary	Amadeus	830	-8.45	2.08	Zhao et al. 1993
89-581	sedimentary	Amadeus	850	-9.94	2.21	Zhao et al. 1993
89-574	sedimentary	Amadeus	850	-6.17	1.93	Zhao et al. 1993
89-574	sedimentary	Amadeus	850	-7.35	2.02	Zhao et al. 1993
89-503	sedimentary	Amadeus	850	-11.31	2.32	Zhao et al. 1993
89-537	sedimentary	Amadeus	830	-8.93	2.12	Zhao et al. 1993
89-521C	sedimentary	Amadeus	830	-8.12	2.06	Zhao et al. 1993
89-573	sedimentary	Amadeus	830	-8.24	2.07	Zhao et al. 1993
73933006	high grade metamorphic rock	Arunta	1800	-1.59	2.38	Black & McCulloch 1984
73933007	high grade metamorphic rock	Arunta	1800	-2.94	2.48	Black & McCulloch 1984
72902010	high grade metamorphic rock	Arunta	1800	-1.5	2.37	Black & McCulloch 1984
72902009	high grade metamorphic rock	Arunta	1800	-2.65	2.46	Black & McCulloch 1984
73913007	metasedimentary	Arunta	1800	-1.35	2.36	Black & McCulloch 1984
948-80	igneous mafic intrusive	Arunta	1750	-0.61	2.26	Foden et al. 1995
JM3	igneous intermediate intrusive	Arunta	1760	-2.34	2.4	Foden et al. 1995
808-130	igneous mafic	Arunta	1750	1.08	2.13	Foden et al. 1995
825-22	igneous mafic	Arunta	1750	-1.13	2.3	Foden et al. 1995
KM2	igneous mafic intrusive	Arunta	1750	-0.25	2.23	Foden et al. 1995

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
825-43	igneous mafic	Arunta	1750	0.06	2.21	Foden et al. 1995
825-10	igneous mafic	Arunta	1750	-1.22	2.31	Foden et al. 1995
JM14	igneous mafic intrusive	Arunta	1750	-0.93	2.28	Foden et al. 1995
948-81	igneous mafic intrusive	Arunta	1750	-0.16	2.23	Foden et al. 1995
948-79	igneous mafic intrusive	Arunta	1750	-0.5	2.25	Foden et al. 1995
BD-92-1	igneous mafic intrusive	Arunta	1750	0.33	2.19	Foden et al. 1995
S6	igneous mafic intrusive	Arunta	1750	0.09	2.21	Foden et al. 1995
SHC	igneous mafic	Arunta	1750	-1.23	2.31	Foden et al. 1995
SHB	igneous mafic	Arunta	1750	-0.21	2.23	Foden et al. 1995
SHA	igneous mafic	Arunta	1750	-2.04	2.37	Foden et al. 1995
JM5	igneous intermediate intrusive	Arunta	1760	-2.23	2.39	Foden et al. 1995
S2	igneous intermediate intrusive	Arunta	1760	-2.13	2.38	Foden et al. 1995
808-28	igneous felsic intrusive	Arunta	1762	-2.71	2.43	Foden et al. 1995
91-508	igneous felsic intrusive	Arunta	1765	0.28	2.21	Foden et al. 1995
825-104	igneous felsic intrusive	Arunta	1747	-2.11	2.37	Foden et al. 1995
PB3	igneous mafic	Arunta	1750	0.79	2.15	Foden et al. 1995
91-507	igneous mafic	Arunta	1750	0.28	2.19	Foden et al. 1995
JM12	igneous intermediate intrusive	Arunta	1760	-2	2.37	Foden et al. 1995
AC07LCV412	high grade metamorphic rock	Arunta	1795	-1.84	2.39	GA unpublished
AC09CJE389	high grade metamorphic rock	Arunta	1803	-1.24	2.35	GA unpublished
AC09CJE382	igneous	Arunta	1796	-2.89	2.47	GA unpublished
IC09LJH778	metasedimentary	Arunta	1650	-6.46	2.62	GA unpublished
AC09CJE394	metasedimentary	Arunta	1815	-18.28	3.65	GA unpublished
AC07LCV293A	metasedimentary	Arunta	1815	-1.69	2.4	GA unpublished
2000081080	igneous mafic	Arunta	1805	2.19	2.1	Hoatson et al. 2005
2000081107	igneous mafic	Arunta	700	7	0.81	Hoatson et al. 2005
2000081107	igneous mafic	Arunta	700	6.95	0.81	Hoatson et al. 2005
2000081003	igneous mafic	Arunta	1811	-0.38	2.29	Hoatson et al. 2005
2000081014	igneous mafic	Arunta	1803	-0.75	2.32	Hoatson et al. 2005
2000081080	igneous mafic	Arunta	1805	1.63	2.14	Hoatson et al. 2005
2000081058	igneous mafic	Arunta	1774	-1.66	2.36	Hoatson et al. 2005
2000081116	igneous mafic intrusive	Arunta	1633	-4.84	2.48	Hoatson et al. 2005
2000081116	igneous mafic intrusive	Arunta	1633	-4.64	2.47	Hoatson et al. 2005
2000081066	igneous mafic intrusive	Arunta	1780	0.47	2.2	Hoatson et al. 2005
2000081066	igneous mafic intrusive	Arunta	1780	0.97	2.17	Hoatson et al. 2005
2000081072	igneous mafic intrusive	Arunta	1689	-0.66	2.21	Hoatson et al. 2005
2000081072	igneous mafic intrusive	Arunta	1689	-0.41	2.19	Hoatson et al. 2005

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
2000081071	igneous mafic intrusive	Arunta	1787	-0.5	2.28	Hoatson et al. 2005
2000081071	igneous mafic intrusive	Arunta	1787	-0.56	2.29	Hoatson et al. 2005
2000081084	igneous mafic	Arunta	1800	0.16	2.24	Hoatson et al. 2005
72913452	igneous ultramafic intrusive	Arunta	1150	-9.99	2.47	Nelson et al. 1989
72913450	igneous ultramafic intrusive	Arunta	1150	-9.24	2.41	Nelson et al. 1989
73914213	igneous intermediate intrusive	Arunta	1150	-9.33	2.42	Nelson et al. 1989
73914202	igneous intermediate intrusive	Arunta	1150	-9.62	2.44	Nelson et al. 1989
72913438	igneous mafic	Arunta	1150	-9.75	2.45	Nelson et al. 1989
72913441	igneous ultramafic	Arunta	1150	-9.68	2.44	Nelson et al. 1989
72913435	igneous ultramafic	Arunta	1150	-11.33	2.57	Nelson et al. 1989
75914578	igneous mafic	Arunta	1150	-10.23	2.48	Nelson et al. 1989
72913434	igneous ultramafic	Arunta	1150	-9.81	2.45	Nelson et al. 1989
72913446	igneous mafic	Arunta	1150	-9.16	2.4	Nelson et al. 1989
73914142	igneous intermediate intrusive	Arunta	1150	-9.52	2.43	Nelson et al. 1989
MR01IRS108	igneous mafic intrusive	Arunta	1635	-4.37	2.45	NTGS unpublished
HU06ND020	igneous mafic intrusive	Arunta	1500	-2.42	2.19	NTGS unpublished
HU06ND023	igneous mafic intrusive	Arunta	1500	-2.04	2.16	NTGS unpublished
HU06ND023	igneous mafic intrusive	Arunta	1500	-2.06	2.16	NTGS unpublished
AC07CJE201	igneous felsic intrusive	Arunta	1700	-2.52	2.36	NTGS unpublished
IC08JAW1028	igneous intermediate intrusive	Arunta	1770	0.42	2.2	NTGS unpublished
IC08JAW395	igneous felsic intrusive	Arunta	1770	-2.04	2.38	NTGS unpublished
IC04DFC001	igneous felsic intrusive	Arunta	1743	-2.5	2.4	NTGS unpublished
AC07EEB122	igneous felsic intrusive	Arunta	1713	-2.37	2.36	NTGS unpublished
AC07EEB118	igneous felsic intrusive	Arunta	1713	-2.34	2.36	NTGS unpublished
MS00AD088R1	igneous felsic intrusive	Arunta	1800	-3.15	2.49	NTGS unpublished
MS00AD083R1	igneous felsic intrusive	Arunta	1800	-2.45	2.44	NTGS unpublished
NA01AC287R1	igneous felsic intrusive	Arunta	1803	-3.04	2.49	NTGS unpublished
LM02IRS010B	igneous mafic intrusive	Arunta	1805	1.63	2.14	NTGS unpublished
IC08JAW742	igneous mafic	Arunta	460	6.41	0.65	NTGS unpublished
IC07JAW149	igneous felsic intrusive	Arunta	1770	-0.83	2.29	NTGS unpublished
IC08LJH602	metasedimentary	Arunta	520	-3.42	1.45	NTGS unpublished
AC07LCV412	igneous felsic	Arunta	1700	-1.13	2.26	NTGS unpublished
IC05DFC127A	igneous felsic intrusive	Arunta	1752	-3.38	2.47	NTGS unpublished
IC05DFC127A (Repeat)	igneous felsic intrusive	Arunta	1750	-3.43	2.47	NTGS unpublished
AC07CJE069	igneous felsic intrusive	Arunta	1700	-3.45	2.43	NTGS unpublished
HA06CJC033	igneous felsic intrusive	Arunta	1638	-4.14	2.43	NTGS unpublished
IC08JAW670	igneous mafic	Arunta	520	0.47	1.15	NTGS unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
HA05DF058	igneous mafic intrusive	Arunta	1771	-3.57	2.5	NTGS unpublished
IC08JAW942	igneous mafic	Arunta	480	5.02	0.78	NTGS unpublished
IC08JAW860	igneous mafic intrusive	Arunta	480	7.55	0.59	NTGS unpublished
IC08JAW411	igneous mafic intrusive	Arunta	460	-1.16	1.23	NTGS unpublished
IC08JAW553	igneous mafic intrusive	Arunta	460	0.95	1.07	NTGS unpublished
IC05BDG127A	igneous felsic intrusive	Arunta	1776	-2.71	2.44	NTGS unpublished
IC08JAW877	igneous ultramafic	Arunta	460	1.97	0.99	NTGS unpublished
AL07CJE034	igneous felsic intrusive	Arunta	380	-2.69	1.27	NTGS unpublished
LM01CJE009	igneous felsic intrusive	Arunta	1780	-4.99	2.62	NTGS unpublished
AC08EEB436	igneous felsic intrusive	Arunta	1806	-3.39	2.52	NTGS unpublished
MS00AD082R1	igneous felsic intrusive	Arunta	1801	-2.66	2.46	NTGS unpublished
MS00AD097R1	igneous felsic intrusive	Arunta	1800	-4.97	2.63	NTGS unpublished
MS00AD065R1	igneous felsic intrusive	Arunta	1804	-3.13	2.5	NTGS unpublished
IC05DFC017A	igneous felsic intrusive	Arunta	1736	-2.85	2.42	NTGS unpublished
IC05DFC086 (Repeat)	igneous felsic intrusive	Arunta	1770	-2.14	2.39	NTGS unpublished
HA06CJC034	igneous felsic intrusive	Arunta	1642	-4.18	2.44	NTGS unpublished
IC08JAW502	igneous felsic	Arunta	1770	1.12	2.15	NTGS unpublished
AC07EEB184	igneous felsic intrusive	Arunta	1700	-4.14	2.48	NTGS unpublished
AC07CJE196	igneous felsic intrusive	Arunta	1700	-2.11	2.33	NTGS unpublished
AC07CJE203	igneous felsic intrusive	Arunta	1700	-0.89	2.24	NTGS unpublished
IC05DFC086	igneous felsic intrusive	Arunta	1729	-2.07	2.35	NTGS unpublished
LM01DFC006	igneous felsic intrusive	Arunta	1758	-5.85	2.66	NTGS unpublished
LM01IRS015	igneous felsic intrusive	Arunta	1780	-2.34	2.42	NTGS unpublished
MR002IRS110	igneous felsic intrusive	Arunta	1635	-5.33	2.52	NTGS unpublished
MR01IRS076	igneous felsic intrusive	Arunta	1640	-7.13	2.66	NTGS unpublished
NA01MG140	igneous felsic intrusive	Arunta	1800	-4.61	2.6	NTGS unpublished
IC08JAW537	igneous felsic intrusive	Arunta	1730	-0.39	2.23	NTGS unpublished
IC08JAW539	igneous felsic intrusive	Arunta	1730	0.22	2.18	NTGS unpublished
AC07CJE011	igneous felsic intrusive	Arunta	1700	-3.01	2.4	NTGS unpublished
MR02IRS111	igneous mafic intrusive	Arunta	1805	4.32	1.93	NTGS unpublished unpublished
IC07JAW042	metamorphic protolith unknown	Arunta	1770	-2.95	2.45	NTGS unpublished unpublished
ISHU98.156	igneous mafic	Arunta	1790	1.18	2.16	Scrimgeour and Raith 2001
HYSE	igneous mafic intrusive	Arunta	1760	-0.63	2.27	Sivell and McCulloch 1997
31001A	igneous mafic intrusive	Arunta	1760	-4.42	2.56	Sivell and McCulloch 1997

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
31003	igneous mafic intrusive	Arunta	1760	-0.58	2.27	Sivell and McCulloch 1997
99096008#2	igneous felsic intrusive	Arunta	1622	-2.57	2.3	Smith 2001
98096003	igneous felsic intrusive	Arunta	1809	-2.76	2.47	Smith 2001
99096008#1	igneous felsic intrusive	Arunta	1622	-2.61	2.3	Smith 2001
98096002	igneous felsic intrusive	Arunta	1803	-3.34	2.51	Smith 2001
99116407A	high grade metamorphic rock	Arunta	1819	-2.01	2.42	Smith 2001
84924139	igneous felsic intrusive	Arunta	1622	-3.69	2.39	Sun et al. 1995
84091645	igneous felsic	Arunta	1754	-4.28	2.54	Sun et al. 1995
71911773	igneous felsic intrusive	Arunta	1873	-0.06	2.32	Sun et al. 1995
84091646	igneous felsic intrusive	Arunta	1760	-4.18	2.54	Sun et al. 1995
84914144	igneous felsic intrusive	Arunta	1751	-3.95	2.51	Sun et al. 1995
84924096	igneous felsic intrusive	Arunta	1670	-3.3	2.4	Sun et al. 1995
71911848	igneous felsic intrusive	Arunta	1873	-0.53	2.36	Sun et al. 1995
84091644	igneous felsic	Arunta	1760	-3.89	2.52	Sun et al. 1995
83091260	igneous felsic	Arunta	1750	-0.19	2.23	Sun et al. 1995
90934741A	igneous	Arunta	1880	-1.98	2.47	Sun et al. 1995
83091360	igneous felsic	Arunta	1760	-2.89	2.44	Sun et al. 1995
84924100	igneous	Arunta	1820	-0.96	2.35	Sun et al. 1995
85914290A	igneous felsic intrusive	Arunta	1751	-3.88	2.51	Sun et al. 1995
84924124	igneous felsic	Arunta	1799	-3.39	2.51	Sun et al. 1995
029	metasedimentary	Arunta	1760	-4.36	2.55	Wade et al. 2008
017	metasedimentary	Arunta	1760	-4.61	2.57	Wade et al. 2008
021	metasedimentary	Arunta	1760	-9.03	2.9	Wade et al. 2008
016	metasedimentary	Arunta	1773	-1.48	2.35	Wade et al. 2008
032	igneous felsic intrusive	Arunta	1771	-1.61	2.35	Wade et al. 2008
028	metasedimentary	Arunta	1760	-1.86	2.36	Wade et al. 2008
44876	high grade metamorphic rock	Arunta	1800	-3.7	2.54	Windrim & McCulloch 1986
44865	high grade metamorphic rock	Arunta	1800	1.21	2.16	Windrim & McCulloch 1986
44875	high grade metamorphic rock	Arunta	1800	-1.07	2.34	Windrim & McCulloch 1986
44874	high grade metamorphic rock	Arunta	1800	1.08	2.17	Windrim & McCulloch 1986
44873	high grade metamorphic rock	Arunta	1800	-2.59	2.45	Windrim & McCulloch 1986
44871	high grade metamorphic rock	Arunta	1800	-1.77	2.39	Windrim & McCulloch 1986

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
44864	high grade metamorphic rock	Arunta	1800	-0.07	2.26	Windrim & McCulloch 1986
44908	high grade metamorphic rock	Arunta	1800	-2.86	2.47	Windrim & McCulloch 1986
44870	high grade metamorphic rock	Arunta	1800	0.21	2.24	Windrim & McCulloch 1986
44845	high grade metamorphic rock	Arunta	1800	3.72	1.98	Windrim & McCulloch 1986
44859	high grade metamorphic rock	Arunta	1800	0.58	2.21	Windrim & McCulloch 1986
44860	high grade metamorphic rock	Arunta	1800	-0.33	2.28	Windrim & McCulloch 1986
44861	high grade metamorphic rock	Arunta	1800	-0.35	2.28	Windrim & McCulloch 1986
44861	high grade metamorphic rock	Arunta	1800	-0.82	2.32	Windrim & McCulloch 1986
44838	high grade metamorphic rock	Arunta	1800	1.17	2.17	Windrim & McCulloch 1986
44840	high grade metamorphic rock	Arunta	1800	-0.47	2.29	Windrim & McCulloch 1986
44841	high grade metamorphic rock	Arunta	1800	-0.62	2.3	Windrim & McCulloch 1986
44839	high grade metamorphic rock	Arunta	1800	1.44	2.15	Windrim & McCulloch 1986
44845	high grade metamorphic rock	Arunta	1800	4.13	1.95	Windrim & McCulloch 1986
44909	high grade metamorphic rock	Arunta	1800	-3.11	2.49	Windrim & McCulloch 1986
44848	high grade metamorphic rock	Arunta	1800	-1.68	2.38	Windrim & McCulloch 1986
44862	igneous felsic intrusive	Arunta	1800	-1.45	2.37	Windrim & McCulloch 1986
44863	igneous felsic intrusive	Arunta	1800	-0.3	2.28	Windrim & McCulloch 1986
44842	igneous mafic	Arunta	1800	-0.06	2.26	Windrim & McCulloch 1986
44843	igneous mafic	Arunta	1800	1.78	2.12	Windrim & McCulloch 1986
44851	metamorphic protolith unknown	Arunta	1800	1.69	2.13	Windrim & McCulloch 1986
44859	high grade metamorphic rock	Arunta	1800	0.26	2.24	Windrim & McCulloch 1986
44859	high grade metamorphic rock	Arunta	1800	0.44	2.22	Windrim & McCulloch 1986
44844	high grade metamorphic rock	Arunta	1800	0.44	2.22	Windrim & McCulloch 1986

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
44883	high grade metamorphic rock	Arunta	1760	5.13	1.84	Windrim et al 1984
44894	high grade metamorphic rock	Arunta	1760	-1.1	2.31	Windrim et al 1984
44912	high grade metamorphic rock	Arunta	1760	-1.77	2.36	Windrim et al 1984
44895	high grade metamorphic rock	Arunta	1760	0.21	2.21	Windrim et al 1984
44890	high grade metamorphic rock	Arunta	1760	-1.11	2.31	Windrim et al 1984
44887	high grade metamorphic rock	Arunta	1760	-0.62	2.27	Windrim et al 1984
44883	high grade metamorphic rock	Arunta	1760	-4.04	2.53	Windrim et al 1984
44883	high grade metamorphic rock	Arunta	1760	-7.08	2.76	Windrim et al 1984
44882	high grade metamorphic rock	Arunta	1760	-2.75	2.43	Windrim et al 1984
44881	high grade metamorphic rock	Arunta	1760	-0.35	2.25	Windrim et al 1984
44883	high grade metamorphic rock	Arunta	1760	-13.61	3.25	Windrim et al 1984
44897	high grade metamorphic rock	Arunta	1760	0.92	2.15	Windrim et al 1984
91-532	metamorphic protolith unknown	Arunta	1770	-2.17	2.39	Zhao 1994
91-552A	metamorphic protolith unknown	Arunta	1770	4.92	1.86	Zhao 1994
91-529	igneous mafic intrusive	Arunta	1770	-0.87	2.3	Zhao 1994
91-534	igneous mafic intrusive	Arunta	1770	-2.75	2.44	Zhao 1994
89-501	igneous mafic intrusive	Arunta	1770	5.13	1.84	Zhao 1994
89-509	metamorphic protolith unknown	Arunta	1770	5.02	1.85	Zhao 1994
91-515	metamorphic protolith unknown	Arunta	1770	4.24	1.91	Zhao 1994
91-523	metamorphic protolith unknown	Arunta	1770	5.07	1.85	Zhao 1994
89-474	igneous mafic intrusive	Arunta	1080	-6.46	2.14	Zhao and McCulloch 1993
89-506	igneous mafic intrusive	Arunta	1080	-7.86	2.25	Zhao and McCulloch 1993
91-546	igneous mafic intrusive	Arunta	1080	-9.86	2.4	Zhao and McCulloch 1993
91-550	igneous mafic intrusive	Arunta	1080	0.95	1.58	Zhao and McCulloch 1993
89-475	igneous mafic intrusive	Arunta	1080	-5.12	2.04	Zhao and McCulloch 1993
89095534	igneous felsic intrusive	Arunta	1747	-3.35	2.46	Zhao and McCulloch 1995
88002	igneous felsic intrusive	Arunta	1751	-1.37	2.32	Zhao and McCulloch 1995
84914130	igneous felsic intrusive	Arunta	1726	-1.32	2.29	Zhao and McCulloch 1995
89095566	igneous felsic intrusive	Arunta	1713	-1.44	2.29	Zhao and McCulloch 1995

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
89095564	igneous felsic intrusive	Arunta	1713	-2.39	2.36	Zhao and McCulloch 1995
89095574	igneous felsic intrusive	Arunta	1713	-1.93	2.33	Zhao and McCulloch 1995
89095578	igneous felsic intrusive	Arunta	1771	-0.98	2.31	Zhao and McCulloch 1995
89095576	igneous felsic intrusive	Arunta	1771	-1.78	2.37	Zhao and McCulloch 1995
89095503	igneous felsic intrusive	Arunta	1726	2.78	1.98	Zhao and McCulloch 1995
89095505	igneous felsic intrusive	Arunta	1771	-2.34	2.41	Zhao and McCulloch 1995
88091	igneous felsic intrusive	Arunta	1750	-0.66	2.26	Zhao and McCulloch 1995
84904049	igneous felsic intrusive	Arunta	1771	-1.43	2.34	Zhao and McCulloch 1995
85094241A	igneous felsic intrusive	Arunta	1713	-3.08	2.42	Zhao and McCulloch 1995
89095557	igneous felsic intrusive	Arunta	1743	-0.76	2.27	Zhao and McCulloch 1995
89095553	igneous felsic intrusive	Arunta	1751	-0.41	2.25	Zhao and McCulloch 1995
88099	igneous felsic intrusive	Arunta	1750	-0.56	2.26	Zhao and McCulloch 1995
84904050	igneous felsic intrusive	Arunta	1713	-2.41	2.37	Zhao and McCulloch 1995
89095513	igneous felsic intrusive	Arunta	1771	-3.68	2.51	Zhao and McCulloch 1995
89095556	igneous felsic intrusive	Arunta	1743	0.1	2.2	Zhao and McCulloch 1995
89095565	igneous felsic intrusive	Arunta	1771	-0.83	2.29	Zhao and McCulloch 1995
89095566	igneous felsic intrusive	Arunta	1713	-1.59	2.3	Zhao and McCulloch 1995
89095512	igneous felsic intrusive	Arunta	1771	-2.99	2.46	Zhao and McCulloch 1995
89095517	igneous felsic intrusive	Arunta	1771	-4.31	2.56	Zhao and McCulloch 1995
89095552	igneous felsic intrusive	Arunta	1771	-2.05	2.39	Zhao and McCulloch 1995
87106	igneous felsic intrusive	Arunta	1873	-3.97	2.62	Zhao and McCulloch 1995
89095528	igneous felsic intrusive	Arunta	1747	-1.74	2.34	Zhao and McCulloch 1995
89095533	igneous felsic intrusive	Arunta	1747	-2.92	2.43	Zhao and McCulloch 1995

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
89095544	igneous felsic intrusive	Arunta	1751	-4.85	2.58	Zhao and McCulloch 1995
89095543	igneous felsic intrusive	Arunta	1751	-1.02	2.29	Zhao and McCulloch 1995
84924126	igneous felsic intrusive	Arunta	1758	-2.88	2.44	Zhao and McCulloch 1995
89095502	igneous felsic	Arunta	1770	-1.76	2.36	Zhao and McCulloch 1995
89095545	igneous	Arunta	1752	-3.53	2.48	Zhao and McCulloch 1995
87064	igneous felsic intrusive	Arunta	1879	-3.66	2.6	Zhao and McCulloch 1995
89095551	igneous felsic intrusive	Arunta	1771	-2.59	2.43	Zhao and McCulloch 1995
89095567	igneous felsic intrusive	Arunta	1771	-1.14	2.32	Zhao and McCulloch 1995
99116406A	igneous felsic intrusive	Davenport	1838	-2.72	2.49	Smith 2001
73303024	metasedimentary	Georgetown-Coen	1685	-5.35	2.56	Black & McCulloch 1984
79300059	igneous felsic volcanic	Georgetown-Coen	1650	0.93	2.06	Black & McCulloch 1984
79300062	igneous felsic volcanic	Georgetown-Coen	1650	-0.71	2.18	Black & McCulloch 1984
79300062	igneous felsic volcanic	Georgetown-Coen	1650	-1.09	2.21	Black & McCulloch 1984
79300060	igneous felsic volcanic	Georgetown-Coen	1650	-3.67	2.41	Black & McCulloch 1984
79300060	igneous felsic volcanic	Georgetown-Coen	1650	-3.14	2.37	Black & McCulloch 1984
79300058	igneous felsic volcanic	Georgetown-Coen	1650	0.82	2.07	Black & McCulloch 1984
80303065	igneous mafic	Georgetown-Coen	1670	4.22	1.83	Black & McCulloch 1984
80303066	igneous mafic	Georgetown-Coen	1670	3.42	1.89	Black & McCulloch 1984
73303001	metasedimentary	Georgetown-Coen	1685	-5.6	2.58	Black & McCulloch 1984
73303006	igneous mafic intrusive	Georgetown-Coen	1670	1.41	2.04	Black & McCulloch 1984
82303068	igneous felsic intrusive	Georgetown-Coen	1670	-5.49	2.56	Black & McCulloch 1984
79300232	igneous mafic intrusive	Georgetown-Coen	1670	4.4	1.82	Black & McCulloch 1984
82303067	igneous mafic intrusive	Georgetown-Coen	1670	-2.27	2.32	Black & McCulloch 1984

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
77303064	igneous felsic volcanic	Georgetown-Coen	1552	-1.91	2.19	Black & McCulloch 1990
81303066	igneous felsic intrusive	Georgetown-Coen	1544	-4.55	2.39	Black & McCulloch 1990
81303068	igneous felsic intrusive	Georgetown-Coen	1550	-3.12	2.28	Black & McCulloch 1990
81303071	igneous felsic intrusive	Georgetown-Coen	1558	-2.37	2.23	Black & McCulloch 1990
81303067	igneous felsic intrusive	Georgetown-Coen	1561	-4.59	2.4	Black & McCulloch 1990
81303069	igneous felsic intrusive	Georgetown-Coen	1564	0.2	2.04	Black & McCulloch 1990
92836584	metamorphic protolith unknown	Georgetown-Coen	1585	7.53	1.51	GA unpublished
70570274	metasedimentary	Georgetown-Coen	1550	-0.79	2.11	GA unpublished
2007167007-01	igneous felsic intrusive	Georgetown-Coen	1559	-4.91	2.43	GA unpublished
2008839059	igneous felsic intrusive	Georgetown-Coen	1560	-0.57	2.1	GA unpublished
2008839057	igneous felsic intrusive	Georgetown-Coen	1560	0.05	2.05	GA unpublished
IWGT342	igneous felsic intrusive	Georgetown-Coen	1563	-1.88	2.2	GA unpublished
2008839046	igneous felsic intrusive	Georgetown-Coen	1558	-1.74	2.19	GA unpublished
2008839056	igneous felsic intrusive	Georgetown-Coen	1559	-0.61	2.1	GA unpublished
2008839008	igneous felsic volcanic	Georgetown-Coen	1552	-1.81	2.19	GA unpublished
2008839064	igneous felsic intrusive	Georgetown-Coen	1550	-3.06	2.28	GA unpublished
92836584	metamorphic protolith unknown	Georgetown-Coen	1585	7.75	1.49	GA unpublished
68480227	igneous mafic intrusive	Georgetown-Coen	1550	4.83	1.68	GA unpublished
BB2234	igneous felsic intrusive	Georgetown-Coen	1525	-1.98	2.18	Knutson and Sun in Blewett et al. 1997
70570200B	metasedimentary	Georgetown-Coen	1550	-0.36	2.07	Knutson and Sun in Blewett et al. 1997
70570225A	metasedimentary	Georgetown-Coen	1550	-3.19	2.29	Knutson and Sun in Blewett et al. 1997
68480231A	metasedimentary	Georgetown-Coen	1550	-2.44	2.23	Knutson and Sun in Blewett et al. 1997
68480232A	metasedimentary	Georgetown-Coen	1550	-5.16	2.44	Knutson and Sun in Blewett et al. 1997

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
92836501	metasedimentary	Georgetown-Coen	1550	-3.39	2.3	Knutson and Sun in Blewett et al. 1997
91836345	metasedimentary	Georgetown-Coen	1550	-0.95	2.12	Knutson and Sun in Blewett et al. 1997
70570256	metasedimentary	Georgetown-Coen	1550	-2.8	2.26	Knutson and Sun in Blewett et al. 1997
70570264	metasedimentary	Georgetown-Coen	1550	-0.45	2.08	Knutson and Sun in Blewett et al. 1997
90831035	metasedimentary	Georgetown-Coen	1100	-7.46	2.23	Knutson and Sun in Blewett et al. 1997
BB2236	high grade metamorphic rock	Georgetown-Coen	1585	-0.44	2.11	Knutson and Sun in Blewett et al. 1997
93834299A	igneous felsic	Georgetown-Coen	1585	-0.8	2.14	Knutson and Sun in Blewett et al. 1997
93836592	high grade metamorphic rock	Georgetown-Coen	1585	-3.27	2.32	Knutson and Sun in Blewett et al. 1997
91831000A	metasedimentary	Georgetown-Coen	1200	-4.05	2.06	Knutson and Sun in Blewett et al. 1997
92836572	igneous felsic	Georgetown-Coen	1585	-3.45	2.34	Knutson and Sun in Blewett et al. 1997
90831005	metasedimentary	Georgetown-Coen	1100	-5.19	2.06	Knutson and Sun in Blewett et al. 1997
92836520	metasedimentary	Georgetown-Coen	1685	-5	2.54	Knutson In Withnall et al. 1997
92836542	metasedimentary	Georgetown-Coen	1685	-4.93	2.53	Knutson In Withnall et al. 1997
92836536	metasedimentary	Georgetown-Coen	1685	0.47	2.12	Knutson In Withnall et al. 1997
92836504B	igneous mafic intrusive	Georgetown-Coen	1670	-3.37	2.4	Knutson In Withnall et al. 1997
92836540	metamorphic protolith unknown	Georgetown-Coen	1670	3.7	1.87	Knutson In Withnall et al. 1997
92836564	metasedimentary	Georgetown-Coen	1585	-2.24	2.25	Knutson in Withnall et al. 1997
92836566	metasedimentary	Georgetown-Coen	1585	-1.98	2.23	Knutson in Withnall et al. 1997
2007169004	sedimentary	Georgetown-Coen	1700	-8.2	2.79	Lambeck et al. 2012
2007169002	sedimentary	Georgetown-Coen	1700	-7.91	2.77	Lambeck et al. 2012
2007169005	sedimentary	Georgetown-Coen	1655	-0.82	2.2	Lambeck et al. 2012
2007169006	sedimentary	Georgetown-Coen	1655	0.46	2.1	Lambeck et al. 2012
G76	igneous felsic intrusive	Kennedy	280	-12.92	1.96	Black & McCulloch 1990

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
74300672	igneous felsic volcanic	Kennedy	330	-8.52	1.67	Black & McCulloch 1990
75301348	igneous felsic volcanic	Kennedy	330	-9.45	1.74	Black & McCulloch 1990
89837502	igneous felsic intrusive	Kennedy	284	-6.76	1.5	Black et al. 1992
89837504	igneous felsic intrusive	Kennedy	287	-7.63	1.57	Black et al. 1992
89837506	igneous felsic intrusive	Kennedy	285	-8.57	1.64	Black et al. 1992
DCC75	igneous felsic intrusive	Kennedy	300	-8.61	1.65	Champion 1991
DCC75r	igneous felsic intrusive	Kennedy	300	-8.98	1.68	Champion 1991
DCC28	igneous felsic intrusive	Kennedy	300	-8.8	1.67	Champion 1991
DCC5	igneous felsic intrusive	Kennedy	321	-9.34	1.73	Champion 1991
DCC33	igneous felsic intrusive	Kennedy	300	-9.53	1.72	Champion 1991
DCC1	igneous felsic intrusive	Kennedy	300	-11.15	1.84	Champion 1991
DCC22	igneous felsic intrusive	Kennedy	304	-11.64	1.88	Champion 1991
92836424	igneous felsic intrusive	Kennedy	328	-12.26	1.95	GA unpublished
92836430	igneous felsic intrusive	Kennedy	345	-14.12	2.11	GA unpublished
93839082	igneous felsic intrusive	Kennedy	330	-11.68	1.91	GA unpublished
90836039	igneous mafic intrusive	Kennedy	285	-3.66	1.27	GA unpublished
93832329A	igneous felsic volcanic	Kennedy	290	-8.49	1.64	GA unpublished
93839090	igneous felsic intrusive	Kennedy	330	-9.34	1.73	GA unpublished
2008839030	igneous felsic intrusive	Kennedy	330	-6.35	1.51	GA unpublished
75300816	igneous felsic volcanic	Kennedy	330	-8.84	1.7	GA unpublished
90836155	igneous mafic intrusive	Kennedy	285	-6.54	1.48	GA unpublished
90836026	igneous felsic intrusive	Kennedy	285	-5.05	1.37	GA unpublished
90836036	igneous felsic intrusive	Kennedy	285	-7.78	1.58	GA unpublished
90836159A	igneous felsic intrusive	Kennedy	285	-7.31	1.54	GA unpublished
90836120	igneous felsic intrusive	Kennedy	285	-7.34	1.54	GA unpublished
91832066	igneous felsic intrusive	Kennedy	285	-6.16	1.46	GA unpublished
75301340	igneous felsic volcanic	Kennedy	290	-9.38	1.7	GA unpublished
93832265	igneous felsic volcanic	Kennedy	300	-12.52	1.95	GA unpublished
90836143	igneous mafic intrusive	Kennedy	285	-9.1	1.68	GA unpublished
93832286	igneous felsic volcanic	Kennedy	290	-9.76	1.73	GA unpublished
93832339	igneous felsic volcanic	Kennedy	290	-11.76	1.88	GA unpublished
83211034a	igneous lamproites	Kimberley	1180	-5.25	2.13	GA Shen-Su Sun
71475B	igneous lamproites	Kimberley	20	-12.24	1.69	GA Shen-Su Sun
71476D	igneous lamproites	Kimberley	20	-13.79	1.81	GA Shen-Su Sun
71480C	igneous lamproites	Kimberley	20	-12.23	1.69	GA Shen-Su Sun
81210197A	igneous lamproites	Kimberley	20	-10.12	1.53	GA Shen-Su Sun

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
71456A	igneous lamproites	Kimberley	20	-11.94	1.67	GA Shen-Su Sun
83211033a	igneous lamproites	Kimberley	1180	-5.01	2.12	GA Shen-Su Sun
81210149	igneous lamproites	Kimberley	20	-13.02	1.75	GA Shen-Su Sun
83211037a	igneous lamproites	Kimberley	1180	-4.77	2.1	GA Shen-Su Sun
83211049a	igneous lamproites	Kimberley	1180	-4.21	2.06	GA Shen-Su Sun
83211009c	igneous lamproites	Kimberley	1180	-4.68	2.09	GA Shen-Su Sun
71449A	igneous lamproites	Kimberley	20	-15.36	1.93	GA Shen-Su Sun
71448F	igneous lamproites	Kimberley	20	-7.76	1.36	GA Shen-Su Sun
83210316	igneous lamproites	Kimberley	20	-13.19	1.76	GA Shen-Su Sun
81210172	igneous lamproites	Kimberley	20	-10.26	1.54	GA Shen-Su Sun
80210126	igneous lamproites	Kimberley	20	-7.37	1.33	GA Shen-Su Sun
80210057	igneous lamproites	Kimberley	20	-14	1.83	GA Shen-Su Sun
80210047	igneous lamproites	Kimberley	20	-13.6	1.8	GA Shen-Su Sun
71160408	igneous lamproites	Kimberley	20	-15.17	1.91	GA Shen-Su Sun
66160326	igneous lamproites	Kimberley	20	-14.39	1.85	GA Shen-Su Sun
66160003	igneous lamproites	Kimberley	20	-13.69	1.8	GA Shen-Su Sun
65912	igneous lamproites	Kimberley	20	-13.8	1.81	GA Shen-Su Sun
83211055a	igneous lamproites	Kimberley	1180	-3.98	2.04	GA Shen-Su Sun
85598001	igneous felsic intrusive	Kimberley	1857	-2.02	2.46	GA Shen-Su Sun
81210203	igneous lamproites	Kimberley	20	-10.6	1.57	GA Shen-Su Sun
83330074	igneous mafic	Kimberley	1850	5.05	1.92	GA Shen-Su Sun
92522436	igneous mafic intrusive	Kimberley	1830	0.47	2.25	GA Shen-Su Sun
83330043	igneous mafic intrusive	Kimberley	1830	1.21	2.19	GA Shen-Su Sun
96496009	igneous mafic intrusive	Kimberley	976	2.25	1.4	GA Shen-Su Sun
83330085	igneous mafic intrusive	Kimberley	1830	-0.01	2.28	GA Shen-Su Sun
83330085	igneous mafic intrusive	Kimberley	1830	0.33	2.26	GA Shen-Su Sun
83330081	igneous mafic intrusive	Kimberley	1830	-0.26	2.3	GA Shen-Su Sun
83330052	igneous mafic intrusive	Kimberley	1830	-0.96	2.35	GA Shen-Su Sun
94520184	igneous felsic intrusive	Kimberley	1857	-0.33	2.33	GA Shen-Su Sun
95520008	igneous mafic intrusive	Kimberley	1850	0.85	2.23	GA Shen-Su Sun
94522127	igneous mafic intrusive	Kimberley	1841	3.5	2.03	GA Shen-Su Sun
83330074	igneous mafic	Kimberley	1850	4.45	1.96	GA Shen-Su Sun
94520051A	igneous intermediate volcanic	Kimberley	1855	1.99	2.15	GA Shen-Su Sun
94520176	igneous felsic volcanic	Kimberley	1857	0.07	2.3	GA Shen-Su Sun
88598005	igneous felsic volcanic	Kimberley	1907	-0.06	2.35	GA Shen-Su Sun
87598021	igneous felsic volcanic	Kimberley	1855	1.97	2.15	GA Shen-Su Sun
94520121	igneous felsic volcanic	Kimberley	1857	1.54	2.19	GA Shen-Su Sun

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
88598010	igneous felsic intrusive	Kimberley	1910	-9.97	3.1	GA Shen-Su Sun
83330030	igneous mafic intrusive	Kimberley	1830	1.29	2.18	GA Shen-Su Sun
87598027	igneous mafic volcanic	Kimberley	1907	-0.88	2.41	GA Shen-Su Sun
83330014	igneous felsic	Kimberley	1850	-3.09	2.53	GA Shen-Su Sun
71453Ma	igneous lamproites	Kimberley	20	-12.61	1.72	GA Shen-Su Sun
87598014	sedimentary	Kimberley	1870	-4.47	2.65	GA Shen-Su Sun
83330072	sedimentary	Kimberley	1870	-4.82	2.68	GA Shen-Su Sun
83330028	sedimentary	Kimberley	1870	-3.59	2.58	GA Shen-Su Sun
87598028	sedimentary	Kimberley	1900	-14.92	3.46	GA Shen-Su Sun
92522001	metasedimentary	Kimberley	1850	1.38	2.19	GA Shen-Su Sun
92522461	igneous mafic intrusive	Kimberley	1830	-0.49	2.32	GA Shen-Su Sun
87598001	igneous volcanic	Kimberley	1855	0.83	2.24	GA Shen-Su Sun
92522533	igneous mafic intrusive	Kimberley	1830	-1.6	2.4	GA Shen-Su Sun
93522021A	igneous mafic intrusive	Kimberley	1830	-0.29	2.3	GA Shen-Su Sun
93522014	igneous mafic intrusive	Kimberley	1830	-1.34	2.38	GA Shen-Su Sun
92522541	igneous mafic intrusive	Kimberley	1830	-2.09	2.44	GA Shen-Su Sun
92522437	igneous mafic intrusive	Kimberley	1830	-1.22	2.37	GA Shen-Su Sun
92522073	igneous mafic intrusive	Kimberley	1856	0.38	2.27	GA Shen-Su Sun
94522287	igneous mafic intrusive	Kimberley	1830	-0.91	2.35	GA Shen-Su Sun
94522172	igneous mafic intrusive	Kimberley	1830	2.06	2.13	GA Shen-Su Sun
83330052	igneous mafic intrusive	Kimberley	1830	-1.4	2.39	GA Shen-Su Sun
83330035	metasedimentary	Kimberley	1850	-3.54	2.56	GA Shen-Su Sun
87598007	igneous felsic intrusive	Kimberley	1862	-3.49	2.57	GA Shen-Su Sun
83211016a	igneous lamproites	Kimberley	1180	-1.84	1.88	GA Shen-Su Sun
87598011	igneous felsic intrusive	Kimberley	1864	-3.7	2.59	GA Shen-Su Sun
83330052	igneous mafic intrusive	Kimberley	1830	-0.95	2.35	GA Shen-Su Sun
87598009	igneous felsic intrusive	Kimberley	1862	-3.77	2.59	GA Shen-Su Sun
87598029	igneous felsic intrusive	Kimberley	1912	-0.89	2.42	GA Shen-Su Sun
93525043	high grade metamorphic rock	Kimberley	1870	-2.75	2.52	GA Shen-Su Sun
93526006	igneous felsic	Kimberley	1849	0.51	2.26	GA Shen-Su Sun
87598010	igneous felsic intrusive	Kimberley	1852	-2.74	2.51	GA Shen-Su Sun
113416	igneous felsic intrusive	Kimberley	1854	-2.69	2.5	Griffin et al. 2000
92721	igneous mafic intrusive	Kimberley	1850	-0.99	2.37	Griffin et al. 2000
92777	igneous felsic volcanic	Kimberley	1855	-3.85	2.59	Griffin et al. 2000
91085	igneous felsic volcanic	Kimberley	1855	-4.02	2.6	Griffin et al. 2000
108532	igneous felsic intrusive	Kimberley	1860	-3.03	2.53	Griffin et al. 2000
95313	igneous mafic intrusive	Kimberley	1850	-2.25	2.47	Griffin et al. 2000

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
51706	igneous felsic intrusive	Kimberley	1820	-1.31	2.37	McCulloch 1987
30803	igneous felsic intrusive	Kimberley	1910	-2.63	2.55	McCulloch 1987
GA5132	igneous mafic intrusive	Kimberley	1800	-0.51	2.29	McCulloch 1987
GA1241	igneous mafic intrusive	Kimberley	1800	-1.15	2.34	McCulloch 1987
8220	metamorphic protolith unknown	Mount Isa	1710	-3.31	2.43	Bierlein & Betts 2004
8223	igneous	Mount Isa	1890	-0.17	2.34	Bierlein & Betts 2004
8218	igneous	Mount Isa	1890	-2.68	2.53	Bierlein & Betts 2004
828	igneous	Mount Isa	1890	-2.7	2.53	Bierlein & Betts 2004
829	igneous	Mount Isa	1890	-2.81	2.54	Bierlein & Betts 2004
8210	igneous	Mount Isa	1890	-3.17	2.57	Bierlein & Betts 2004
8212	igneous	Mount Isa	1890	-2.26	2.5	Bierlein & Betts 2004
8221	metasomatic	Mount Isa	1860	-3.19	2.55	Bierlein & Betts 2004
825	unknown	Mount Isa	1860	-2.93	2.53	Bierlein & Betts 2004
826	unknown	Mount Isa	1860	-2.75	2.51	Bierlein & Betts 2004
827	unknown	Mount Isa	1860	-4.81	2.67	Bierlein & Betts 2004
8211	igneous	Mount Isa	1890	-3.18	2.57	Bierlein & Betts 2004
FBMI6514	igneous mafic intrusive	Mount Isa	1860	2.32	2.13	Bierlein et al. 2011
FBMI6501	unknown	Mount Isa	1860	-0.86	2.37	Bierlein et al. 2011
FBMI5602	high grade metamorphic rock	Mount Isa	1860	-2.45	2.49	Bierlein et al. 2011
FBMI6510	igneous felsic intrusive	Mount Isa	1775	-2.15	2.4	Bierlein et al. 2011
FBMI6504	igneous felsic intrusive	Mount Isa	1855	-2.98	2.53	Bierlein et al. 2011
FBMI6511C	igneous felsic intrusive	Mount Isa	1860	-3.82	2.59	Bierlein et al. 2011
FBMI5601	igneous felsic intrusive	Mount Isa	1718	-3.4	2.44	Bierlein et al. 2011
FBMI5605	igneous felsic intrusive	Mount Isa	1722	-2.71	2.4	Bierlein et al. 2011
FBMI6518	igneous mafic intrusive	Mount Isa	763	-7.14	1.93	Bierlein et al. 2011
FBMI6508B	igneous mafic intrusive	Mount Isa	1860	-4.13	2.62	Bierlein et al. 2011
FBMI5604	igneous mafic intrusive	Mount Isa	1860	-1.53	2.42	Bierlein et al. 2011
FBMI5608	igneous felsic intrusive	Mount Isa	1860	-3.04	2.54	Bierlein et al. 2011
FBMI5607	igneous mafic intrusive	Mount Isa	1860	0.43	2.27	Bierlein et al. 2011
FBMI6508D	igneous mafic intrusive	Mount Isa	1860	-1.37	2.41	Bierlein et al. 2011
Mt Whelan 1	igneous felsic intrusive	Mount Isa	1769	-2.6	2.43	GA unpublished
PDMT173B	igneous felsic intrusive	Mount Isa	1861	-2.31	2.48	GA unpublished
IWMI2799	igneous felsic volcanic	Mount Isa	1782	-0.41	2.27	GA unpublished
LJHMI576	igneous felsic volcanic	Mount Isa	1857	-0.04	2.31	GA unpublished
LJHMI 775	igneous volcanic	Mount Isa	1633	-3.9	2.41	GA unpublished
ISSNG053	sedimentary	Mount Isa	1600	-2.29	2.26	GA unpublished
PBMI177	sedimentary	Mount Isa	1736	-1.37	2.31	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
LJHMI565B	sedimentary	Mount Isa	1757	-4.57	2.56	GA unpublished
PBMI175	unknown	Mount Isa	1734	2.36	2.02	GA unpublished
TD0802	sedimentary	Mount Isa	1515	-4.14	2.33	GA unpublished
LJHMI 900	igneous felsic intrusive	Mount Isa	1735	-4.84	2.57	GA unpublished
PDMT 174	igneous felsic intrusive	Mount Isa	1792	-4.09	2.56	GA unpublished
LJHMI 420	igneous felsic intrusive	Mount Isa	1679	-6.23	2.62	GA unpublished
PDMT 149	igneous felsic	Mount Isa	1862	-3.63	2.58	GA unpublished
95208068	igneous	Mount Isa	1890	-3.37	2.59	GA unpublished
PDMT155	igneous	Mount Isa	1851	-3.12	2.53	GA unpublished
WPMI 1051	igneous felsic intrusive	Mount Isa	1858	-3.04	2.53	GA unpublished
PDMT153	high grade metamorphic rock	Mount Isa	1858	-2.37	2.48	GA unpublished
LJHMI 565A	igneous felsic intrusive	Mount Isa	1795	-3	2.48	GA unpublished
WPMI1464	igneous felsic intrusive	Mount Isa	1859	-2.91	2.52	GA unpublished
ISSNG047	sedimentary	Mount Isa	1616	-1.76	2.24	GA unpublished
IWMI2686	metasedimentary	Mount Isa	1610	1.24	2	GA unpublished
APMI1115	metasedimentary	Mount Isa	1784	-4.15	2.56	GA unpublished
GSQ Dobbyn No1	metasedimentary	Mount Isa	1592	-2.99	2.31	GA unpublished
92208032	metasedimentary	Mount Isa	1680	0.34	2.13	GA unpublished
85206003	igneous mafic intrusive	Mount Isa	1508	-2.52	2.2	GA unpublished
92208033	metasedimentary	Mount Isa	1680	-1.1	2.24	GA unpublished
86206117	igneous mafic	Mount Isa	1545	-2.9	2.26	GA unpublished
92208010	metasedimentary	Mount Isa	1680	-4.66	2.51	GA unpublished
92208016	igneous felsic volcanic	Mount Isa	1680	-2.7	2.36	GA unpublished
ISSNG 012	sedimentary	Mount Isa	1598	-2.75	2.29	GA unpublished
IWMI2804	igneous felsic volcanic	Mount Isa	1768	-2.14	2.39	GA unpublished
92208025	igneous felsic volcanic	Mount Isa	1745	-7.42	2.77	GA unpublished
95208052	igneous felsic volcanic	Mount Isa	1760	0.83	2.16	GA unpublished
95208053	igneous felsic volcanic	Mount Isa	1760	-1.96	2.37	GA unpublished
86206081	igneous mafic intrusive	Mount Isa	1520	-2.78	2.23	GA unpublished
86206122	igneous felsic intrusive	Mount Isa	1545	0.63	2	GA unpublished
ISSNG 056	sedimentary	Mount Isa	1599	-5.57	2.51	GA unpublished
LJHMI 752	igneous felsic volcanic	Mount Isa	1819	-1.06	2.35	GA unpublished
ISSNG 026	sedimentary	Mount Isa	1577	-3.89	2.36	GA unpublished
APMI1216	metasedimentary	Mount Isa	1743	-5.11	2.59	GA unpublished
APMI 1209	metasedimentary	Mount Isa	1752	-5.05	2.6	GA unpublished
ISSNG024	sedimentary	Mount Isa	1577	-1.91	2.21	GA unpublished
85206007	igneous felsic intrusive	Mount Isa	1508	-2.79	2.22	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
86206120	igneous felsic intrusive	Mount Isa	1545	-2.15	2.21	GA unpublished
APMI 1028	sedimentary	Mount Isa	1712	-4.17	2.5	GA unpublished
APMI1106	sedimentary	Mount Isa	1749	-2.07	2.37	GA unpublished
APMI 1232	sedimentary	Mount Isa	1653	-6.4	2.62	GA unpublished
2009165029	sedimentary	Mount Isa	1691	-4.33	2.49	GA unpublished
92208038	igneous felsic intrusive	Mount Isa	1680	-1.35	2.26	GA unpublished
2009165015	sedimentary	Mount Isa	1652	-4.49	2.47	Lambeck et al. 2012
2009165014	sedimentary	Mount Isa	1652	-3.32	2.38	Lambeck et al. 2012
2008165104	sedimentary	Mount Isa	1668	-5.25	2.54	Lambeck et al. 2012
91779032	sedimentary	Mount Isa	1639	-0.85	2.19	Lambeck et al. 2012
91779034	igneous volcanic	Mount Isa	1639	-2.24	2.29	Lambeck et al. 2012
2009165049	sedimentary	Mount Isa	1647	-4.52	2.47	Lambeck et al. 2012
2008165076	igneous felsic	Mount Isa	1668	-25.09	4.04	Lambeck et al. 2012
91779042	sedimentary	Mount Isa	1648	-1.66	2.25	Lambeck et al. 2012
95779098	igneous felsic	Mount Isa	1668	-2.77	2.35	Lambeck et al. 2012
1945980	sedimentary	Mount Isa	1655	-0.6	2.18	Lambeck et al. 2012
2006165013	sedimentary	Mount Isa	1655	-0.55	2.18	Lambeck et al. 2012
2009165012	sedimentary	Mount Isa	1655	-6.98	2.66	Lambeck et al. 2012
2006165025	sedimentary	Mount Isa	1680	-5.36	2.56	Lambeck et al. 2012
2006169027	sedimentary	Mount Isa	1680	-4.77	2.52	Lambeck et al. 2012
2008165068	igneous felsic	Mount Isa	1668	-3.54	2.41	Lambeck et al. 2012
92208013	igneous felsic intrusive	Mount Isa	1654	-1.12	2.22	Lambeck et al. 2012
2009165020	sedimentary	Mount Isa	1652	-2.67	2.33	Lambeck et al. 2012
2004169015	igneous felsic intrusive	Mount Isa	1674	-5.41	2.56	Lambeck et al. 2012
2004169018	igneous felsic intrusive	Mount Isa	1670	-5.09	2.53	Lambeck et al. 2012
74205211	igneous felsic volcanic	Mount Isa	1678	-4.39	2.49	Lambeck et al. 2012
95779090	igneous volcanic	Mount Isa	1647	0.4	2.1	Lambeck et al. 2012
95779104	igneous volcanic	Mount Isa	1654	-1.28	2.23	Lambeck et al. 2012
91779005	igneous volcanic	Mount Isa	1652	-1.34	2.23	Lambeck et al. 2012
2008165077	sedimentary	Mount Isa	1668	-12.24	3.07	Lambeck et al. 2012
2009165033	igneous mafic intrusive	Mount Isa	1658	-0.73	2.19	Lambeck et al. 2012
MK69/3	metasomatic	Mount Isa	1730	-6.34	2.68	Maas et al. 1987
77200832	metasomatic	Mount Isa	1730	-4.4	2.53	Maas et al. 1987
77205013A	metasomatic	Mount Isa	1730	-3.86	2.49	Maas et al. 1987
77200832B	metasomatic	Mount Isa	1730	-6.12	2.66	Maas et al. 1987
77200832B	metasomatic	Mount Isa	1730	-4.93	2.57	Maas et al. 1987
MK9447	metasomatic	Mount Isa	1730	-3.75	2.48	Maas et al. 1987

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
MK70	metasomatic	Mount Isa	1730	-4.44	2.53	Maas et al. 1987
MK69	metasomatic	Mount Isa	1730	-3.58	2.47	Maas et al. 1987
MK68	metasomatic	Mount Isa	1730	-3.99	2.5	Maas et al. 1987
77200832	metasomatic	Mount Isa	1730	-4.57	2.54	Maas et al. 1987
77200832	metasomatic	Mount Isa	1730	-10.86	3.02	Maas et al. 1987
MK69/5	metasomatic	Mount Isa	1730	-4.4	2.53	Maas et al. 1987
77205013A	metasomatic	Mount Isa	1730	-5.33	2.6	Maas et al. 1987
77205013A	metasomatic	Mount Isa	1730	-3.1	2.43	Maas et al. 1987
MK69/1	metasomatic	Mount Isa	1730	-4.64	2.55	Maas et al. 1987
77200832A	metasomatic	Mount Isa	1730	-5.24	2.59	Maas et al. 1987
MK716	metasedimentary	Mount Isa	1750	-3.68	2.49	Maas et al. 1987
MK756	metasedimentary	Mount Isa	1750	-3.25	2.46	Maas et al. 1987
MK755	metasedimentary	Mount Isa	1750	-4.32	2.54	Maas et al. 1987
MK754	metasedimentary	Mount Isa	1750	-3.36	2.47	Maas et al. 1987
MK69/5	metasomatic	Mount Isa	1730	-3.65	2.47	Maas et al. 1987
77205013A	metasomatic	Mount Isa	1730	-3.71	2.48	Maas et al. 1987
77205013A	metasomatic	Mount Isa	1730	-4.11	2.51	Maas et al. 1987
71201262D	metasomatic	Mount Isa	1730	-3.86	2.49	Maas et al. 1987
77200822A	metasomatic	Mount Isa	1730	-4.2	2.51	Maas et al. 1987
77200822A	metasomatic	Mount Isa	1730	-5.41	2.61	Maas et al. 1987
77205013A	metasomatic	Mount Isa	1730	-3.9	2.49	Maas et al. 1987
MK69/4	metasomatic	Mount Isa	1730	-5.08	2.58	Maas et al. 1987
77200832A	metasomatic	Mount Isa	1730	-3.53	2.46	Maas et al. 1987
42732	igneous felsic intrusive	Mount Isa	1520	-3.27	2.27	Mark 2001
42704	igneous felsic intrusive	Mount Isa	1545	-3.18	2.28	Mark 2001
42709	igneous felsic intrusive	Mount Isa	1520	-2.16	2.18	Mark 2001
42708	igneous felsic intrusive	Mount Isa	1545	-2	2.19	Mark 2001
42739	igneous felsic intrusive	Mount Isa	1520	-2.99	2.25	Mark 2001
42762	igneous felsic intrusive	Mount Isa	1520	-2.55	2.21	Mark 2001
42737	igneous felsic intrusive	Mount Isa	1520	-2.97	2.25	Mark 2001
42696	igneous felsic intrusive	Mount Isa	1520	-2.74	2.23	Mark 2001
77205009	metasedimentary	Mount Isa	1890	-2.11	2.49	McCulloch 1987
73205121	igneous felsic volcanic	Mount Isa	1783	-1.8	2.38	McCulloch 1987/Wyborn et al. 1988
79205312	igneous felsic volcanic	Mount Isa	1862	-2.91	2.53	McCulloch 1987/Wyborn et al. 1988

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
79205309	igneous felsic intrusive	Mount Isa	1862	-1.63	2.43	McCulloch 1987/Wyborn et al. 1988
73205129	igneous felsic volcanic	Mount Isa	1865	-2.29	2.48	McCulloch 1987/Wyborn et al. 1988
GM95-30	igneous	Mount Isa	1890	-3.36	2.58	McDonald et al. 1997
GM94-107	metasedimentary	Mount Isa	2800	4.17	2.78	McDonald et al. 1997
GM95-45	igneous	Mount Isa	1890	-2.57	2.53	McDonald et al. 1997
GM95-42	igneous	Mount Isa	1890	-3.31	2.58	McDonald et al. 1997
GM93-62	igneous felsic volcanic	Mount Isa	1860	-3.8	2.59	McDonald et al. 1997
GM95-43	igneous	Mount Isa	1890	-3.28	2.58	McDonald et al. 1997
GM95-49	igneous mafic intrusive	Mount Isa	2800	3.68	2.81	McDonald et al. 1997
GM93-71	igneous felsic volcanic	Mount Isa	1860	-2.94	2.53	McDonald et al. 1997
Gm95-38	igneous	Mount Isa	1890	-3.24	2.58	McDonald et al. 1997
GM93-64	igneous felsic volcanic	Mount Isa	1860	-2.74	2.51	McDonald et al. 1997
GM95-37	metamorphic protolith unknown	Mount Isa	2800	4.25	2.77	McDonald et al. 1997
GM94-67	igneous felsic intrusive	Mount Isa	1860	-3.13	2.54	McDonald et al. 1997
GM94-30	igneous felsic intrusive	Mount Isa	1860	-2.65	2.51	McDonald et al. 1997
GM94-106	igneous felsic intrusive	Mount Isa	1860	-2.76	2.51	McDonald et al. 1997
GM94-104	igneous felsic intrusive	Mount Isa	1860	-3.8	2.59	McDonald et al. 1997
GM93-73	igneous felsic intrusive	Mount Isa	1860	-2.04	2.46	McDonald et al. 1997
GM93-30	igneous felsic intrusive	Mount Isa	1860	-2.91	2.53	McDonald et al. 1997
GM93-66	igneous felsic volcanic	Mount Isa	1860	-2.88	2.52	McDonald et al. 1997
GM95-34	igneous	Mount Isa	1890	-2.17	2.49	McDonald et al. 1997
GM94-100	igneous	Mount Isa	1890	-1.91	2.48	McDonald et al. 1997
GM94-85	igneous mafic intrusive	Mount Isa	2800	4.63	2.74	McDonald et al. 1997
GM95-36A	igneous	Mount Isa	1890	-3.72	2.61	McDonald et al. 1997
92208029	metasomatic	Mount Isa	1742	-1.63	2.33	Page & Sun 1988
72205018A	igneous felsic intrusive	Mount Isa	1730	-2.92	2.42	Page & Sun 1988
92208012	metasomatic	Mount Isa	1746	-1.85	2.35	Page & Sun 1988
72205016A	metasomatic	Mount Isa	1730	-13.1	3.19	Page & Sun 1988
72205016E	metasomatic	Mount Isa	1730	-17.65	3.53	Page & Sun 1988
92208028	metasomatic	Mount Isa	1618	0.8	2.04	Page & Sun 1988
92208026	metasedimentary	Mount Isa	1680	-2.63	2.35	Page & Sun 1988
92208004	metasedimentary	Mount Isa	1677	-2.34	2.33	Page & Sun 1988
79205320	igneous felsic intrusive	Mount Isa	1493	-3.46	2.26	Page & Sun 1988
79205322	igneous felsic intrusive	Mount Isa	1508	-2.58	2.21	Page & Sun 1988

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
86206124	igneous felsic intrusive	Mount Isa	1545	-1.32	2.14	Page & Sun 1988
72205017A	igneous felsic intrusive	Mount Isa	1730	-3.07	2.43	Page & Sun 1988
72205013G	igneous felsic intrusive	Mount Isa	1730	-3.69	2.48	Page & Sun 1988
72205032A	igneous felsic intrusive	Mount Isa	1480	-3.32	2.24	Page & Sun 1988; reanalysed GA
72205030A	igneous felsic intrusive	Mount Isa	1754	-1.67	2.34	Page & Sun 1988; reanalysed GA
72205044F	igneous felsic intrusive	Mount Isa	1670	-3.1	2.38	Wyborn et al. 1988/GA unpublihed
89-519	sedimentary	Ngalia	510	-9.69	1.91	Zhao et al. 1993
77303009	igneous felsic intrusive	Pama	425	-15.9	2.31	Black & McCulloch 1990
81303073	igneous felsic intrusive	Pama	421	-16.31	2.33	Black & McCulloch 1990
G63	igneous felsic intrusive	Pama	424	-15.89	2.3	Black & McCulloch 1990
89837508	igneous felsic intrusive	Pama	409	-11.54	1.96	Black et al. 1992
89837500	igneous felsic intrusive	Pama	407	-10.72	1.9	Black et al. 1992
70570129	igneous felsic intrusive	Pama	406	-13.8	2.13	Black et al. 1992
89837501	igneous felsic intrusive	Pama	407	-11.03	1.92	Black et al. 1992
89837507	igneous felsic intrusive	Pama	405	-10.87	1.91	Black et al. 1992
89837511	igneous felsic intrusive	Pama	405	-14.7	2.2	Black et al. 1992
90834330	igneous felsic intrusive	Pama	406	-13.74	2.13	Black et al. 1992
89837505	igneous felsic intrusive	Pama	407	-13.62	2.12	Black et al. 1992
89837510	igneous felsic intrusive	Pama	408	-14.41	2.18	Black et al. 1992
89837509	igneous felsic intrusive	Pama	408	-13.34	2.1	Black et al. 1992
89837503	igneous felsic intrusive	Pama	409	-13.03	2.08	Black et al. 1992
70570190	igneous felsic intrusive	Pama	398	-12.73	2.04	Black et al. 1992
DCC14	igneous felsic intrusive	Pama	426	-19.36	2.57	Champion 1991
DCC128	igneous felsic intrusive	Pama	426	-13.94	2.16	Champion 1991
DCC119	igneous felsic intrusive	Pama	426	-18.73	2.52	Champion 1991
IRCP019A	igneous felsic intrusive	Pama	400	-14.87	2.21	Fanning unpublished
IRWM040	igneous felsic intrusive	Pama	420	-13.81	2.15	Fanning unpublished
IRWM009	igneous felsic intrusive	Pama	420	-14.88	2.23	Fanning unpublished
IRCP019	igneous felsic intrusive	Pama	400	-15.05	2.22	Fanning unpublished
91836224	igneous felsic intrusive	Pama	407	-13.86	2.14	GA unpublished
90836117	igneous felsic intrusive	Pama	406	-11.73	1.98	GA unpublished
91836198	igneous felsic intrusive	Pama	406	-14.4	2.18	GA unpublished
90836016	igneous felsic intrusive	Pama	406	-12.37	2.02	GA unpublished
90836064	igneous felsic intrusive	Pama	406	-12.2	2.01	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
90836106	igneous felsic intrusive	Pama	406	-14.28	2.17	GA unpublished
90836022A	igneous felsic intrusive	Pama	406	-12.16	2.01	GA unpublished
93839086	igneous felsic intrusive	Pama	425	-16.08	2.32	GA unpublished
90836102	igneous felsic intrusive	Pama	406	-12.32	2.02	GA unpublished
91836280	igneous felsic intrusive	Pama	407	-12.72	2.05	GA unpublished
2008837014	igneous felsic intrusive	Pama	418	-14.6	2.2	GA unpublished
93839053	igneous felsic intrusive	Pama	410	-15.72	2.28	GA unpublished
2008838017	igneous felsic intrusive	Pama	425	-16.42	2.35	GA unpublished
93839019	igneous felsic intrusive	Pama	380	-11.82	1.96	GA unpublished
93839018	igneous felsic intrusive	Pama	380	-9.52	1.79	GA unpublished
91836389	igneous mafic intrusive	Pama	407	-12.57	2.04	GA unpublished
90836061	igneous mafic intrusive	Pama	407	-10.07	1.85	GA unpublished
91836403	igneous felsic intrusive	Pama	402	-13.26	2.09	GA unpublished
91832082	igneous felsic intrusive	Pama	407	-12.04	2	GA unpublished
92836427	igneous felsic intrusive	Pama	407	-12.17	2.01	GA unpublished
90836060	igneous felsic intrusive	Pama	408	-9.85	1.84	GA unpublished
92836429	igneous felsic intrusive	Pama	407	-12.39	2.03	GA unpublished
91836349	igneous felsic intrusive	Pama	407	-12.29	2.02	GA unpublished
91832063	igneous felsic intrusive	Pama	407	-13	2.07	GA unpublished
93839075	igneous felsic intrusive	Pama	425	-11.88	2	GA unpublished
91836344	igneous felsic intrusive	Pama	407	-14.42	2.18	GA unpublished
91836261	igneous felsic intrusive	Pama	407	-14	2.15	GA unpublished
91836309	igneous felsic intrusive	Pama	407	-13.61	2.12	GA unpublished
91832184	igneous felsic intrusive	Pama	407	-13.5	2.11	GA unpublished
90836097	igneous felsic intrusive	Pama	407	-11.62	1.97	GA unpublished
91836356	igneous felsic intrusive	Pama	407	-11.47	1.96	GA unpublished
GA697	igneous mafic intrusive	Pine Creek	2530	3.66	2.59	McCullloch 1987
RJ1	high grade metamorphic rock	Pine Creek	2530	-3.6	3.14	McCullloch 1987
GA693	igneous felsic	Pine Creek	2530	-1.63	2.99	McCullloch 1987
72124081C	igneous felsic intrusive	Pine Creek	1867	-2.45	2.5	McCullloch 1987
72124048A	igneous felsic intrusive	Pine Creek	2520	-0.81	2.92	McCullloch 1987
72124048A	igneous felsic	Pine Creek	2500	-1.07	2.92	McCullloch 1987
GA676	igneous felsic intrusive	Pine Creek	2530	-4.88	3.23	McCullloch 1987
GA662	igneous felsic	Pine Creek	2530	-10.51	3.66	McCullloch 1987
72124069D	igneous felsic	Pine Creek	1886	-3.37	2.58	McCullloch 1987
AL08JHO135A	igneous felsic intrusive	Pine Creek	1860	-3.88	2.6	NTGS unpublished
PK05CJC018	igneous mafic intrusive	Pine Creek	1860	-1.17	2.39	NTGS unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
FE05CJC033	metasedimentary	Pine Creek	1860	-3.96	2.6	NTGS unpublished
AL07LMG127	igneous ultramafic	Pine Creek	1860	0.84	2.24	NTGS unpublished
AL08JHO021	igneous felsic intrusive	Pine Creek	2520	3.14	2.62	NTGS unpublished
CP08JHO101	igneous felsic intrusive	Pine Creek	1860	-3.59	2.58	NTGS unpublished
CP07LMG036A	igneous felsic intrusive	Pine Creek	1860	-4.18	2.62	NTGS unpublished
PK04NJD027	igneous mafic	Pine Creek	1860	-1.25	2.4	NTGS unpublished
FE05CJC021	igneous mafic intrusive	Pine Creek	1860	-2.61	2.5	NTGS unpublished
FE05CJC018	igneous mafic intrusive	Pine Creek	1860	-2.63	2.5	NTGS unpublished
FE05CJC017	igneous mafic intrusive	Pine Creek	1860	-2.36	2.48	NTGS unpublished
AL08JHO165	igneous felsic	Pine Creek	2640	2.7	2.75	NTGS unpublished
CS05CJC015	igneous mafic intrusive	Pine Creek	1860	-5.05	2.69	NTGS unpublished
CS05CJC006	igneous mafic intrusive	Pine Creek	1860	-0.12	2.32	NTGS unpublished
PK05CJC005	igneous mafic intrusive	Pine Creek	1860	2.67	2.1	NTGS unpublished
AL07LMG020	igneous felsic intrusive	Pine Creek	1860	-4.09	2.61	NTGS unpublished
FE05CJC038	igneous mafic	Pine Creek	1860	-2.89	2.52	NTGS unpublished
FE05CJC038	igneous mafic	Pine Creek	1860	-2.8	2.52	NTGS unpublished
FE05CJC034	igneous mafic	Pine Creek	1860	2.13	2.15	NTGS unpublished
PC05CJC032	igneous mafic	Pine Creek	1860	-4.15	2.62	NTGS unpublished
PC05CJC029	igneous mafic	Pine Creek	1860	1.97	2.16	NTGS unpublished
PC05CJC028	igneous mafic	Pine Creek	1860	1.6	2.19	NTGS unpublished
FR04NJD013	igneous mafic intrusive	Pine Creek	1860	-2.45	2.49	NTGS unpublished
AL07JHO050A	igneous felsic	Pine Creek	2527	-0.41	2.89	NTGS unpublished
FE05CJC011	Igneous	Pine Creek	1860	-3.13	2.54	NTGS unpublished
FE05CJC041	Igneous	Pine Creek	1860	-4.51	2.65	NTGS unpublished
AL08LMG105	igneous felsic	Pine Creek	2520	-1.21	2.95	NTGS unpublished
AL08LMG099	igneous felsic	Pine Creek	2520	-1.31	2.96	NTGS unpublished
AL08JHO196A	igneous felsic	Pine Creek	1860	-3.54	2.57	NTGS unpublished
AL08JHO196B	igneous felsic	Pine Creek	1860	-3.78	2.59	NTGS unpublished
PK04JHL001	igneous felsic intrusive	Pine Creek	1853	-3.11	2.53	NTGS unpublished
AL07CJC018	igneous felsic	Pine Creek	2510	-0.94	2.92	NTGS unpublished
CP07CJC010	igneous felsic	Pine Creek	2520	-0.23	2.87	NTGS unpublished
CP08CJC001	igneous felsic	Pine Creek	2513	-1.28	2.95	NTGS unpublished
AL08JHO094	igneous felsic	Pine Creek	2671	-1.95	3.13	NTGS unpublished
PC04JHL001	igneous felsic intrusive	Pine Creek	1858	-4.52	2.65	NTGS unpublished
FE05CJC025	igneous mafic intrusive	Pine Creek	1860	-3.22	2.55	NTGS unpublished
PK04JHL001	igneous felsic intrusive	Pine Creek	1853	-3.05	2.53	NTGS unpublished
CP07JHO252	igneous felsic intrusive	Pine Creek	1868	-4.67	2.66	NTGS unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
AL08JHO135B	igneous felsic	Pine Creek	1860	-3.4	2.56	NTGS unpublished
184863	igneous felsic intrusive	Tanami	1795	-5.01	2.63	Bagas et al. 2010
178875	igneous felsic intrusive	Tanami	1795	-2.9	2.47	Bagas et al. 2010
178884	igneous felsic intrusive	Tanami	1795	-3.04	2.48	Bagas et al. 2010
87495002	metasedimentary	Tanami	1900	-11.9	3.24	GA unpublished
88495016B	igneous felsic intrusive	Tanami	1800	-6.34	2.73	GA unpublished?
88495018A	igneous felsic intrusive	Tanami	1800	-8.95	2.93	GA unpublished?
95495028	igneous felsic intrusive	Tanami	1800	-4.77	2.62	GA unpublished?
94495022B	igneous felsic intrusive	Tanami	2513	-1.45	2.96	GA unpublished?
88495008	high grade metamorphic rock	Tanami	1874	-7	2.85	GA unpublished?
94495022A	igneous felsic intrusive	Tanami	2513	-0.68	2.9	GA unpublished?
88495015	igneous felsic intrusive	Tanami	1800	-7.49	2.82	GA unpublished?
72491492	igneous felsic intrusive	Tanami	1795	-5.11	2.64	GA unpublished?
72491495	igneous felsic intrusive	Tanami	1795	-3.06	2.48	GA unpublished?
72494210	igneous felsic intrusive	Tanami	1795	-5.97	2.7	GA unpublished?
87496004	igneous felsic intrusive	Tanami	1795	-2.57	2.45	GA unpublished?
72494150A	igneous felsic intrusive	Tanami	1795	-3.81	2.54	GA unpublished?
87495004A	igneous felsic intrusive	Tanami	1795	-4	2.55	GA unpublished?
88495021	high grade metamorphic rock	Tanami	2504	-6.26	3.32	GA unpublished?
72495029C	igneous felsic volcanic	Tanami	1824	-1.36	2.38	McCullloch 1987
72495023C	igneous felsic intrusive	Tanami	1815	-1.69	2.4	McCullloch 1987
72495024C	igneous felsic intrusive	Tanami	1815	-1.99	2.42	McCullloch 1987
TAN00AD090R1	igneous felsic intrusive	Tanami	1800	-4.23	2.57	NTGS unpublished
AC165R1	igneous felsic intrusive	Tanami	1800	-4.18	2.57	NTGS unpublished
NA01MG222	igneous felsic intrusive	Tanami	1800	-6.2	2.72	NTGS unpublished
99496219	igneous felsic intrusive	Tanami	1815	-4.27	2.59	Smith 2001
99496221	igneous felsic intrusive	Tanami	1801	-1.94	2.4	Smith 2001
99496213	igneous felsic intrusive	Tanami	1821	-3.4	2.53	Smith 2001
99496220	igneous felsic intrusive	Tanami	1805	-4.26	2.58	Smith 2001
99496223	igneous felsic intrusive	Tanami	1844	-3.4	2.55	Smith 2001
99496224	igneous felsic intrusive	Tanami	1812	-6.44	2.75	Smith 2001
99496212	igneous mafic volcanic	Tanami	1850	-0.18	2.31	Smith 2001
81303072	igneous felsic intrusive	Thomson	431	-5.49	1.53	Black & McCulloch 1990
93839097	igneous felsic intrusive	Thomson	425	-5.56	1.53	GA unpublished
2008080013	sedimentary	Victoria	1600	-15.53	3.26	GA unpublished
98776703	igneous volcanic	Victoria	1640	0.91	2.05	GA unpublished
98776702	igneous volcanic	Victoria	1640	-4.53	2.46	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
73063284B	igneous mafic	Warramunga	1829	-4.8	2.64	Black & McCulloch 1984
73063284B	igneous mafic	Warramunga	1829	-3.97	2.58	Black & McCulloch 1984
73063284C	igneous mafic	Warramunga	1829	-5.31	2.68	Black & McCulloch 1984
73063284C	igneous mafic	Warramunga	1829	-5.66	2.71	Black & McCulloch 1984
73063284A	igneous mafic	Warramunga	1829	-5.8	2.72	Black & McCulloch 1984
78063318	igneous felsic intrusive	Warramunga	1848	-3.58	2.57	McCullloch 1987
75063317	igneous felsic volcanic	Warramunga	1845	-3.34	2.55	McCullloch 1987
2000081139	igneous mafic intrusive	Warumpi	1639	1.49	2.01	Hoatson et al. 2005
2000081135	igneous mafic intrusive	Warumpi	1637	-0.03	2.12	Hoatson et al. 2005
2000081139	igneous mafic intrusive	Warumpi	1639	1.63	2	Hoatson et al. 2005
2000081139	igneous mafic intrusive	Warumpi	1639	1.28	2.03	Hoatson et al. 2005
MR01IRS085	igneous felsic intrusive	Warumpi	1635	-0.2	2.13	NTGS unpublished
MR01IRS044	igneous felsic intrusive	Warumpi	1690	-2	2.31	NTGS unpublished
MR01IRS039A	igneous mafic intrusive	Warumpi	1620	-1.26	2.2	NTGS unpublished
MR01IRS050	igneous mafic intrusive	Warumpi	1640	0.87	2.06	NTGS unpublished
MR01IRS078	igneous felsic intrusive	Warumpi	1635	-2.09	2.28	NTGS unpublished
MR01IRS062	igneous felsic intrusive	Warumpi	1640	-1.84	2.26	NTGS unpublished
ML00IRS307	igneous felsic intrusive	Warumpi	1637	-1.92	2.26	Scrimgeour et al. 2005
ML00IRS220	high grade metamorphic rock	Warumpi	1661	-1.63	2.26	Scrimgeour et al. 2005
ML00IRS261	igneous felsic intrusive	Warumpi	1631	-3.6	2.39	Scrimgeour et al. 2005
ML00IRS202	igneous felsic intrusive	Warumpi	1683	-0.59	2.2	Scrimgeour et al. 2005
ML00CJE261	igneous felsic intrusive	Warumpi	1631	-2.08	2.27	Scrimgeour et al. 2005
ML00IRS282	igneous felsic intrusive	Warumpi	1642	-3.38	2.38	Scrimgeour et al. 2005
ML01IRS231A	igneous felsic volcanic	Warumpi	1680	-1.11	2.24	Scrimgeour et al. 2005
ML01IRS479	igneous mafic	Warumpi	1680	-0.71	2.21	Scrimgeour et al. 2005
ML00IRS174	metasedimentary	Warumpi	1660	-4.47	2.48	Scrimgeour et al. 2005
ML01IRS518	igneous felsic intrusive	Warumpi	1635	-2.22	2.29	Scrimgeour et al. 2005
ML00DFC129	igneous felsic intrusive	Warumpi	1639	-3.04	2.35	Scrimgeour et al. 2005

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
84091669	high grade metamorphic rock	Warumpi	1660	-2.13	2.3	Sun et al. 1995
84091668	igneous felsic intrusive	Warumpi	1136	-8.22	2.32	Sun et al. 1995
84091632	igneous felsic intrusive	Warumpi	1136	-10.15	2.47	Sun et al. 1995
90938064A	igneous	Warumpi	1680	-4.13	2.47	Sun et al. 1995
90938043	igneous	Warumpi	1605	-1.14	2.18	Sun et al. 1995
90934782A	high grade metamorphic rock	Warumpi	1678	-1.54	2.27	Sun et al. 1995
90936059	igneous	Warumpi	1650	-0.47	2.17	Sun et al. 1995
96496028A	igneous felsic intrusive	Warumpi	1643	-2	2.28	Wyborn et al. 1998
96496024	igneous felsic volcanic	Warumpi	1643	-1.5	2.24	Wyborn et al. 1998
96496035	igneous felsic intrusive	Warumpi	1643	-2.11	2.28	Wyborn et al. 1998
91-521	igneous mafic	Warumpi	1770	0.19	2.22	Zhao 1994
89095535	igneous felsic	Warumpi	1603	1	2.02	Zhao and McCulloch 1995
90936301	high grade metamorphic rock	Warumpi	1615	1.37	2	Zhao and McCulloch 1995
89915581	igneous felsic	Warumpi	1615	1.48	1.99	Zhao and McCulloch 1995
84094037	igneous felsic	Warumpi	1648	-2.42	2.31	Zhao and McCulloch 1995
89095539	igneous felsic	Warumpi	1648	-1.57	2.25	Zhao and McCulloch 1995
89095541	igneous felsic	Warumpi	1603	1.22	2	Zhao and McCulloch 1995
89095542	igneous felsic	Warumpi	1603	2.58	1.9	Zhao and McCulloch 1995
89095537	igneous felsic	Warumpi	1648	-1.89	2.27	Zhao and McCulloch 1995

Appendix Table B.3 Neodymium isotopic data for rocks of the South Australia Element. Data sources specified in the Reference column. Refer to for Appendix Table A.2 full Province names.

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
R68495	igneous felsic intrusive	Curnamona	1703	0.05	2.17	Ashley et al. 1996
R68592	igneous felsic volcanic	Curnamona	1699	1.15	2.08	Ashley et al. 1996
ME01ND7	igneous felsic intrusive	Curnamona	496	-14.05	2.23	Elburg et al. 2003
ME00ND4	igneous felsic intrusive	Curnamona	496	-15.18	2.31	Elburg et al. 2003
ME00PIN8	igneous felsic intrusive	Curnamona	496	-12.59	2.12	Elburg et al. 2003
ME00ND3	igneous felsic intrusive	Curnamona	496	-11.97	2.07	Elburg et al. 2003
ME00SB3	igneous felsic intrusive	Curnamona	496	-12.48	2.11	Elburg et al. 2003
ME00SB2	igneous felsic intrusive	Curnamona	496	-15.5	2.34	Elburg et al. 2003
ARK12A	igneous felsic intrusive	Curnamona	496	-14.85	2.29	Elburg et al. 2003
ME00ND5	igneous felsic intrusive	Curnamona	496	-15.02	2.3	Elburg et al. 2003
ME00DI4	metasomatic	Curnamona	442	-13.5	2.14	Elburg et al. 2003
ME00PIN9	igneous felsic intrusive	Curnamona	496	-12.36	2.1	Elburg et al. 2003
ME01DI6	metasomatic	Curnamona	442	-13.75	2.16	Elburg et al. 2003
ME00DI5	metasomatic	Curnamona	442	-13.42	2.13	Elburg et al. 2003
ME00PIN1	igneous felsic intrusive	Curnamona	496	-12.43	2.1	Elburg et al. 2003
ME00PIN6	igneous felsic intrusive	Curnamona	496	-12.59	2.12	Elburg et al. 2003
ME00PIN7	igneous felsic intrusive	Curnamona	496	-13.81	2.21	Elburg et al. 2003
AW223	igneous felsic intrusive	Curnamona	1575	1.76	1.94	Elburg et al. 2012
ARK418	igneous felsic intrusive	Curnamona	1560	-1.74	2.19	Elburg et al. 2012
ARK674	igneous felsic intrusive	Curnamona	455	-4.27	1.45	Elburg et al. 2012
ARK580	igneous felsic intrusive	Curnamona	455	-4.59	1.48	Elburg et al. 2012
ARK570	igneous felsic intrusive	Curnamona	1560	-1.67	2.18	Elburg et al. 2012
96180042	igneous mafic intrusive	Curnamona	827	6.09	0.99	GA unpublished
96180050	igneous mafic intrusive	Curnamona	827	6.35	0.97	GA unpublished
96180032	igneous felsic intrusive	Curnamona	1703	-1.25	2.27	GA unpublished
96180026	igneous	Curnamona	1685	-1.86	2.3	GA unpublished
96180256	ultraigneous mafic intrusive	Curnamona	827	-3.68	1.72	GA unpublished
ALMA S3	high grade metamorphic rock	Curnamona	1704	-4.33	2.5	McCulloch 1987
S5	metasedimentary	Curnamona	1700	-4.23	2.49	McCulloch 1987
82-428	high grade metamorphic rock	Curnamona	1685	-2.19	2.33	McCulloch 1987
BHLO	high grade metamorphic rock	Curnamona	1685	-3.58	2.43	McCulloch 1987
1086-HSE	igneous felsic intrusive	Curnamona	440	-2.61	1.32	Neumann 2001-cited in Elburg et al. 2003
99MP-1	igneous felsic intrusive	Curnamona	440	-8.85	1.79	Neumann 2001-cited in Elburg et al. 2003
Be3	igneous felsic intrusive	Curnamona	440	-12.52	2.06	Neumann 2001-cited in Elburg et al. 2003

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
Be2	igneous felsic intrusive	Curnamona	440	-14.35	2.2	Neumann 2001-cited in Elburg et al. 2003
Be4	igneous felsic intrusive	Curnamona	440	-13.92	2.17	Neumann 2001-cited in Elburg et al. 2003
1086-PCf	igneous felsic intrusive	Curnamona	440	-6.99	1.65	Neumann 2001-cited in Elburg et al. 2003
Be1	igneous felsic intrusive	Curnamona	440	-12.8	2.09	Neumann 2001-cited in Elburg et al. 2003
95BH04	high grade metamorphic rock	Curnamona	1704	-4.26	2.5	Raveggi et al. 2008
95BH10	high grade metamorphic rock	Curnamona	1597	-4.77	2.45	Raveggi et al. 2008
MAS22	high grade metamorphic rock	Curnamona	1704	-5.04	2.56	Raveggi et al. 2008
MAS21	high grade metamorphic rock	Curnamona	1685	-3.05	2.39	Raveggi et al. 2008
MAS66	high grade metamorphic rock	Curnamona	1685	-3.23	2.4	Raveggi et al. 2008
94BH45	high grade metamorphic rock	Curnamona	1685	-2.15	2.32	Raveggi et al. 2008
MAS46	metasedimentary	Curnamona	1700	-5.46	2.58	Raveggi et al. 2008
95BH16	high grade metamorphic rock	Curnamona	1703	-1.48	2.29	Raveggi et al. 2008
94BH29	high grade metamorphic rock	Curnamona	1600	-4.6	2.44	Raveggi et al. 2008
MAS71	metasedimentary	Curnamona	1700	-4.17	2.49	Raveggi et al. 2008
94BH37	igneous felsic intrusive	Curnamona	1600	-4.31	2.41	Raveggi et al. 2008
94BH39	igneous felsic intrusive	Curnamona	1596	-4.61	2.43	Raveggi et al. 2008
MAS16	metasedimentary	Curnamona	1700	-5.42	2.58	Raveggi et al. 2008
94BH46	high grade metamorphic rock	Curnamona	1685	-1.96	2.31	Raveggi et al. 2008
RS687236	igneous felsic volcanic	Curnamona	1585	-3.24	2.32	Wade et al. 2012
RS687237	igneous felsic volcanic	Curnamona	1585	-3.94	2.37	Wade et al. 2012
R1709061	igneous felsic volcanic	Curnamona	1587	-2.2	2.24	Wade et al. 2012
RS668268	igneous mafic volcanic	Curnamona	1585	-1.46	2.19	Wade et al. 2012
RS687244	igneous felsic volcanic	Curnamona	1585	-3.75	2.36	Wade et al. 2012
R1709062	igneous felsic volcanic	Curnamona	1585	-4.06	2.38	Wade et al. 2012
RS687238	igneous felsic volcanic	Curnamona	1585	-3.64	2.35	Wade et al. 2012
RS687235	igneous felsic volcanic	Curnamona	1585	-4.24	2.4	Wade et al. 2012
RS687227	igneous felsic volcanic	Curnamona	1585	-3.55	2.34	Wade et al. 2012
RS687225	igneous felsic volcanic	Curnamona	1585	-3.9	2.37	Wade et al. 2012
RS668269	igneous mafic volcanic	Curnamona	1585	0.24	2.06	Wade et al. 2012
2002363021A	metasomatic	Gawler	1718	-3.9	2.48	Budd & Skirrow 2007
2002363021C	metasomatic	Gawler	1718	-2.43	2.37	Budd & Skirrow 2007
2000363004	igneous felsic intrusive	Gawler	1722.3	-4.32	2.52	Budd & Skirrow 2007
2000363017A	metasomatic	Gawler	1718	-5.39	2.59	Budd & Skirrow 2007
2002363002I	metasedimentary	Gawler	1660	-6.11	2.6	Budd & Skirrow 2007
2002363001G	metasedimentary	Gawler	1660	-3.44	2.4	Budd & Skirrow 2007

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
2002363001G	metasedimentary	Gawler	1660	-3.58	2.41	Budd & Skirrow 2007
2002363002A	metasedimentary	Gawler	1660	-2.42	2.32	Budd & Skirrow 2007
2000363008B	igneous felsic intrusive	Gawler	1715.1	-5.64	2.61	Budd & Skirrow 2007
2000363007D	igneous mafic intrusive	Gawler	1580	0.11	2.06	Budd & Skirrow 2007
2000363005D	igneous felsic intrusive	Gawler	1718.6	-4.31	2.51	Budd & Skirrow 2007
2000363004	igneous felsic intrusive	Gawler	1722.3	-4.68	2.54	Budd & Skirrow 2007
2000363007A	igneous felsic intrusive	Gawler	1718	-4.52	2.53	Budd & Skirrow 2007
2000363009A	igneous mafic intrusive	Gawler	1580	0.17	2.06	Budd & Skirrow 2007
6037RS34	igneous felsic volcanic	Gawler	2558	0.16	2.88	Cowley & Fanning 1992
6037RS32	igneous felsic volcanic	Gawler	2558	0.25	2.87	Cowley & Fanning 1992
6037RS33	igneous felsic volcanic	Gawler	2558	0.46	2.85	Cowley & Fanning 1992
6037RS27	igneous felsic volcanic	Gawler	2558	0.8	2.83	Cowley & Fanning 1992
6037RS26	igneous intermediate volcanic	Gawler	2558	2.6	2.69	Cowley & Fanning 1992
6037RS25	igneous intermediate volcanic	Gawler	2558	2.28	2.72	Cowley & Fanning 1992
6037RS30	igneous intermediate volcanic	Gawler	2558	-0.28	2.91	Cowley & Fanning 1992
6037RS31	igneous felsic volcanic	Gawler	2558	-0.06	2.89	Cowley & Fanning 1992
6037RS29	igneous intermediate volcanic	Gawler	2558	-1.11	2.97	Cowley & Fanning 1992
SS-87	igneous felsic intrusive	Gawler	1588	-5.05	2.46	Creaser 1989; cited in Johnson & McCulloch 1995
9373	igneous felsic intrusive	Gawler	1598	-3.59	2.36	Creaser 1995
B143	igneous felsic intrusive	Gawler	1843	-2.67	2.49	Creaser 1995
9432	igneous felsic volcanic	Gawler	1592	-3.53	2.35	Creaser 1995
9298	igneous felsic volcanic	Gawler	1585	-5.8	2.51	Creaser 1995
9347	igneous felsic intrusive	Gawler	1590	-8.8	2.74	Creaser 1995
9383	igneous felsic intrusive	Gawler	1593	-4.84	2.45	Creaser 1995
9307	igneous felsic intrusive	Gawler	1850	-2.37	2.48	Creaser 1995
9392	igneous felsic intrusive	Gawler	1582	-4.59	2.42	Creaser 1995
9445	igneous felsic intrusive	Gawler	1585	-14.3	3.15	Creaser 1995
9442	igneous felsic intrusive	Gawler	1598	-4.12	2.4	Creaser 1995
9311	igneous felsic intrusive	Gawler	1585	-5.07	2.46	Creaser 1995
9338	igneous felsic intrusive	Gawler	1588	-5.05	2.46	Creaser 1995
2008371087	igneous felsic intrusive	Gawler	3152	0.51	3.35	Fraser et al. 2010
2008371081	igneous felsic intrusive	Gawler	2529	-7.49	3.43	Fraser et al. 2010
2008371085	igneous felsic intrusive	Gawler	3151	-0.92	3.45	Fraser et al. 2010
2008371082	igneous felsic intrusive	Gawler	1738	-7.93	2.8	Fraser et al. 2010
2008371086	igneous felsic intrusive	Gawler	3155	0.21	3.37	Fraser et al. 2010
2008371080	igneous felsic intrusive	Gawler	3158	1.14	3.3	Fraser et al. 2010

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
2008371067	igneous felsic intrusive	Gawler	3149	0.17	3.37	Fraser et al. 2010
2008371044	igneous felsic volcanic	Gawler	1754	-2.12	2.38	GA unpublished
2009371030	igneous felsic intrusive	Gawler	2446	3.09	2.56	GA unpublished
2009371041	igneous felsic intrusive	Gawler	2511	0.07	2.84	GA unpublished
2008371041	igneous felsic intrusive	Gawler	2823	-1.52	3.22	GA unpublished
2008371033	igneous felsic intrusive	Gawler	1720	-9.78	2.93	GA unpublished
2009371029	igneous felsic intrusive	Gawler	2418	-4.29	3.1	GA unpublished
2009371026	igneous felsic intrusive	Gawler	2004	-4.28	2.75	GA unpublished
2008371050	igneous felsic intrusive	Gawler	1790	-4.67	2.6	GA unpublished
2008371050	igneous felsic intrusive	Gawler	1790	-4.69	2.6	GA unpublished
2008371071	igneous felsic intrusive	Gawler	1792	-4.49	2.59	GA unpublished
2009371025	igneous felsic intrusive	Gawler	1722	-8.44	2.83	GA unpublished
2008371045	igneous felsic volcanic	Gawler	1754	-3.53	2.48	GA unpublished
2008371049	igneous felsic volcanic	Gawler	1792	-4.73	2.61	GA unpublished
2008371083	metasedimentary	Gawler	2019	-4.95	2.81	GA unpublished
2009371021	igneous felsic intrusive	Gawler	1724	-7.27	2.74	GA unpublished
2009371020	metasedimentary	Gawler	2507	-0.46	2.88	GA unpublished
2009371028	metasedimentary	Gawler	2003	-7.24	2.97	GA unpublished
2009371017	igneous felsic intrusive	Gawler	1714	-1.48	2.3	GA unpublished
2009371016	igneous felsic intrusive	Gawler	1717	-0.75	2.24	GA unpublished
2008371042	igneous felsic intrusive	Gawler	2521	-1.37	2.96	GA unpublished
2009371014	high grade metamorphic rock	Gawler	2597	1.32	2.82	GA unpublished
2009371023	igneous felsic intrusive	Gawler	1724	-8.31	2.82	GA unpublished
R1643444	high grade metamorphic rock	Gawler	1764	-1.07	2.31	Howard et al. 2011
R1643397	high grade metamorphic rock	Gawler	1760	-3.07	2.45	Howard et al. 2011
R1643427	high grade metamorphic rock	Gawler	1760	4.04	1.92	Howard et al. 2011
R1643452	high grade metamorphic rock	Gawler	1752	-3.4	2.47	Howard et al. 2011
R1643450	high grade metamorphic rock	Gawler	1774	-2.67	2.44	Howard et al. 2011
R1643428	high grade metamorphic rock	Gawler	1760	4.34	1.9	Howard et al. 2011
RX4547	igneous mafic intrusive	Gawler	1588	0.1	2.07	Johnson & McCulloch 1995
RX4571	sedimentary	Gawler	1575	2.53	1.88	Johnson & McCulloch 1995
RX4570	sedimentary	Gawler	1575	-3.25	2.31	Johnson & McCulloch 1995
RX4508	metasomatic	Gawler	1590	-2.62	2.28	Johnson & McCulloch 1995
RX4533	igneous felsic intrusive	Gawler	1588	-3.4	2.34	Johnson & McCulloch 1995

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
RX4542	metasomatic	Gawler	1590	-2.25	2.25	Johnson & McCulloch 1995
RX3213	igneous felsic intrusive	Gawler	1588	-4.21	2.4	Johnson & McCulloch 1995
RX4463	metasomatic	Gawler	1590	-2.79	2.29	Johnson & McCulloch 1995
RX4546	igneous mafic intrusive	Gawler	1588	0.47	2.04	Johnson & McCulloch 1995
RX4566	igneous mafic intrusive	Gawler	1588	0.12	2.07	Johnson & McCulloch 1995
RX4539	igneous mafic intrusive	Gawler	1588	-37.64	4.92	Johnson & McCulloch 1995
RX4513	metasomatic	Gawler	1590	-0.28	2.1	Johnson & McCulloch 1995
RX4462	metasomatic	Gawler	1590	-2.93	2.3	Johnson & McCulloch 1995
RX4510	metasomatic	Gawler	1590	-2.39	2.26	Johnson & McCulloch 1995
RX3698	igneous felsic intrusive	Gawler	1588	-3.99	2.38	Johnson & McCulloch 1995
RX4503	metasomatic	Gawler	1590	-2.58	2.28	Johnson & McCulloch 1995
RX3184	metasomatic	Gawler	1590	-2.34	2.26	Johnson & McCulloch 1995
RX3184	metasomatic	Gawler	1590	-3.99	2.38	Johnson & McCulloch 1995
RX4537	metasomatic	Gawler	1590	-2.07	2.24	Johnson & McCulloch 1995
RX4536	metasomatic	Gawler	1590	-4.91	2.45	Johnson & McCulloch 1995
RX4514	metasomatic	Gawler	1590	-2.68	2.28	Johnson & McCulloch 1995
RX4559	metasomatic	Gawler	1590	-2.22	2.25	Johnson & McCulloch 1995
RX4543	ultraigneous mafic intrusive	Gawler	1588	3.96	1.78	Johnson & McCulloch 1995
RX4512	metasomatic	Gawler	1590	-2.38	2.26	Johnson & McCulloch 1995
RX4509	metasomatic	Gawler	1590	-3.79	2.37	Johnson & McCulloch 1995
RX4502	metasomatic	Gawler	1590	-2.61	2.28	Johnson & McCulloch 1995
RX4529	metasomatic	Gawler	1590	-3.15	2.32	Johnson & McCulloch 1995
RX4531	metasomatic	Gawler	1590	-1.98	2.23	Johnson & McCulloch 1995

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
RX4548	ultraigneous mafic intrusive	Gawler	1588	3.73	1.8	Johnson & McCulloch 1995
RX3214	igneous felsic intrusive	Gawler	1588	-3.5	2.34	Johnson & McCulloch 1995
RX4511	metasomatic	Gawler	1590	-2.74	2.29	Johnson & McCulloch 1995
363436	igneous felsic intrusive	Gawler	1680	-2.35	2.33	Payne et al. 2010
370932	igneous felsic intrusive	Gawler	1680	-1.26	2.25	Payne et al. 2010
WGC81	igneous felsic intrusive	Gawler	1680	-5.79	2.59	Payne et al. 2010
444833	igneous felsic intrusive	Gawler	1680	-5.11	2.54	Payne et al. 2010
444832	igneous felsic intrusive	Gawler	1680	-5.81	2.59	Payne et al. 2010
444835	igneous felsic intrusive	Gawler	1680	-1.67	2.28	Payne et al. 2010
370936	igneous felsic intrusive	Gawler	1680	-0.59	2.2	Payne et al. 2010
378933	igneous felsic intrusive	Gawler	1680	-0.12	2.17	Payne et al. 2010
350428	igneous felsic intrusive	Gawler	1680	-0.9	2.22	Payne et al. 2010
368573	igneous felsic intrusive	Gawler	1680	-1.83	2.29	Payne et al. 2010
444834	igneous felsic intrusive	Gawler	1680	-5.16	2.54	Payne et al. 2010
350435	igneous felsic intrusive	Gawler	1680	-1.56	2.27	Payne et al. 2010
378924	igneous felsic intrusive	Gawler	1680	0.18	2.14	Payne et al. 2010
368571	igneous felsic intrusive	Gawler	1680	-0.6	2.2	Payne et al. 2010
879-47	igneous felsic intrusive	Gawler	1680	-4.85	2.52	Payne et al. 2010
370938	igneous felsic intrusive	Gawler	1680	1.26	2.06	Payne et al. 2010
444825	igneous felsic intrusive	Gawler	1680	-5.1	2.54	Payne et al. 2010
879-29B	igneous felsic intrusive	Gawler	1680	-9.94	2.9	Payne et al. 2010
879-66F	igneous felsic intrusive	Gawler	1680	-8.98	2.83	Payne et al. 2010
879-4A	igneous mafic intrusive	Gawler	1680	-3.66	2.43	Payne et al. 2010
350424	igneous felsic intrusive	Gawler	1680	3.09	1.92	Payne et al. 2010
444824	igneous felsic intrusive	Gawler	1680	-1.59	2.28	Payne et al. 2010
1667144	igneous mafic volcanic	Gawler	2553	-0.94	2.96	Reid et al. 2009
1667143	igneous mafic volcanic	Gawler	2553	-1.78	3.02	Reid et al. 2009
not given	high grade metamorphic rock	Gawler	2520	-2.56	3.05	Rich 2000
not given	high grade metamorphic rock	Gawler	2520	-1.34	2.96	Rich 2000
not given	igneous felsic intrusive	Gawler	2517	-2.22	3.02	Schaefer 1998
not given	igneous felsic intrusive	Gawler	2558	0.92	2.82	Schaefer 1998
not given	metasedimentary	Gawler	2520	-3.21	3.1	Schaefer 1998
not given	high grade metamorphic rock	Gawler	2520	-3.29	3.11	Schaefer 1998
2001368025Z	metasedimentary	Gawler	1750	-5	2.59	Skirrow et al. 2007
TI002 753.63	igneous mafic intrusive	Gawler	1585	-2.34	2.25	Skirrow et al. 2007

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
2000366005	igneous mafic intrusive	Gawler	1585	-2.05	2.23	Skirrow et al. 2007
2001368001O	igneous mafic intrusive	Gawler	1764	-0.36	2.25	Skirrow et al. 2007
2001368001T	igneous mafic intrusive	Gawler	1764	0.46	2.19	Skirrow et al. 2007
9403	igneous mafic intrusive	Gawler	1585	-3.61	2.35	Skirrow et al. 2007
2001368007S	metasedimentary	Gawler	1750	-3.47	2.48	Skirrow et al. 2007
2001368023B	metasedimentary	Gawler	1750	-2.74	2.42	Skirrow et al. 2007
2001368007U	metasedimentary	Gawler	1750	-2.86	2.43	Skirrow et al. 2007
2001368007X	metasedimentary	Gawler	1750	-3.83	2.5	Skirrow et al. 2007
2001368007X	metasedimentary	Gawler	1750	-3.9	2.51	Skirrow et al. 2007
2001368007E	metasedimentary	Gawler	1750	-2.44	2.4	Skirrow et al. 2007
2001368007G	metasedimentary	Gawler	1750	-10.43	3	Skirrow et al. 2007
2001368023A	igneous intermediate volcanic	Gawler	1585	-4.02	2.38	Skirrow et al. 2007
2001368002G	metasedimentary	Gawler	1750	-2.45	2.4	Skirrow et al. 2007
2001368001Q	igneous mafic intrusive	Gawler	1764	0.48	2.19	Skirrow et al. 2007
2001368005	metasomatic	Gawler	1750	-2.49	2.4	Skirrow et al. 2007
TI002 744	metasomatic	Gawler	1750	-3.25	2.46	Skirrow et al. 2007
GD23A	igneous felsic intrusive	Gawler	1850	1.34	2.2	Skirrow et al. 2007
GD23B	igneous felsic intrusive	Gawler	1850	-1.35	2.4	Skirrow et al. 2007
GD23C	igneous felsic intrusive	Gawler	1850	1.25	2.2	Skirrow et al. 2007
GD52	igneous felsic intrusive	Gawler	1850	0.27	2.28	Skirrow et al. 2007
GD53	igneous felsic intrusive	Gawler	1850	0.07	2.29	Skirrow et al. 2007
GD46	igneous felsic intrusive	Gawler	1850	-2.82	2.51	Skirrow et al. 2007
GD45	igneous felsic intrusive	Gawler	1850	-2.31	2.47	Skirrow et al. 2007
GD44a	igneous felsic intrusive	Gawler	1850	0.79	2.24	Skirrow et al. 2007
2001368017D	metasomatic	Gawler	1585	-3.99	2.38	Skirrow et al. 2007
2001368002E	metasedimentary	Gawler	1750	-1.77	2.35	Skirrow et al. 2007
2001368017E	igneous felsic intrusive	Gawler	1585	-5.47	2.49	Skirrow et al. 2007
2001368001P	igneous mafic intrusive	Gawler	1764	-0.33	2.25	Skirrow et al. 2007
9349	igneous intermediate intrusive	Gawler	1585	-3.94	2.37	Skirrow et al. 2007
2001368017O	metasomatic	Gawler	1585	-3.97	2.38	Skirrow et al. 2007
2002368028B	igneous mafic intrusive	Gawler	1585	-5.73	2.51	Skirrow et al. 2007
2001368015F	igneous felsic intrusive	Gawler	1585	-5.78	2.51	Skirrow et al. 2007
9395	igneous felsic extrusive	Gawler	1585	-2.45	2.26	Skirrow et al. 2007
TI002 656.19	igneous felsic intrusive	Gawler	1585	-6.11	2.54	Skirrow et al. 2007
2001367000D	igneous felsic intrusive	Gawler	1850	-2.83	2.51	Skirrow et al. 2007
2000366039	igneous intermediate intrusive	Gawler	1585	-4.85	2.44	Skirrow et al. 2007
9410	igneous felsic intrusive	Gawler	1585	-8.75	2.74	Skirrow et al. 2007

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
9339	igneous felsic intrusive	Gawler	1585	-3.3	2.33	Skirrow et al. 2007
9356	igneous felsic intrusive	Gawler	1585	-4.14	2.39	Skirrow et al. 2007
2001367000F	igneous felsic intrusive	Gawler	1850	-2.11	2.46	Skirrow et al. 2007
2002368028A	igneous mafic intrusive	Gawler	1585	-4.91	2.45	Skirrow et al. 2007
2000366047	igneous intermediate intrusive	Gawler	1585	-1.39	2.18	Skirrow et al. 2007
613119	igneous intermediate volcanic	Gawler	2558	3.56	2.62	Swain et al. 2005
5056786	high grade metamorphic rock	Gawler	2520	-3.54	3.12	Swain et al. 2005
5056787	high grade metamorphic rock	Gawler	2520	-0.3	2.88	Swain et al. 2005
5056788	high grade metamorphic rock	Gawler	2520	-3.71	3.14	Swain et al. 2005
613120	igneous felsic volcanic	Gawler	2558	-1.57	3.01	Swain et al. 2005
5056777	high grade metamorphic rock	Gawler	2520	-1.81	2.99	Swain et al. 2005
621277	igneous felsic intrusive	Gawler	2517	0.28	2.83	Swain et al. 2005
613125	igneous mafic volcanic	Gawler	2558	1.01	2.81	Swain et al. 2005
621276	igneous felsic intrusive	Gawler	2517	0.96	2.78	Swain et al. 2005
506614	metasedimentary	Gawler	2530	0.82	2.8	Swain et al. 2005
445519	high grade metamorphic rock	Gawler	2520	-0.81	2.92	Swain et al. 2005
506598	metasedimentary	Gawler	2530	-2.84	3.08	Swain et al. 2005
506606	metasedimentary	Gawler	2530	-1.34	2.97	Swain et al. 2005
505724	igneous felsic intrusive	Gawler	2500	0.42	2.81	Swain et al. 2005
505725	igneous felsic intrusive	Gawler	2500	0.25	2.82	Swain et al. 2005
495628	metasedimentary	Gawler	2510	-0.64	2.9	Swain et al. 2005
494305	metasedimentary	Gawler	2530	0.33	2.84	Swain et al. 2005
506613	metasedimentary	Gawler	2530	1.11	2.78	Swain et al. 2005
495643	metasedimentary	Gawler	2510	-0.85	2.91	Swain et al. 2005
621279	igneous felsic intrusive	Gawler	2517	0.29	2.83	Swain et al. 2005
5056776	high grade metamorphic rock	Gawler	2520	-1.66	2.98	Swain et al. 2005
494306	metasedimentary	Gawler	2530	-1.34	2.97	Swain et al. 2005
5056789	high grade metamorphic rock	Gawler	2520	-0.2	2.87	Swain et al. 2005
CMPJ7	igneous felsic intrusive	Gawler	1620	0.17	2.09	Swain et al. 2008
1096-01	igneous felsic intrusive	Gawler	1620	-0.16	2.12	Swain et al. 2008
1096-22	igneous felsic intrusive	Gawler	1620	0.02	2.1	Swain et al. 2008
CGRP7	igneous felsic intrusive	Gawler	1620	2.48	1.92	Swain et al. 2008
GDCB7	igneous felsic intrusive	Gawler	1620	0.03	2.1	Swain et al. 2008
CGCB1	igneous felsic intrusive	Gawler	1620	4.18	1.79	Swain et al. 2008
1096-17	igneous felsic intrusive	Gawler	1620	0.69	2.05	Swain et al. 2008
1096-14	igneous felsic intrusive	Gawler	1620	-0.34	2.13	Swain et al. 2008
2008371049	igneous felsic volcanic	Gawler	1792	-3.74	2.53	Szpunar & Fraser 2010

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
2008371045	igneous felsic volcanic	Gawler	1754	-2.63	2.42	Szpunar & Fraser 2010
2008371054	igneous felsic volcanic	Gawler	1752	-20.14	3.73	Szpunar & Fraser 2010
2008371073	metasedimentary	Gawler	1790	-4.31	2.57	Szpunar & Fraser 2010
2008371046	sedimentary	Gawler	1750	-4.43	2.55	Szpunar & Fraser 2010
2008371055	sedimentary	Gawler	1750	-3.35	2.47	Szpunar & Fraser 2010
MV4	igneous felsic volcanic	Gawler	1792	-4.14	2.56	Szpunar & Fraser 2010
MV7	igneous felsic volcanic	Gawler	1792	-3.44	2.51	Szpunar & Fraser 2010
R786128	igneous felsic volcanic	Gawler	1792	-4.64	2.6	Szpunar & Fraser 2010
MGV1	igneous felsic volcanic	Gawler	1750	-1.59	2.33	Szpunar & Fraser 2010
BS3	metasedimentary	Gawler	1790	-2.85	2.46	Szpunar & Fraser 2010
BS5	metasedimentary	Gawler	1790	-1.4	2.35	Szpunar & Fraser 2010
HH1	sedimentary	Gawler	1750	-3	2.44	Szpunar & Fraser 2010
WM1	sedimentary	Gawler	1750	-2.26	2.38	Szpunar & Fraser 2010
MF4	sedimentary	Gawler	1750	-2.15	2.38	Szpunar & Fraser 2010
MF2	sedimentary	Gawler	1750	-0.6	2.26	Szpunar & Fraser 2010
88-Y10	igneous felsic volcanic	Gawler	1592	-3.53	2.35	Turner et al. 1993a
466-C142	high grade metamorphic rock	Gawler	2520	-6.39	3.34	Turner et al. 1993a
466-F30	high grade metamorphic rock	Gawler	2520	0.26	2.84	Turner et al. 1993a
466-JC3	igneous felsic	Gawler	2520	0.2	2.84	Turner et al. 1993a
466-256	metasedimentary	Gawler	2520	-2.27	3.03	Turner et al. 1993a
884-MG4	igneous felsic intrusive	Gawler	1754	-2.92	2.44	Turner et al. 1993a
515-B143	igneous felsic intrusive	Gawler	1850	-2.86	2.51	Turner et al. 1993a
515-B201	igneous mafic intrusive	Gawler	1896	-2.77	2.55	Turner et al. 1993a
6131RS14	high grade metamorphic rock	Gawler	2400	-4.1	3.07	Turner et al. 1993a
6031 RS60	high grade metamorphic rock	Gawler	2400	1.7	2.63	Turner et al. 1993a
515-B26	igneous mafic intrusive	Gawler	1850	-7.08	2.83	Turner et al. 1993a
884-MG2	igneous mafic volcanic	Gawler	1754	-0.1	2.23	Turner et al. 1993a
515-B152	igneous felsic intrusive	Gawler	1850	4.86	1.93	Turner et al. 1993a
884-DPA	igneous felsic volcanic	Gawler	2558	-2.47	3.08	Turner et al. 1993a
RS27	igneous mafic intrusive	Gawler	830	2.9	1.23	Turner et al. 1993a
6131RS147	metasedimentary	Gawler	1850	-6.79	2.81	Turner et al. 1993a
939-90-13	metasedimentary	Gawler	1850	-2.66	2.5	Turner et al. 1993a
884-DPB	igneous mafic volcanic	Gawler	2558	3.92	2.59	Turner et al. 1993a
658672	igneous felsic intrusive	Gawler	1505	3.78	1.72	Wade et al. 2007
658671	igneous felsic intrusive	Gawler	1505	1.69	1.88	Wade et al. 2007
658669	igneous felsic intrusive	Gawler	1505	2.19	1.85	Wade et al. 2007
not given	igneous volcanic	Gawler	2520	-3.43	3.12	Woodhouse 2002

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
not given	igneous volcanic	Gawler	2520	-3.76	3.14	Woodhouse 2002

Appendix Table B.4 Neodymium isotopic data for rocks of the Tasman Element. Data sources specified in the Reference column. Refer to for Appendix Table A.2 full Province names.

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
95220020	metamorphic protolith unknown	Delamerian	380	4.7	0.72	Black et al 2010
99220046	igneous felsic intrusive	Delamerian	360	-4.81	1.42	Black et al 2010
99220045	igneous felsic intrusive	Delamerian	361	-7.79	1.64	Black et al 2010
99220059	igneous felsic intrusive	Delamerian	351	-4.98	1.42	Black et al 2010
93220006	sedimentary	Delamerian	380	-6.56	1.57	Black et al 2010
2001220076	sedimentary	Delamerian	380	-7.51	1.64	Black et al 2010
95220027	sedimentary	Delamerian	380	-12.13	1.99	Black et al 2010
98220036	sedimentary	Delamerian	380	-12	1.98	Black et al 2010
2002220085	igneous felsic intrusive	Delamerian	370	-5.42	1.47	Black et al 2010
99220060	sedimentary	Delamerian	380	-12.46	2.01	Black et al 2010
99220043	igneous felsic intrusive	Delamerian	373	-4.99	1.44	Black et al 2010
98220034	sedimentary	Delamerian	380	-12.05	1.98	Black et al 2010
99220042	igneous felsic intrusive	Delamerian	374	-2.9	1.28	Black et al 2010
99220047	igneous felsic intrusive	Delamerian	362	-9.7	1.79	Black et al 2010
2001220077	sedimentary	Delamerian	380	-12.19	1.99	Black et al 2010
95220018	metamorphic protolith unknown	Delamerian	380	2.08	0.91	Black et al 2010
A1109-6	igneous felsic intrusive	Delamerian	492.6	-6	1.62	Foden et al. 2002
KiSM-34	igneous felsic intrusive	Delamerian	504	-11.91	2.07	Foden et al. 2002
ss11	igneous felsic intrusive	Delamerian	504	-12.93	2.15	Foden et al. 2002
91-CYH1	igneous felsic intrusive	Delamerian	504	-2.41	1.36	Foden et al. 2002
SS11	igneous felsic intrusive	Delamerian	504	-13.61	2.2	Foden et al. 2002
Kiû29	igneous felsic intrusive	Delamerian	504	-12.61	2.12	Foden et al. 2002
KI89-6	igneous felsic intrusive	Delamerian	504	-13.47	2.19	Foden et al. 2002
861-1	igneous felsic intrusive	Delamerian	500	-8.29	1.8	Foden et al. 2002
88-TC1	igneous felsic intrusive	Delamerian	513.4	-2.4	1.36	Foden et al. 2002
Ki-07	igneous felsic intrusive	Delamerian	504	-12.44	2.11	Foden et al. 2002
88-RG1	igneous felsic intrusive	Delamerian	514	-6.2	1.65	Foden et al. 2002
779-52	igneous felsic intrusive	Delamerian	490	-3.03	1.39	Foden et al. 2002
88-1014	igneous felsic intrusive	Delamerian	500	-2.68	1.37	Foden et al. 2002
BC-M2	igneous felsic intrusive	Delamerian	506	0.86	1.11	Foden et al. 2002
BC-M9	igneous felsic intrusive	Delamerian	506	1.87	1.04	Foden et al. 2002
A1109-5	igneous felsic intrusive	Delamerian	506	-6.02	1.63	Foden et al. 2002
A1109-4	igneous felsic intrusive	Delamerian	500	-4.96	1.54	Foden et al. 2002
A1109 11	igneous felsic intrusive	Delamerian	514	-5.47	1.6	Foden et al. 2002

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
1131-6	igneous mafic intrusive	Delamerian	500	4.61	0.82	Foden et al. 2002
A1109/13	igneous felsic intrusive	Delamerian	485.7	-7.91	1.76	Foden et al. 2002
A1109/14	igneous felsic intrusive	Delamerian	485.7	0.16	1.15	Foden et al. 2002
1155chl7	igneous intrusive	Delamerian	500	-10.64	1.97	Foden et al. 2002
1155ch3	igneous intrusive	Delamerian	500	-11.24	2.02	Foden et al. 2002
1155ch22	igneous intrusive	Delamerian	500	-7.19	1.71	Foden et al. 2002
1155cg8	igneous intrusive	Delamerian	500	-4.49	1.51	Foden et al. 2002
GM-140	igneous felsic intrusive	Delamerian	485.7	-5.08	1.54	Foden et al. 2002
1155ch50	igneous mafic intrusive	Delamerian	500	2.11	1.01	Foden et al. 2002
ssl6	igneous felsic intrusive	Delamerian	504	-11.99	2.08	Foden et al. 2002
1131-8	igneous mafic intrusive	Delamerian	500	6.09	0.71	Foden et al. 2002
GM-153	igneous felsic intrusive	Delamerian	485.7	-5.84	1.6	Foden et al. 2002
PD-9588	igneous felsic intrusive	Delamerian	513.2	-8.13	1.79	Foden et al. 2002
861-12	igneous felsic intrusive	Delamerian	495	-8.51	1.81	Foden et al. 2002
GM-167	igneous felsic intrusive	Delamerian	485.7	-5.74	1.59	Foden et al. 2002
BC-VH35	igneous felsic intrusive	Delamerian	500	-10.54	1.97	Foden et al. 2002
ssl6	igneous felsic intrusive	Delamerian	504	-12.82	2.14	Foden et al. 2002
1155ch58	igneous mafic intrusive	Delamerian	500	-1.73	1.3	Foden et al. 2002
G401385	igneous felsic intrusive	Delamerian	373	-4.11	1.37	GA unpublished
99220044	igneous felsic intrusive	Delamerian	357	-6.37	1.53	GA unpublished
VV12	igneous felsic intrusive	Delamerian	396	1.89	0.94	Hergt et al. 2007
VV18	igneous felsic intrusive	Delamerian	396	1.15	1	Hergt et al. 2007
VV34	igneous felsic intrusive	Delamerian	396	1.92	0.94	Hergt et al. 2007
VV33	igneous felsic intrusive	Delamerian	396	1.45	0.98	Hergt et al. 2007
VV32	igneous felsic intrusive	Delamerian	396	0.23	1.07	Hergt et al. 2007
VV30	igneous felsic intrusive	Delamerian	396	1.31	0.99	Hergt et al. 2007
VV27	igneous felsic intrusive	Delamerian	396	1.45	0.97	Hergt et al. 2007
VV25	igneous felsic intrusive	Delamerian	396	1.54	0.97	Hergt et al. 2007
VV35	igneous felsic intrusive	Delamerian	396	1.51	0.97	Hergt et al. 2007
VV19	igneous felsic intrusive	Delamerian	396	0.7	1.03	Hergt et al. 2007
VV2	igneous felsic intrusive	Delamerian	396	1.22	0.99	Hergt et al. 2007
VV16	igneous felsic intrusive	Delamerian	396	1.15	1	Hergt et al. 2007
VV15	igneous felsic intrusive	Delamerian	396	-0.77	1.14	Hergt et al. 2007
VV13	igneous felsic intrusive	Delamerian	396	1.95	0.94	Hergt et al. 2007
VV11	igneous felsic intrusive	Delamerian	396	2.09	0.93	Hergt et al. 2007
VV1	igneous felsic intrusive	Delamerian	396	2.05	0.93	Hergt et al. 2007
VV10	igneous felsic intrusive	Delamerian	396	2.05	0.93	Hergt et al. 2007

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
VV9	igneous felsic intrusive	Delamerian	396	1.75	0.95	Hergt et al. 2007
VV23	igneous felsic intrusive	Delamerian	396	1.54	0.97	Hergt et al. 2007
PG11	igneous felsic intrusive	Delamerian	487	-2.59	1.36	Turner et al. 1993a
339-GB	igneous felsic volcanic	Delamerian	490	0.85	1.1	Turner et al. 1993a
2000	igneous felsic intrusive	Delamerian	490	-4.11	1.47	Turner et al. 1993a
876-C1	igneous mafic intrusive	Delamerian	500	2.59	0.98	Turner et al. 1993a
15-301	igneous felsic intrusive	Delamerian	490	-1.73	1.29	Turner et al. 1993a
2001	igneous felsic	Delamerian	490	-1.51	1.28	Turner et al. 1993a
861-93	igneous felsic intrusive	Delamerian	482.3	-1.12	1.24	Turner et al. 1993a
861-121	igneous felsic intrusive	Delamerian	493	-7.27	1.71	Turner et al. 1993b
861-86	igneous felsic intrusive	Delamerian	495	-3.35	1.42	Turner et al. 1993b
861-41	igneous felsic intrusive	Delamerian	495	-4.02	1.47	Turner et al. 1993b
861-99	igneous felsic intrusive	Delamerian	495	-8.69	1.82	Turner et al. 1993b
861-90	igneous felsic intrusive	Delamerian	485	-2.79	1.37	Turner et al. 1993b
861-130	igneous felsic intrusive	Delamerian	495	-6.4	1.65	Turner et al. 1993b
14	igneous mafic intrusive	Delamerian	495	1.44	1.06	Whelan et al. 2007
4	igneous felsic intrusive	Delamerian	495	-0.81	1.23	Whelan et al. 2007
3	igneous felsic intrusive	Delamerian	495	-7.96	1.77	Whelan et al. 2007
1	igneous felsic intrusive	Delamerian	495	-1.02	1.24	Whelan et al. 2007
11	igneous felsic intrusive	Delamerian	495	-5.46	1.58	Whelan et al. 2007
7	igneous mafic volcanic	Delamerian	495	4.35	0.84	Whelan et al. 2007
9	igneous mafic volcanic	Delamerian	495	-2.38	1.35	Whelan et al. 2007
18	igneous mafic volcanic	Delamerian	495	-0.07	1.17	Whelan et al. 2007
12	igneous mafic intrusive	Delamerian	495	1.19	1.08	Whelan et al. 2007
5	igneous felsic intrusive	Delamerian	495	-3.32	1.42	Whelan et al. 2007
13	igneous mafic intrusive	Delamerian	495	2.14	1.01	Whelan et al. 2007
10	igneous felsic intrusive	Delamerian	495	-2.93	1.39	Whelan et al. 2007
CJ1	igneous felsic intrusive	Kennedy	320	-8.22	1.64	Black & McCulloch 1990
B173	igneous felsic intrusive	Kennedy	300	-8.17	1.62	Black & McCulloch 1990
70571028	igneous felsic volcanic	Kennedy	280	-3.99	1.29	Black & McCulloch 1990
70571007	igneous felsic volcanic	Kennedy	280	-3.69	1.27	Black & McCulloch 1990
DCC217	igneous felsic intrusive	Kennedy	280	-5.58	1.41	Champion 1991
DCC183	igneous felsic intrusive	Kennedy	260	-5.2	1.36	Champion 1991
DCC189	igneous felsic intrusive	Kennedy	281	-3.89	1.28	Champion 1991
DCC212	igneous felsic intrusive	Kennedy	280	-4.93	1.36	Champion 1991
NQ32	igneous felsic intrusive	Kennedy	305	-7.56	1.58	Champion 1991
NQ19	igneous felsic intrusive	Kennedy	305	-7.18	1.55	Champion 1991

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
DCC93	igneous felsic intrusive	Kennedy	300	-7.86	1.6	Champion 1991
DCC271	igneous felsic intrusive	Kennedy	266	-5.95	1.42	Champion 1991
DCC83	igneous felsic intrusive	Kennedy	280	-5.97	1.44	Champion 1991
DCC166	igneous felsic intrusive	Kennedy	259	-4.64	1.32	Champion 1991
DCC86	igneous felsic intrusive	Kennedy	280	-6.67	1.49	Champion 1991
DCC275	igneous felsic intrusive	Kennedy	280	-5.19	1.38	Champion 1991
DCC90	igneous felsic intrusive	Kennedy	280	-2.25	1.16	Champion 1991
DCC206	igneous felsic intrusive	Kennedy	276	-5.69	1.41	Champion 1991
DCC218	igneous felsic intrusive	Kennedy	276	-3.93	1.28	Champion 1991
DCC264	igneous felsic intrusive	Kennedy	275	-6.14	1.45	Champion 1991
DCC145	igneous felsic intrusive	Kennedy	275	-5.39	1.39	Champion 1991
DCC145	igneous felsic intrusive	Kennedy	275	-5.66	1.41	Champion 1991
DCC160	igneous felsic intrusive	Kennedy	270	-2.63	1.18	Champion 1991
DCC129	igneous felsic intrusive	Kennedy	270	-4	1.28	Champion 1991
PLB27	igneous felsic intrusive	Kennedy	305	-7.17	1.55	Champion 1991
BB1421	igneous felsic intrusive	Kennedy	281	-3.71	1.27	Fanning unpublished
83300068	igneous felsic volcanic	Kennedy	280	-4.39	1.32	GA unpublished
83300236	igneous felsic volcanic	Kennedy	301	-7.47	1.57	GA unpublished
84300580	igneous felsic intrusive	Kennedy	300	-7.45	1.57	GA unpublished
83300390a	igneous felsic intrusive	Kennedy	280	-6.94	1.51	GA unpublished
86300882	igneous felsic intrusive	Kennedy	280	-6.05	1.44	GA unpublished
93839094	igneous felsic intrusive	Kennedy	315	2.42	0.83	GA unpublished
86300859	igneous felsic intrusive	Kennedy	280	-4.71	1.34	GA unpublished
82300071	igneous felsic volcanic	Kennedy	306	-6.96	1.53	GA unpublished
70571020	igneous felsic volcanic	Kennedy	305	-7.33	1.56	GA unpublished
86300917	igneous felsic volcanic	Kennedy	278	-4.48	1.32	GA unpublished
83300161	igneous felsic volcanic	Kennedy	284	-5.55	1.41	GA unpublished
86300836	igneous felsic volcanic	Kennedy	308	-9.67	1.74	GA unpublished
83300262	igneous felsic volcanic	Kennedy	280	-4.58	1.33	GA unpublished
88503170	igneous felsic volcanic	Kennedy	304.7	-0.35	1.03	GA unpublished
RJB2549	igneous felsic intrusive	Kennedy	280	-1.4	1.09	GA unpublished
RJB2571	igneous felsic intrusive	Kennedy	280	-0.69	1.04	GA unpublished
93839039	igneous felsic intrusive	Kennedy	280	0.53	0.95	GA unpublished
93839010r	igneous felsic intrusive	Kennedy	280	0.36	0.96	GA unpublished
93839010	igneous felsic intrusive	Kennedy	280	0.73	0.93	GA unpublished
89503028	igneous felsic volcanic	Kennedy	293.5	0.56	0.96	GA unpublished
89302108	igneous felsic intrusive	Kennedy	292.6	0.86	0.93	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
88302095	igneous felsic intrusive	Kennedy	289.6	0.2	0.98	GA unpublished
200801512	igneous felsic intrusive	Kennedy	292	-0.26	1.02	GA unpublished
200801512	igneous felsic intrusive	Kennedy	292	0.05	0.99	GA unpublished
200801501	igneous felsic volcanic	Kennedy	302	-0.19	1.02	GA unpublished
86300876	igneous felsic volcanic	Kennedy	281	-5.41	1.4	GA unpublished
BB4853	igneous felsic intrusive	Kennedy	297.2	-0.41	1.03	GA-GSQ unpublished
BB4797	igneous felsic intrusive	Kennedy	280	-0.3	1.01	GA-GSQ unpublished
BB4837	igneous felsic intrusive	Kennedy	300	-0.32	1.03	GA-GSQ unpublished
BB4832	igneous felsic intrusive	Kennedy	300	-0.4	1.03	GA-GSQ unpublished
BB4846	igneous felsic intrusive	Kennedy	297.2	-0.43	1.03	GA-GSQ unpublished
BB4845	igneous felsic intrusive	Kennedy	290	-0.28	1.02	GA-GSQ unpublished
BB4834	igneous felsic intrusive	Kennedy	290	-0.88	1.06	GA-GSQ unpublished
BB4646	igneous felsic intrusive	Kennedy	300	-3.98	1.3	GA-GSQ unpublished
RGMP78/93	igneous felsic volcanic	Kennedy	279	-2.05	1.14	GSQ-Fanning unpublished
RGMP335/94	igneous felsic volcanic	Kennedy	326	-5.43	1.43	GSQ-Fanning unpublished
BB1665	igneous felsic intrusive	Kennedy	277	-2.74	1.19	GSQ-Fanning unpublished
DCC202	igneous felsic intrusive	Kennedy	275	-6.43	1.47	GSQ-Fanning unpublished
RJB246	igneous felsic intrusive	Kennedy	286	-3.24	1.24	GSQ-Fanning unpublished
BB1427	igneous felsic intrusive	Kennedy	264	-0.61	1.02	GSQ-Fanning unpublished
RJB282	igneous felsic intrusive	Kennedy	336	-7.31	1.59	GSQ-Fanning unpublished
BB1685	igneous felsic intrusive	Kennedy	279	-3.24	1.23	GSQ-Fanning unpublished
DCC212	igneous felsic intrusive	Kennedy	280	-6.16	1.45	GSQ-Fanning unpublished
DCC216	igneous felsic intrusive	Kennedy	284	-4.06	1.3	GSQ-Fanning unpublished
RJB485	igneous felsic intrusive	Kennedy	335	-9.69	1.76	GSQ-Fanning unpublished
RGMP78/87	igneous felsic volcanic	Kennedy	277	-3.59	1.26	GSQ-Fanning unpublished
RGMP77/87	igneous felsic volcanic	Kennedy	277	-3.6	1.26	GSQ-Fanning unpublished
RGMP80/87	igneous felsic volcanic	Kennedy	277	-4.28	1.31	GSQ-Fanning unpublished
RJB484	igneous felsic intrusive	Kennedy	301	-1.78	1.14	GSQ-Fanning unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
RGMP107/94	igneous felsic intrusive	Kennedy	282	-4.2	1.31	GSQ-Fanning unpublished
2001220080	igneous felsic intrusive	Lachlan	385	-1.57	1.19	Black et al 2010
99220058	igneous felsic intrusive	Lachlan	396	-5.84	1.52	Black et al 2010
2001220078	sedimentary	Lachlan	380	-12.04	1.98	Black et al 2010
98220033	metasedimentary	Lachlan	380	-10.29	1.85	Black et al 2010
2001220079	igneous felsic intrusive	Lachlan	401	-6.23	1.56	Black et al 2010
99220055	igneous felsic intrusive	Lachlan	400	-5.52	1.5	Black et al 2010
99220048	igneous felsic intrusive	Lachlan	390	-2.67	1.28	Black et al 2010
99220052	igneous felsic intrusive	Lachlan	389	-3.27	1.32	Black et al 2010
99220050	igneous felsic intrusive	Lachlan	388	-3.73	1.36	Black et al 2010
99220050	igneous felsic intrusive	Lachlan	388	-3.78	1.36	Black et al 2010
99220051	igneous felsic intrusive	Lachlan	386	-4.79	1.44	Black et al 2010
99220056	unknown	Lachlan	399	-5.23	1.48	Black et al 2010
99220054	igneous felsic intrusive	Lachlan	384	-5.34	1.48	Black et al 2010
2001220071	igneous felsic intrusive	Lachlan	381	-4.92	1.44	Black et al 2010
99220061	igneous felsic intrusive	Lachlan	378	-2.88	1.29	Black et al 2010
2001220070	igneous felsic intrusive	Lachlan	377	-3.17	1.31	Black et al 2010
2001220075	igneous felsic intrusive	Lachlan	374	-3.4	1.32	Black et al 2010
2002220081	igneous felsic intrusive	Lachlan	374	-2.91	1.28	Black et al 2010
99220057	igneous felsic intrusive	Lachlan	387	-5.96	1.53	Black et al 2010
WEEM0471	igneous mafic volcanic	Lachlan	405	4.82	0.73	GA unpublished
R000547	igneous felsic intrusive	Lachlan	376.5	-3.17	1.31	GA unpublished
91844305	igneous mafic volcanic	Lachlan	450	7.85	0.54	GA unpublished
95846010	igneous mafic volcanic	Lachlan	450	5.88	0.69	GA unpublished
71840485	igneous mafic volcanic	Lachlan	450	6.46	0.64	GA unpublished
91844298	igneous mafic volcanic	Lachlan	450	6.87	0.61	GA unpublished
91844219	igneous mafic volcanic	Lachlan	450	6.91	0.61	GA unpublished
91844278	igneous mafic volcanic	Lachlan	450	7.21	0.59	GA unpublished
91844165	igneous mafic volcanic	Lachlan	450	6.55	0.64	GA unpublished
91847163	igneous mafic volcanic	Lachlan	450	3.94	0.83	GA unpublished
91847164	igneous mafic volcanic	Lachlan	450	5.56	0.71	GA unpublished
91843305	igneous mafic volcanic	Lachlan	450	1.67	1	GA unpublished
97846037	igneous mafic volcanic	Lachlan	405	8.14	0.48	GA unpublished
94849050	igneous mafic volcanic	Lachlan	450	5.9	0.68	GA unpublished
8928LMC0002	igneous felsic intrusive	Lachlan	413	-5.09	1.48	GA unpublished
COSM0262A	igneous mafic intrusive	Lachlan	450	5.59	0.71	GA unpublished
92844418	igneous felsic intrusive	Lachlan	450	6.28	0.66	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
92844509	igneous intermediate intrusive	Lachlan	450	6.5	0.64	GA unpublished
87840030	igneous intermediate intrusive	Lachlan	450	5.7	0.7	GA unpublished
91844215	igneous intermediate intrusive	Lachlan	450	6.65	0.63	GA unpublished
94849019	igneous intermediate volcanic	Lachlan	450	7.31	0.58	GA unpublished
94849046	igneous mafic volcanic	Lachlan	450	6.65	0.63	GA unpublished
94849016	igneous mafic intrusive	Lachlan	450	5.81	0.69	GA unpublished
94849048	igneous mafic volcanic	Lachlan	450	6.7	0.62	GA unpublished
87840093	igneous mafic intrusive	Lachlan	450	6.55	0.64	GA unpublished
95846063	igneous mafic volcanic	Lachlan	375	4.35	0.74	GA unpublished
8827JAF0005	igneous felsic intrusive	Lachlan	411	-4.36	1.43	GA unpublished
8928LMC0364	igneous felsic intrusive	Lachlan	382	3.44	0.81	GA unpublished
8827ODT0090	igneous felsic intrusive	Lachlan	411	-5.95	1.55	GA unpublished
8827ODT0173	igneous felsic intrusive	Lachlan	423	-7.73	1.69	GA unpublished
91844169	igneous intermediate volcanic	Lachlan	450	6.9	0.61	GA unpublished
WEEM0310	igneous intermediate volcanic	Lachlan	404	6.94	0.57	GA unpublished
92843188	igneous felsic intrusive	Lachlan	320	-0.49	1.06	GA unpublished
92843185	igneous felsic intrusive	Lachlan	320	-1.32	1.12	GA unpublished
92843132	igneous felsic intrusive	Lachlan	320	-1.4	1.13	GA unpublished
91847231	igneous felsic intrusive	Lachlan	320	0.67	0.97	GA unpublished
92847289	igneous felsic intrusive	Lachlan	320	-3.37	1.28	GA unpublished
8827JAF0837	igneous felsic intrusive	Lachlan	424	-4.51	1.45	GA unpublished
WRP-046	igneous felsic intrusive	Lachlan	431	-7.27	1.66	GA unpublished
8928LMC0363	igneous felsic intrusive	Lachlan	326	0.16	1.01	GA unpublished
SB6	igneous felsic intrusive	Lachlan	395	-0.69	1.14	GA unpublished
R006956	igneous felsic intrusive	Lachlan	384.9	-4.78	1.43	GA unpublished
R004493	igneous felsic intrusive	Lachlan	376.5	-4.58	1.41	GA unpublished
8827JAF0300	igneous felsic intrusive	Lachlan	411	-3.72	1.38	GA unpublished
96846376	igneous felsic intrusive	Lachlan	450	6.99	0.6	GA unpublished
94849012	igneous mafic volcanic	Lachlan	450	6.8	0.62	GA unpublished
8827ODT0265	igneous felsic volcanic	Lachlan	419	-4.96	1.48	GA unpublished
8928LMC0365	igneous felsic intrusive	Lachlan	324	0.9	0.96	GA unpublished
8729CJS0002	igneous felsic intrusive	Lachlan	429	-7.55	1.68	GA unpublished
8827CJS0070	igneous felsic volcanic	Lachlan	414	-5.77	1.53	GA unpublished
8827JAF0193	igneous felsic volcanic	Lachlan	414	-5.71	1.53	GA unpublished
8928LMC0073	igneous felsic volcanic	Lachlan	386	-1.93	1.22	GA unpublished
8827ODT0372	igneous felsic volcanic	Lachlan	413	-5.54	1.52	GA unpublished
8928LMC0368	igneous volcanic	Lachlan	413	-7	1.63	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
8827ODT1152	igneous felsic volcanic	Lachlan	422	-6.97	1.63	GA unpublished
2000844522	igneous intermediate intrusive	Lachlan	417	1.6	0.98	GA unpublished
2000844521	igneous intermediate intrusive	Lachlan	417	3.09	0.87	GA unpublished
98844520	igneous intermediate intrusive	Lachlan	417	2.63	0.9	GA unpublished
8827JAF0672	igneous intermediate intrusive	Lachlan	428	-8.61	1.76	GA unpublished
97848017	igneous felsic intrusive	Lachlan	320	1.4	0.92	GA unpublished
8827JAF0067	igneous felsic volcanic	Lachlan	412	-5.28	1.5	GA unpublished
5	igneous felsic intrusive	Lachlan	429	-9.49	1.83	Healy et al. 2004
54	igneous mafic intrusive	Lachlan	429	-2.17	1.28	Healy et al. 2004
30	igneous mafic intrusive	Lachlan	429	-2.09	1.27	Healy et al. 2004
19	igneous mafic intrusive	Lachlan	429	-2.95	1.33	Healy et al. 2004
76	igneous felsic intrusive	Lachlan	429	-9.11	1.8	Healy et al. 2004
73	igneous felsic intrusive	Lachlan	429	-9.55	1.83	Healy et al. 2004
41	igneous felsic intrusive	Lachlan	429	-9.19	1.8	Healy et al. 2004
38	igneous felsic intrusive	Lachlan	429	-9.78	1.85	Healy et al. 2004
37	igneous felsic intrusive	Lachlan	429	-10.57	1.91	Healy et al. 2004
25	igneous felsic intrusive	Lachlan	429	-10.08	1.87	Healy et al. 2004
22	igneous felsic intrusive	Lachlan	429	-9.31	1.81	Healy et al. 2004
9	igneous felsic intrusive	Lachlan	429	-9.53	1.83	Healy et al. 2004
TKB-17	igneous felsic intrusive	Lachlan	401	-6.55	1.58	Kemp et al. 2009
TKB-1	igneous felsic intrusive	Lachlan	389.3	0.59	1.03	Kemp et al. 2009
TKB-100	igneous felsic intrusive	Lachlan	393	-6.59	1.58	Kemp et al. 2009
KK-4	igneous felsic intrusive	Lachlan	416	-5.2	1.49	Kemp et al. 2009
TKB-11	igneous felsic intrusive	Lachlan	385.2	-1.48	1.19	Kemp et al. 2009
BB31	igneous felsic intrusive	Lachlan	412.6	0	1.1	McCulloch & Chappell 1982
BB42r	igneous felsic intrusive	Lachlan	418	-3.44	1.36	McCulloch & Chappell 1982
SC5	metasedimentary	Lachlan		-14.45	1.84	McCulloch & Chappell 1982
BB42	igneous felsic intrusive	Lachlan	418	-3.7	1.38	McCulloch & Chappell 1982
C1	igneous felsic intrusive	Lachlan	428.5	-9.02	1.79	McCulloch & Chappell 1982
BB74	igneous felsic intrusive	Lachlan	417.3	-6.63	1.6	McCulloch & Chappell 1982
BB60	igneous felsic intrusive	Lachlan	416.9	-3.2	1.34	McCulloch & Chappell 1982
BB62	igneous felsic intrusive	Lachlan	415.9	0.52	1.06	McCulloch & Chappell 1982

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
BB10	igneous felsic intrusive	Lachlan	415.6	-2.55	1.29	McCulloch & Chappell 1982
BB138x	high grade metamorphic rock	Lachlan	429	-9.72	1.84	McCulloch & Chappell 1982
BBl63	igneous felsic intrusive	Lachlan	436.2	-7.85	1.71	McCulloch & Chappell 1982
BB61	igneous felsic intrusive	Lachlan	436	-8.66	1.77	McCulloch & Chappell 1982
BB130x	high grade metamorphic rock	Lachlan	429	-9.05	1.79	McCulloch & Chappell 1982
BB48	igneous felsic intrusive	Lachlan	418	-5.24	1.5	McCulloch & Chappell 1982
BB2	igneous felsic intrusive	Lachlan	435.6	-7.79	1.7	McCulloch & Chappell 1982
BB53	igneous felsic intrusive	Lachlan	425.5	-7.37	1.66	McCulloch & Chappell 1982
BB110	igneous felsic intrusive	Lachlan	415.6	-2.17	1.26	McCulloch & Chappell 1982
BB9	igneous felsic intrusive	Lachlan	435.1	-5.93	1.56	McCulloch & Chappell 1982
BB127x	unknown	Lachlan	435	-5.56	1.54	McCulloch & Chappell 1982
C4	metasedimentary	Lachlan		-12.52	1.7	McCulloch & Chappell 1982
KB22	igneous felsic intrusive	Lachlan	424	-4.81	1.47	McCulloch & Chappell 1982
BB12	igneous felsic intrusive	Lachlan	435.1	-6.33	1.59	McCulloch & Chappell 1982
KB139	igneous felsic intrusive	Lachlan	418	-3.57	1.37	McCulloch & Chappell 1982
KB32	igneous felsic intrusive	Lachlan	434.6	-8.58	1.76	McCulloch & Chappell 1982
KB51	igneous felsic intrusive	Lachlan	432	-7.43	1.67	McCulloch & Chappell 1982
BB19r	igneous felsic intrusive	Lachlan	428.7	-8.15	1.73	McCulloch & Chappell 1982
BB19	igneous felsic intrusive	Lachlan	428.7	-8.31	1.74	McCulloch & Chappell 1982
KB31	igneous felsic intrusive	Lachlan	432	-7.9	1.71	McCulloch & Chappell 1982
BB104	igneous felsic intrusive	Lachlan	419.2	-2.05	1.26	McCulloch & Chappell 1982
BB86	igneous felsic intrusive	Lachlan	418.7	-3.1	1.34	McCulloch & Chappell 1982
K36077	igneous felsic intrusive	Lachlan	384	-5.88	1.52	Sun and Higgins 1996
84162004	igneous felsic intrusive	Lachlan	386.8	-5.74	1.51	Sun and Higgins 1996

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
84162025	igneous felsic intrusive	Lachlan	386.8	-9.1	1.76	Sun and Higgins 1996
702710	igneous felsic intrusive	Lachlan	384	-3.6	1.35	Sun and Higgins 1996
40567	igneous felsic intrusive	Lachlan	386.8	-4.7	1.43	Sun and Higgins 1996
40567	igneous felsic intrusive	Lachlan	386.8	-4.97	1.45	Sun and Higgins 1996
84162017	igneous felsic intrusive	Lachlan	386.8	-5.53	1.49	Sun and Higgins 1996
63034	igneous felsic intrusive	Lachlan	386.8	-6.28	1.55	Sun and Higgins 1996
63037	igneous felsic intrusive	Lachlan	377.8	-3.13	1.31	Sun and Higgins 1996
40561	igneous felsic intrusive	Lachlan	386.8	-5.71	1.51	Sun and Higgins 1996
742520	igneous felsic intrusive	Lachlan	377.8	-2.36	1.25	Sun and Higgins 1996
40549	igneous felsic intrusive	Lachlan	378	-2.09	1.23	Sun and Higgins 1996
40545	igneous felsic intrusive	Lachlan	378	-3.91	1.36	Sun and Higgins 1996
C43217	igneous felsic intrusive	Lachlan	384	-5.11	1.46	Sun and Higgins 1996
MM172	igneous mafic intrusive	Lachlan	385	0.71	1.02	Sun and Higgins 1996
C41701	igneous mafic intrusive	Lachlan	385	0.52	1.04	Sun and Higgins 1996
84161005	igneous mafic intrusive	Lachlan	385	5.87	0.63	Sun and Higgins 1996
MM117	igneous felsic intrusive	Lachlan	396	-5.36	1.49	Sun and Higgins 1996
MM141	igneous felsic intrusive	Lachlan	396	-5.81	1.52	Sun and Higgins 1996
MM142	igneous felsic intrusive	Lachlan	396	-5.1	1.47	Sun and Higgins 1996
MM142	igneous felsic intrusive	Lachlan	396	-4.78	1.44	Sun and Higgins 1996
R62537	igneous felsic intrusive	Lachlan	384	-5.73	1.51	Sun and Higgins 1996
C40524	igneous felsic intrusive	Lachlan	387	-6.02	1.53	Sun and Higgins 1996
40517	igneous felsic intrusive	Lachlan	387	-4.75	1.43	Sun and Higgins 1996
R62583	igneous felsic intrusive	Lachlan	384	-5.08	1.46	Sun and Higgins 1996
40548	igneous felsic intrusive	Lachlan	378	-1.97	1.22	Sun and Higgins 1996
R62579	igneous felsic intrusive	Lachlan	384	-3.37	1.33	Sun and Higgins 1996
C40533	igneous felsic intrusive	Lachlan	380	-2.46	1.26	Sun and Higgins 1996
63038	metasomatic	Lachlan	377.8	-3.43	1.33	Sun and Higgins 1996
40549	igneous felsic intrusive	Lachlan	378	-2.45	1.25	Sun and Higgins 1996
40544	igneous felsic intrusive	Lachlan	378	-5.86	1.51	Sun and Higgins 1996
742524	igneous felsic intrusive	Lachlan	377.8	-2.22	1.24	Sun and Higgins 1996
84162205	igneous felsic intrusive	Lachlan	377.8	-2.79	1.28	Sun and Higgins 1996
63039	metasomatic	Lachlan	377.8	-3.63	1.34	Sun and Higgins 1996
40519	igneous felsic intrusive	Lachlan	387	-4.52	1.42	Sun and Higgins 1996
MM135	igneous felsic intrusive	Lachlan	395.7	-6.25	1.55	Sun and Higgins 1996
43134	igneous felsic intrusive	Lachlan	384.3	-5.98	1.52	Sun and Higgins 1996
63035	igneous felsic intrusive	Lachlan	377.8	-6.78	1.58	Sun and Higgins 1996
63036	igneous felsic intrusive	Lachlan	377.8	-3.27	1.32	Sun and Higgins 1996

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
702708	igneous felsic intrusive	Lachlan	384	-3.4	1.33	Sun and Higgins 1996
43134	igneous felsic intrusive	Lachlan	384.3	-5.66	1.5	Sun and Higgins 1996
43101	igneous felsic intrusive	Lachlan	384.3	-4.02	1.38	Sun and Higgins 1996
43101	igneous felsic intrusive	Lachlan	384.3	-4.61	1.42	Sun and Higgins 1996
40559	igneous felsic intrusive	Lachlan	386.8	-5.71	1.51	Sun and Higgins 1996
40559	igneous felsic intrusive	Lachlan	386.8	-5.49	1.49	Sun and Higgins 1996
84162008	igneous felsic intrusive	Lachlan	386.8	-6.42	1.56	Sun and Higgins 1996
40549	igneous felsic intrusive	Lachlan	378	-2.38	1.25	Sun and Higgins 1996
40549	igneous felsic intrusive	Lachlan	378	-2.7	1.27	Sun and Higgins 1996
40549	igneous felsic intrusive	Lachlan	378	-2.5	1.26	Sun and Higgins 1996
C43304A	metasedimentary	Lachlan	380	-11.07	1.9	Sun and Higgins 1996
84162108	igneous felsic intrusive	Lachlan	377.8	-2.5	1.26	Sun and Higgins 1996
C40572	metasedimentary	Lachlan	380	-10.23	1.84	Sun and Higgins 1996
84162108	igneous felsic intrusive	Lachlan	377.8	-2.08	1.23	Sun and Higgins 1996
92844511	metasomatic	Lachlan	450	4.53	0.79	Wyborn & Sun 1993
92844462	metasomatic	Lachlan	450	4.81	0.77	Wyborn & Sun 1993
92844514	metasomatic	Lachlan	450	-1.67	1.26	Wyborn & Sun 1993
92844521	metasomatic	Lachlan	450	6.48	0.64	Wyborn & Sun 1993
92844508	metasomatic	Lachlan	450	6.15	0.67	Wyborn & Sun 1993
DCC242	metasedimentary	Mossman	400	-3.91	1.38	Champion 1991
BB1959A	igneous felsic intrusive	Mossman	500	-8.73	1.83	Fanning unpublished
2008838005	igneous mafic volcanic	Mossman	420	5.7	0.67	GA unpublished
2008838003	igneous mafic volcanic	Mossman	420	6.67	0.6	GA unpublished
2008838011	igneous mafic volcanic	Mossman	380	7.61	0.5	GA unpublished
2008838010	igneous mafic volcanic	Mossman	470	5.38	0.74	GA unpublished
2008838008	igneous mafic volcanic	Mossman	470	5.78	0.71	GA unpublished
JDH743	igneous felsic intrusive	Mossman	455	-4.97	1.51	GA-GSQ unpublished
2008838009H	igneous felsic intrusive	Mossman	455	-5.79	1.57	GA-GSQ unpublished
2008838009J	igneous felsic intrusive	Mossman	455	-7.78	1.72	GA-GSQ unpublished
2008838009D	igneous felsic intrusive	Mossman	455	-6.75	1.64	GA-GSQ unpublished
PD1378	igneous mafic volcanic	Mossman	420	5.37	0.7	Vos et al. 2006
MUL03-01A	igneous mafic volcanic	Mossman	470	5.28	0.75	Vos et al. 2006
MUL DOL	igneous mafic volcanic	Mossman	420	4.38	0.77	Vos et al. 2006
HODG DOL	igneous mafic volcanic	Mossman	300	-3.39	1.26	Vos et al. 2006
PD769B	igneous mafic volcanic	Mossman	380	7.48	0.51	Vos et al. 2006
MUL03-04A	igneous mafic volcanic	Mossman	420	5.72	0.67	Vos et al. 2006
Mt Ben	igneous mafic volcanic	Mossman	380	7.52	0.5	Vos et al. 2006

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
PD1374	igneous mafic volcanic	Mossman	420	6.29	0.63	Vos et al. 2006
U137A	igneous felsic volcanic	New England	250	-2.13	1.12	Allen 2000
U81B	igneous felsic volcanic	New England	284	-1.48	1.1	Allen 2000
U78	igneous felsic volcanic	New England	250	-1.04	1.04	Allen 2000
U82A	igneous mafic intrusive	New England	250	4.25	0.64	Allen 2000
BG175a	igneous mafic volcanic	New England	250	7.13	0.43	Allen 2000
U91	igneous mafic volcanic	New England	250	4.93	0.59	Allen 2000
U22	igneous mafic intrusive	New England	133	6.54	0.37	Allen et al. 1997
BW64	igneous intermediate intrusive	New England	142	5.1	0.49	Allen et al. 1997
BG118	igneous felsic intrusive	New England	119	3.05	0.62	Allen et al. 1997
BW46	igneous felsic intrusive	New England	131	4.99	0.49	Allen et al. 1997
BW14a	igneous felsic intrusive	New England	120	3.86	0.56	Allen et al. 1997
CU232	igneous felsic intrusive	New England	103	4.2	0.52	Allen et al. 1997
BG37	igneous intermediate intrusive	New England	120	5.71	0.42	Allen et al. 1997
R72016	igneous felsic intrusive	New England	292	3.01	0.77	Bryant et al. 1997
R72006	igneous felsic intrusive	New England	292	2.99	0.77	Bryant et al. 1997
R72075	igneous felsic intrusive	New England	253	4.89	0.6	Bryant et al. 1997
R72346	igneous felsic intrusive	New England	250	5.41	0.55	Bryant et al. 1997
R72003	igneous felsic intrusive	New England	292	3.08	0.77	Bryant et al. 1997
R72015	igneous felsic intrusive	New England	292	4.3	0.67	Bryant et al. 1997
R72009	igneous felsic intrusive	New England	292	3.88	0.71	Bryant et al. 1997
R70208	igneous felsic intrusive	New England	253	2.65	0.77	Bryant et al. 1997
R72130	igneous felsic intrusive	New England	253	4.32	0.64	Bryant et al. 1997
R70212	igneous felsic intrusive	New England	250	4.25	0.64	Bryant et al. 1997
R70222	igneous felsic intrusive	New England	253	1.97	0.82	Bryant et al. 1997
R72245B	igneous felsic intrusive	New England	253	3.61	0.69	Bryant et al. 1997
R72311	igneous felsic intrusive	New England	253	0.43	0.93	Bryant et al. 1997
R72010	igneous felsic intrusive	New England	292	4.08	0.69	Bryant et al. 1997
R72096	igneous felsic intrusive	New England	260	6.34	0.49	Bryant et al. 1997
R72026	igneous felsic intrusive	New England	292	1.49	0.89	Bryant et al. 1997
R70211	igneous felsic intrusive	New England	250	2.06	0.81	Bryant et al. 1997
R72320	igneous felsic intrusive	New England	250	3.36	0.71	Bryant et al. 1997
R72172	igneous felsic intrusive	New England	260	4.67	0.62	Bryant et al. 1997
R72337	igneous felsic intrusive	New England	250	5.4	0.56	Bryant et al. 1997
R72088	igneous felsic intrusive	New England	253	5.2	0.57	Bryant et al. 1997
R72163B	igneous felsic intrusive	New England	260	5.86	0.53	Bryant et al. 1997
R72098	igneous felsic intrusive	New England	260	5.18	0.58	Bryant et al. 1997

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
R70203	igneous felsic intrusive	New England	260	4.8	0.61	Bryant et al. 1997
R72315	igneous felsic intrusive	New England	253	3.38	0.71	Bryant et al. 1997
200801505C	igneous felsic intrusive	New England	292	-0.79	1.06	GA unpublished
200901506	igneous volcanic	New England	229	3.91	0.65	GA unpublished
200801518	igneous felsic intrusive	New England	143	4.94	0.5	GA unpublished
200701517	igneous felsic intrusive	New England	322	1.85	0.88	GA unpublished
200701510	igneous felsic intrusive	New England	118	5.11	0.47	GA unpublished
200801517	igneous felsic intrusive	New England	341	1.26	0.94	GA unpublished
200801510	igneous felsic intrusive	New England	328	2.75	0.82	GA unpublished
200701516	igneous felsic intrusive	New England	323	1.94	0.88	GA unpublished
200701511	igneous felsic intrusive	New England	119	4.99	0.48	GA unpublished
200701509	igneous felsic volcanic	New England	347	-2.7	1.25	GA unpublished
200701514	high grade metamorphic rock	New England	298	-9.2	1.7	GA unpublished
200801506	igneous intermediate intrusive	New England	292	-0.33	1.02	GA unpublished
200901501	igneous volcanic	New England	229	4.81	0.58	GA unpublished
200701525	igneous felsic volcanic	New England	228	5.4	0.54	GA unpublished
200701534	igneous felsic intrusive	New England	235	3.75	0.67	GA unpublished
200701523	igneous felsic intrusive	New England	268	3.2	0.74	GA unpublished
200701533	igneous felsic intrusive	New England	235	4.34	0.62	GA unpublished
200701528	igneous felsic intrusive	New England	226	4.72	0.59	GA unpublished
200701526	igneous felsic intrusive	New England	226	5.9	0.5	GA unpublished
200801505B	high grade metamorphic rock	New England	290	-7.14	1.53	GA unpublished
200701548	igneous felsic intrusive	New England	244	3.26	0.71	GA unpublished
200801617	igneous intermediate intrusive	New England	238	3.47	0.69	GA unpublished
200801615	igneous intermediate intrusive	New England	228	4.07	0.64	GA unpublished
200801613	igneous intermediate intrusive	New England	221	4.17	0.62	GA unpublished
200701541	igneous felsic volcanic	New England	253	0.9	0.9	GA unpublished
200801607	igneous felsic intrusive	New England	252.5	1.24	0.87	GA unpublished
200701539	igneous felsic intrusive	New England	298	3.54	0.74	GA unpublished
200701537	igneous felsic intrusive	New England	295	1.72	0.87	GA unpublished
200801511	igneous felsic volcanic	New England	292	0.33	0.97	GA unpublished
200801608	igneous felsic intrusive	New England	256.6	4.66	0.62	GA unpublished
200801611	igneous mafic intrusive	New England	212	4.94	0.56	GA unpublished
200801605	igneous felsic intrusive	New England	254.7	1.14	0.88	GA unpublished
200801604	igneous felsic intrusive	New England	252.6	1.37	0.86	GA unpublished
200801606	igneous felsic intrusive	New England	252.3	0.33	0.94	GA unpublished
200801601	igneous felsic intrusive	New England	252	1.57	0.85	GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
200801603	igneous felsic intrusive	New England	251.8	1.84	0.83	GA unpublished
200801602	igneous felsic intrusive	New England	251.3	0.35	0.94	GA unpublished
200801616	igneous felsic intrusive	New England	231	4.97	0.57	GA unpublished
200701553	igneous felsic intrusive	New England	260	2.82	0.76	GA unpublished
RJB1962	igneous felsic intrusive	New England	290	0.46	0.96	GA-GSQ unpublished
BB4593	igneous felsic intrusive	New England	308	1.43	0.9	GA-GSQ unpublished
GSO552	igneous felsic intrusive	New England	316	2.54	0.83	GA-GSQ unpublished
RJB654	igneous felsic intrusive	New England	323	2.41	0.84	GA-GSQ unpublished
RGMP168/96	igneous felsic intrusive	New England	251	6.31	0.49	GA-GSQ unpublished
RGMP153/96	igneous felsic intrusive	New England	250	6.66	0.46	GA-GSQ unpublished
GSO544	igneous felsic intrusive	New England	240	4.78	0.59	GA-GSQ unpublished
RJB997	igneous felsic intrusive	New England	228	4.41	0.61	GA-GSQ unpublished
RGMP167/96	igneous felsic intrusive	New England	250	3.43	0.7	GA-GSQ unpublished
GSO562	igneous felsic intrusive	New England	328	4.58	0.68	GA-GSQ unpublished
RGMP154/96	igneous felsic intrusive	New England	250	6.4	0.48	GA-GSQ unpublished
RGMP162/96	igneous felsic intrusive	New England	270	8.49	0.34	GA-GSQ unpublished
RGMP170/96	igneous felsic intrusive	New England	251	7.59	0.39	GA-GSQ unpublished
RJB2241	igneous felsic intrusive	New England	250	0.61	0.92	GA-GSQ unpublished
RJB1002	igneous felsic intrusive	New England	250	3.32	0.71	GA-GSQ unpublished
RGMP51/96	igneous felsic intrusive	New England	234	5.96	0.5	GA-GSQ unpublished
RJB2777	igneous felsic intrusive	New England	229	5.27	0.55	GA-GSQ unpublished
RJB1469	igneous felsic intrusive	New England	130	4.95	0.49	GA-GSQ unpublished
GSO173	igneous felsic intrusive	New England	251	3.05	0.73	GA-GSQ unpublished
RGMP220/95	igneous felsic intrusive	New England	225	5.97	0.49	GA-GSQ unpublished
BB4830	igneous felsic intrusive	New England	275	6.87	0.47	GA-GSQ unpublished
2007839001	igneous felsic intrusive	New England	280	7.48	0.42	GA-GSQ unpublished
2007839003	igneous felsic intrusive	New England	255	4.16	0.65	GA-GSQ unpublished
2007839004	igneous felsic intrusive	New England	248	3.49	0.7	GA-GSQ unpublished
BB4824	igneous felsic intrusive	New England	290	-0.46	1.03	GA-GSQ unpublished
BB4601	igneous felsic intrusive	New England	322	1.74	0.89	GA-GSQ unpublished
BB4823	igneous felsic intrusive	New England	300	-0.64	1.05	GA-GSQ unpublished
RGMP159/96	igneous felsic intrusive	New England	230	7.4	0.39	GA-GSQ unpublished
BB4829	igneous felsic intrusive	New England	275	6.5	0.49	GA-GSQ unpublished
2007839002	igneous felsic intrusive	New England	257	3.92	0.67	GA-GSQ unpublished
RJB1246	igneous felsic intrusive	New England	244	2.79	0.75	GA-GSQ unpublished
BB4788	igneous felsic intrusive	New England	244	3.65	0.68	GA-GSQ unpublished
BB4820	igneous felsic intrusive	New England	130	4.68	0.51	GA-GSQ unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
BB4577	igneous felsic intrusive	New England	120	4.91	0.48	GA-GSQ unpublished
RGMP376/96	igneous intermediate intrusive	New England	140	5.45	0.46	GA-GSQ unpublished
RGMP201/96	igneous felsic intrusive	New England	369	6.98	0.54	GA-GSQ unpublished
RJB2782	igneous felsic intrusive	New England	260	2.71	0.77	GA-GSQ unpublished
RGMP112/95	igneous felsic intrusive	New England	251	7.84	0.37	GA-GSQ unpublished
BB4609	igneous felsic intrusive	New England	322	1.47	0.91	GA-GSQ unpublished
G385	igneous felsic intrusive	New England	292	-0.19	1.01	Hensel et al. 1985
WRA	igneous felsic intrusive	New England	254	1.22	0.87	Hensel et al. 1985
TOBA	igneous felsic intrusive	New England	292	0.71	0.94	Hensel et al. 1985
KIMBA	igneous felsic intrusive	New England	292	1.62	0.88	Hensel et al. 1985
INGA	igneous felsic intrusive	New England	292	0.19	0.98	Hensel et al. 1985
HA	igneous felsic intrusive	New England	292	0.73	0.94	Hensel et al. 1985
HRA	igneous felsic intrusive	New England	292	0.98	0.92	Hensel et al. 1985
GK6	igneous felsic intrusive	New England	292	-0.08	1	Hensel et al. 1985
HH142	igneous felsic intrusive	New England	292	0.11	0.99	Hensel et al. 1985
GG1	igneous felsic intrusive	New England	265	4.6	0.63	Hensel et al. 1985
DSGR1	igneous felsic intrusive	New England	256	1.31	0.87	Hensel et al. 1985
HM208	igneous felsic intrusive	New England	254	0.53	0.93	Hensel et al. 1985
WRA42	igneous felsic intrusive	New England	254	0.47	0.93	Hensel et al. 1985
G419	igneous felsic intrusive	New England	292	-0.85	1.06	Hensel et al. 1985
SHT1	igneous felsic intrusive	New England	254	0.95	0.89	Hensel et al. 1985
CT13	igneous felsic intrusive	New England	292	-0.22	1.01	Hensel et al. 1985
ORLA	igneous felsic intrusive	New England	254	-1.77	1.1	Hensel et al. 1985
G415	igneous felsic intrusive	New England	254	1.4	0.86	Hensel et al. 1985
RM2	igneous felsic intrusive	New England	240	4.55	0.61	Hensel et al. 1985
TM2	igneous felsic intrusive	New England	296	0.98	0.93	Hensel et al. 1985
853	igneous felsic intrusive	New England	290	1.64	0.87	Hensel et al. 1985
RIGDM	igneous felsic intrusive	New England	254	3.08	0.73	Hensel et al. 1985
G447	igneous felsic intrusive	New England	254	1.11	0.88	Hensel et al. 1985
WRA39	igneous felsic intrusive	New England	254	0.5	0.93	Hensel et al. 1985
KTXIG	unknown	New England	254	1.1	0.88	Hensel et al. 1985
G223	igneous felsic intrusive	New England	265	0.97	0.9	Hensel et al. 1985
G432	igneous felsic intrusive	New England	254	2.25	0.8	Hensel et al. 1985
DR	igneous felsic volcanic	New England	254	0.14	0.96	Hensel et al. 1985
ORLAX	unknown	New England	254	2.13	0.81	Hensel et al. 1985
CT5	unknown	New England	292	0.78	0.94	Hensel et al. 1985
DUND2X	unknown	New England	292	2.17	0.83	Hensel et al. 1985

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
KDD	igneous mafic intrusive	New England	254	1.21	0.87	Hensel et al. 1985
GOGS	igneous felsic intrusive	New England	260	4.32	0.64	Hensel et al. 1985
HH302	igneous felsic intrusive	New England	252	3.21	0.72	Hensel et al. 1985
PTVPT	igneous felsic intrusive	New England	254	0.7	0.91	Hensel et al. 1985
BCKT3	igneous felsic intrusive	New England	254	1.46	0.86	Hensel et al. 1985
HH284	igneous felsic intrusive	New England	254	-0.31	0.99	Hensel et al. 1985
G401	igneous felsic intrusive	New England	254	1.61	0.84	Hensel et al. 1985
HH304	igneous felsic intrusive	New England	248	4.25	0.64	Hensel et al. 1985
KT	igneous felsic intrusive	New England	254	-0.09	0.97	Hensel et al. 1985
WT	igneous felsic intrusive	New England	254	-0.12	0.97	Hensel et al. 1985
SHT2	igneous felsic intrusive	New England	254	1.55	0.85	Hensel et al. 1985
BTB	igneous felsic intrusive	New England	267	6.18	0.51	Hensel et al. 1985
IWSD01	igneous felsic intrusive	Pama	382	-9.17	1.76	GA unpublished
8928LMC0366	igneous intermediate intrusive	Sydney Basin	180	2.04	0.75	GA unpublished
88302221	igneous felsic intrusive	Thomson	480	-6.5	1.64	Fanning unpublished
88302122	igneous felsic intrusive	Thomson	420	-1.62	1.23	Fanning unpublished
88302114	igneous felsic intrusive	Thomson	420	-0.23	1.12	Fanning unpublished
88302044	igneous felsic intrusive	Thomson	420	-1.79	1.24	Fanning unpublished
88302032	igneous felsic intrusive	Thomson	420	-0.77	1.16	Fanning unpublished
88302052	igneous felsic intrusive	Thomson	420	-0.48	1.14	Fanning unpublished
RBRS1209	igneous felsic intrusive	Thomson	480	-2.59	1.35	Fanning unpublished
200701501	igneous felsic volcanic	Thomson	363	-5.73	1.49	GA unpublished
200701503	igneous felsic volcanic	Thomson	360	-4.47	1.39	GA unpublished
200901509	igneous felsic intrusive	Thomson	385	-5.5	1.49	GA unpublished
93839001A	igneous felsic intrusive	Thomson	420	-5.91	1.55	GA unpublished
93839009	igneous felsic intrusive	Thomson	460	-3.67	1.41	GA unpublished
200901509	igneous felsic intrusive	Thomson	385	-5.39	1.48	GA unpublished
89503064	igneous intermediate volcanic	Thomson	365	-2.12	1.22	GA unpublished
RJB3130	igneous felsic intrusive	Thomson	380	-5.5	1.49	GA-GSQ unpublished
RJB3129	igneous felsic intrusive	Thomson	380	-3.42	1.33	GA-GSQ unpublished
93839095	igneous felsic intrusive	Thomson	480	-4.14	1.47	GA-GSQ unpublished
RGMP88/86	igneous felsic intrusive	Thomson	480	7.78	0.57	GA-GSQ unpublished
93839078	igneous felsic intrusive	Thomson	480	-4.52	1.49	GA-GSQ unpublished
GS1629	igneous felsic intrusive	Thomson	480	7.77	0.57	GA-GSQ unpublished
RGMP10/85	igneous felsic intrusive	Thomson	480	7.74	0.57	GA-GSQ unpublished
RGMP89/86	igneous felsic intrusive	Thomson	480	7.04	0.62	GA-GSQ unpublished
2006839003	igneous felsic intrusive	Thomson	360	-3.03	1.28	GA-GSQ unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
RGMP432/91	igneous felsic intrusive	Thomson	375	-3.97	1.37	GA-GSQ unpublished
RGMP8/85	igneous felsic intrusive	Thomson	480	7.09	0.62	GA-GSQ unpublished
RGMP9/85	igneous felsic intrusive	Thomson	480	7.65	0.58	GA-GSQ unpublished
2007834001	igneous felsic intrusive	Thomson	380	-9.89	1.82	GA-GSQ unpublished
2007834006	igneous felsic intrusive	Thomson	380	-4.66	1.42	GA-GSQ unpublished
2007834005	igneous felsic intrusive	Thomson	380	-4.94	1.44	GA-GSQ unpublished
2007834004	igneous felsic intrusive	Thomson	380	-10.1	1.83	GA-GSQ unpublished
2007834003	igneous felsic intrusive	Thomson	380	-10.35	1.85	GA-GSQ unpublished
RGMP407/91	igneous felsic intrusive	Thomson	382	-3.26	1.32	GA-GSQ unpublished
BB1715	igneous felsic intrusive	Thomson	480	-3.87	1.45	GA-GSQ unpublished
2006839001	igneous felsic intrusive	Thomson	360	-3.23	1.3	GA-GSQ unpublished

Appendix Table B.5 Neodymium isotopic data for rocks of the Pinjarra Element. Data sources specified in the Reference column. Refer to for Appendix Table A.2 for full Province names.

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
1797	high grade metamorphic rock	Pinjarra Orogen	1050	-8.28	2.25	Fletcher et al. 1985
56433B	high grade metamorphic rock	Pinjarra Orogen	1050	-7.99	2.23	Fletcher et al. 1985
1672	high grade metamorphic rock	Pinjarra Orogen	1050	-9.7	2.36	Fletcher et al. 1985
1757	high grade metamorphic rock	Pinjarra Orogen	1050	-10.4	2.41	Fletcher et al. 1985
1758	high grade metamorphic rock	Pinjarra Orogen	1050	-7.49	2.19	Fletcher et al. 1985
57430	igneous felsic	Pinjarra Orogen	1050	-8.08	2.24	Fletcher et al. 1985
20593	high grade metamorphic rock	Pinjarra Orogen	1050	-8.58	2.28	Fletcher et al. 1985
82-426	high grade metamorphic rock	Pinjarra Orogen	560	-1.94	1.37	McCulloch 1987
82-427a	high grade metamorphic rock	Pinjarra Orogen	560	-0.34	1.25	McCulloch 1987

Appendix Table B.6 Neodymium isotopic data for rocks of the Central Australia Element. Data sources specified in the Reference column. Refer to for Appendix Table A.2 for full Province names.

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
60711	igneous	Gascoyne	2540	-0.77	2.93	Fletcher et al 1983a
69103	igneous felsic intrusive	Gascoyne	1800	-3.33	2.51	Fletcher et al 1983a
60713	igneous felsic intrusive	Gascoyne	2540	3.2	2.63	Fletcher et al 1983a
60706	high grade metamorphic rock	Gascoyne	1650	-7.55	2.7	Fletcher et al 1983a
60720	igneous felsic intrusive	Gascoyne	1975	-5.1	2.79	Fletcher et al 1983a
142849	igneous felsic intrusive	Gascoyne	1812	-14.26	3.34	Sheppard et al. 2003
135449	igneous felsic intrusive	Gascoyne	1801	-7.89	2.85	Sheppard et al. 2003
164306	igneous felsic intrusive	Gascoyne	1812	-13.29	3.27	Sheppard et al. 2003
164305	igneous felsic intrusive	Gascoyne	1812	-11.48	3.13	Sheppard et al. 2003
142900	igneous felsic intrusive	Gascoyne	1802	-6.81	2.77	Sheppard et al. 2003
142852	igneous felsic intrusive	Gascoyne	1797	-7.92	2.85	Sheppard et al. 2003
164302	igneous felsic intrusive	Gascoyne	1812	-5.85	2.71	Sheppard et al. 2003
142854	igneous felsic intrusive	Gascoyne	1812	-7.35	2.82	Sheppard et al. 2003
135485	igneous felsic intrusive	Gascoyne	1806	-6.74	2.77	Sheppard et al. 2003
144854	igneous mafic	Gascoyne	1990	0.11	2.41	Sheppard et al. 2004
142933	igneous mafic intrusive	Gascoyne	1989	-1.21	2.51	Sheppard et al. 2004
142850	igneous felsic intrusive	Gascoyne	1958	-3.4	2.64	Sheppard et al. 2004
142911	igneous felsic intrusive	Gascoyne	1961	-5.81	2.83	Sheppard et al. 2004
142912	igneous felsic intrusive	Gascoyne	1961	-6.54	2.88	Sheppard et al. 2004
159778	igneous felsic intrusive	Gascoyne	1961	-6.35	2.87	Sheppard et al. 2004
142928	igneous felsic intrusive	Gascoyne	1974	-4.68	2.75	Sheppard et al. 2004
142926	igneous felsic intrusive	Gascoyne	2002	-3.79	2.71	Sheppard et al. 2004
168949	igneous felsic intrusive	Gascoyne	1954	-10.89	3.21	Sheppard et al. 2004
142988	igneous felsic	Gascoyne	2552	-1.26	2.98	Sheppard et al. 2004
159781	igneous felsic intrusive	Gascoyne	2002	-5.32	2.83	Sheppard et al. 2004
168947	igneous felsic	Gascoyne	2006	-7.53	3	Sheppard et al. 2004
144836	igneous felsic intrusive	Gascoyne	1977	-4.05	2.71	Sheppard et al. 2004
144833	igneous felsic intrusive	Gascoyne	1999	-3.26	2.67	Sheppard et al. 2004
164309	igneous felsic intrusive	Gascoyne	2544	-0.53	2.92	Sheppard et al. 2004
142925	igneous felsic intrusive	Gascoyne	2002	-4.77	2.78	Sheppard et al. 2004
159780	igneous felsic intrusive	Gascoyne	2000	-5.23	2.82	Sheppard et al. 2004
142930	igneous felsic intrusive	Gascoyne	1994	-5.57	2.84	Sheppard et al. 2004

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
159782	igneous felsic intrusive	Gascoyne	1985	-5.85	2.85	Sheppard et al. 2004
142932	igneous felsic intrusive	Gascoyne	1977	-5.06	2.78	Sheppard et al. 2004
159765	high grade metamorphic rock	Gascoyne	1990	1.71	2.29	Sheppard et al. 2004
96929	igneous mafic volcanic	Pilbara	2970	-1.41	3.34	Arndt et al. 2001
96958	igneous mafic volcanic	Pilbara	2970	-1.53	3.35	Arndt et al. 2001
96957	igneous mafic volcanic	Pilbara	2970	-2.28	3.4	Arndt et al. 2001
105710	igneous mafic volcanic	Pilbara	2700	0.33	2.98	Arndt et al. 2001
96946	igneous mafic volcanic	Pilbara	2970	-1.84	3.37	Arndt et al. 2001
96938	igneous mafic volcanic	Pilbara	2970	-2.24	3.4	Arndt et al. 2001
96932	igneous mafic volcanic	Pilbara	2970	-1.75	3.36	Arndt et al. 2001
M17	igneous mafic volcanic	Pilbara	2690	-2.35	3.18	Arndt et al. 2001
M16	igneous mafic volcanic	Pilbara	2690	-3.76	3.28	Arndt et al. 2001
97419K	igneous mafic volcanic	Pilbara	2720	-3.29	3.27	Arndt et al. 2001
96994K	igneous mafic volcanic	Pilbara	2720	-2.68	3.23	Arndt et al. 2001
96959	igneous mafic volcanic	Pilbara	2970	-2.01	3.38	Arndt et al. 2001
96915R	igneous mafic volcanic	Pilbara	2780	-2.1	3.23	Arndt et al. 2001
96975	igneous mafic volcanic	Pilbara	3010	0.01	3.27	Arndt et al. 2001
96960	igneous mafic volcanic	Pilbara	2970	-1.45	3.34	Arndt et al. 2001
96954N	igneous mafic volcanic	Pilbara	2970	-1.75	3.36	Arndt et al. 2001
96952N	igneous mafic volcanic	Pilbara	2970	-2.64	3.43	Arndt et al. 2001
96951N	igneous mafic volcanic	Pilbara	2970	-1.31	3.33	Arndt et al. 2001
71RWD21	igneous mafic volcanic	Pilbara	3270	0.43	3.45	Arndt et al. 2001
96911R	igneous mafic volcanic	Pilbara	2780	-2.82	3.29	Arndt et al. 2001
96978	igneous mafic volcanic	Pilbara	3010	-1.35	3.37	Arndt et al. 2001
96914R	igneous mafic volcanic	Pilbara	2780	-1.89	3.22	Arndt et al. 2001
96970	igneous mafic volcanic	Pilbara	3010	0.04	3.26	Arndt et al. 2001
96968	igneous mafic volcanic	Pilbara	2970	-1.65	3.36	Arndt et al. 2001
96967	igneous mafic volcanic	Pilbara	2970	-2.3	3.41	Arndt et al. 2001
96965	igneous mafic volcanic	Pilbara	2970	-1.59	3.35	Arndt et al. 2001
96963	igneous mafic volcanic	Pilbara	2970	-2.01	3.38	Arndt et al. 2001
96962	igneous mafic volcanic	Pilbara	2970	-2.25	3.4	Arndt et al. 2001
96961	igneous mafic volcanic	Pilbara	2970	-1.96	3.38	Arndt et al. 2001
71RWD1	igneous mafic volcanic	Pilbara	3270	0.88	3.42	Arndt et al. 2001

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
96979R	igneous mafic volcanic	Pilbara	2780	-2.16	3.24	Arndt et al. 2001
99854	igneous mafic volcanic	Pilbara	2700	-0.77	3.07	Arndt et al. 2001
EM59	igneous mafic volcanic	Pilbara	3470	0.31	3.63	Arndt et al. 2001
EM69	igneous mafic volcanic	Pilbara	3470	0.58	3.61	Arndt et al. 2001
96910R	igneous mafic volcanic	Pilbara	2780	-2.17	3.24	Arndt et al. 2001
EM70	igneous mafic volcanic	Pilbara	3470	1.03	3.57	Arndt et al. 2001
99856	igneous mafic volcanic	Pilbara	2700	0.22	2.99	Arndt et al. 2001
EM71	igneous mafic volcanic	Pilbara	3470	1.03	3.57	Arndt et al. 2001
EM82	igneous mafic volcanic	Pilbara	3470	1.35	3.55	Arndt et al. 2001
105701	igneous mafic volcanic	Pilbara	2700	-0.46	3.04	Arndt et al. 2001
105704	igneous mafic volcanic	Pilbara	2700	-0.31	3.03	Arndt et al. 2001
105707	igneous mafic volcanic	Pilbara	2700	0.35	2.98	Arndt et al. 2001
SB593	igneous felsic intrusive	Pilbara	2851	-8.01	3.74	Bickle et al. 1989
SB450	igneous felsic intrusive	Pilbara	2925	-4.47	3.53	Bickle et al. 1989
S9	igneous felsic intrusive	Pilbara	2925	-5.23	3.59	Bickle et al. 1989
SB599	igneous felsic intrusive	Pilbara	2925	-3.32	3.45	Bickle et al. 1989
Y1-5	igneous felsic intrusive	Pilbara	2908	-3.41	3.44	Bickle et al. 1989
Y1-7	igneous felsic intrusive	Pilbara	2908	-3.23	3.42	Bickle et al. 1989
SB584	igneous felsic intrusive	Pilbara	2851	-6.1	3.59	Bickle et al. 1989
SB437	igneous felsic intrusive	Pilbara	2928	-4.37	3.53	Bickle et al. 1989
A171-4	igneous felsic intrusive	Pilbara	3470	1.65	3.53	Bickle et al. 1993
SB611	igneous felsic intrusive	Pilbara	3470	-0.82	3.71	Bickle et al. 1993
SB615	igneous felsic intrusive	Pilbara	3470	-1.53	3.77	Bickle et al. 1993
SB616	igneous felsic intrusive	Pilbara	3470	1	3.57	Bickle et al. 1993
A11-4	igneous felsic intrusive	Pilbara	3470	0.77	3.59	Bickle et al. 1993
A207-1	igneous felsic intrusive	Pilbara	3470	0.74	3.59	Bickle et al. 1993
A195-1	igneous felsic intrusive	Pilbara	3470	-0.57	3.69	Bickle et al. 1993
203366	igneous felsic intrusive	Pilbara	3239	-1	3.53	Brauhart & Morant 2000
203368	igneous felsic intrusive	Pilbara	3238	-0.5	3.49	Brauhart & Morant 2000
207334	igneous felsic volcanic	Pilbara	3238	-0.49	3.49	Brauhart & Morant 2000
207186	igneous mafic intrusive	Pilbara	3238	-0.42	3.49	Brauhart & Morant 2000
84770021	igneous ultramafic intrusive	Pilbara	2925	0.08	3.19	GA Shen-Su Sun
84770094	igneous mafic intrusive	Pilbara	2925	-0.33	3.22	GA Shen-Su Sun

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
84770115	igneous felsic intrusive	Pilbara	2927	-0.04	3.2	GA Shen-Su Sun
84770094	igneous mafic intrusive	Pilbara	2925	-0.1	3.2	GA Shen-Su Sun
84770042	igneous ultramafic intrusive	Pilbara	2925	-0.35	3.22	GA Shen-Su Sun
87330127	igneous mafic intrusive	Pilbara	3016	-0.28	3.29	GA Shen-Su Sun
84770094	igneous mafic intrusive	Pilbara	2925	-0.09	3.2	GA Shen-Su Sun
84770094	igneous mafic intrusive	Pilbara	2925	-0.04	3.2	GA Shen-Su Sun
84770061	igneous mafic intrusive	Pilbara	2925	-0.11	3.2	GA Shen-Su Sun
84770061	igneous mafic intrusive	Pilbara	2925	19.35	1.74	GA Shen-Su Sun
84770052	igneous mafic intrusive	Pilbara	2925	-0.16	3.21	GA Shen-Su Sun
84770052	igneous mafic intrusive	Pilbara	2925	-0.17	3.21	GA Shen-Su Sun
80040250	igneous mafic volcanic	Pilbara	3150	1.01	3.31	GA unpublished
2006651001	igneous intermediate intrusive	Pilbara	3465	0.73	3.59	GA unpublished
80040221	igneous mafic volcanic	Pilbara	3150	0.91	3.31	GA unpublished
125404	igneous felsic intrusive	Pilbara	2500	2.18	2.68	GA-GSWA unpublished
98049219	igneous felsic intrusive	Pilbara	2850	-0.63	3.18	GA-GSWA unpublished
118975	igneous felsic volcanic	Pilbara	3251	0.31	3.44	GA-GSWA unpublished
114305	igneous felsic volcanic	Pilbara	3115	2.65	3.15	GA-GSWA unpublished
114358	igneous felsic volcanic	Pilbara	3122	1.34	3.26	GA-GSWA unpublished
114356	igneous felsic volcanic	Pilbara	3118	1.69	3.23	GA-GSWA unpublished
114350	igneous felsic volcanic	Pilbara	3125	3.58	3.09	GA-GSWA unpublished
136826	unknown	Pilbara	2944	0.49	3.17	GA-GSWA unpublished
118973	igneous felsic volcanic	Pilbara	3010	0.76	3.21	GA-GSWA unpublished
136833	igneous felsic intrusive	Pilbara	3100	2.48	3.15	GA-GSWA unpublished
84770115	igneous felsic intrusive	Pilbara	2990	0.32	3.23	GA-GSWA unpublished
118964	igneous felsic intrusive	Pilbara	2925	0.11	3.19	GA-GSWA unpublished
127330	sedimentary	Pilbara	3058	0.45	3.27	GA-GSWA unpublished
136834	igneous felsic	Pilbara	3100	2.6	3.15	GA-GSWA unpublished
127320	igneous felsic intrusive	Pilbara	3014	1.99	3.12	GA-GSWA unpublished
127334	igneous felsic intrusive	Pilbara	3000	0.67	3.21	GA-GSWA unpublished
141945	igneous felsic intrusive	Pilbara	2765	-2.34	3.24	GA-GSWA unpublished
118966	igneous felsic intrusive	Pilbara	3014	-0.42	3.3	GA-GSWA unpublished
118967	igneous felsic intrusive	Pilbara	2948	0.56	3.17	GA-GSWA unpublished
141977	igneous felsic intrusive	Pilbara	2931	-0.26	3.22	GA-GSWA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
98049174B	igneous felsic intrusive	Pilbara	2940	0.2	3.19	GA-GSWA unpublished
127327	igneous felsic intrusive	Pilbara	3018	0.55	3.23	GA-GSWA unpublished
98049159	igneous felsic intrusive	Pilbara	2950	0.75	3.16	GA-GSWA unpublished
127333	sedimentary	Pilbara	3000	1.16	3.17	GA-GSWA unpublished
127328	metasedimentary	Pilbara	3000	0.41	3.23	GA-GSWA unpublished
118965	igneous felsic intrusive	Pilbara	3093	2.85	3.12	GA-GSWA unpublished
98049154	igneous felsic intrusive	Pilbara	2850	1.64	3.01	GA-GSWA unpublished
97045003	igneous felsic intrusive	Pilbara	2930	1.1	3.12	GA-GSWA unpublished
98049140	igneous felsic intrusive	Pilbara	2930	-1.4	3.31	GA-GSWA unpublished
97045053	igneous felsic intrusive	Pilbara	2850	-0.81	3.19	GA-GSWA unpublished
118976	igneous felsic volcanic	Pilbara	3023	-0.63	3.32	GA-GSWA unpublished
168920	igneous felsic volcanic	Pilbara	3467	0.73	3.59	GSWA-GA unpublished
97045027A	igneous mafic volcanic	Pilbara	2970	-1.93	3.38	GSWA-GA unpublished
174442	igneous mafic volcanic	Pilbara	3120	8.46	2.72	GSWA-GA unpublished
160238	ultraigneous mafic volcanic	Pilbara	3200	0.56	3.38	GSWA-GA unpublished
168995	igneous felsic volcanic	Pilbara	3515	0.95	3.62	GSWA-GA unpublished
168915	igneous felsic volcanic	Pilbara	3432	0.72	3.56	GSWA-GA unpublished
98049027A	igneous mafic intrusive	Pilbara	2970	0.47	3.2	GSWA-GA unpublished
179711	igneous felsic volcanic	Pilbara	3470	1.27	3.55	GSWA-GA unpublished
176712	igneous mafic volcanic	Pilbara	3200	3.46	3.16	GSWA-GA unpublished
160725	igneous felsic intrusive	Pilbara	2850	-2.02	3.28	GSWA-GA unpublished
160705	igneous felsic intrusive	Pilbara	2950	-0.15	3.23	GSWA-GA unpublished
141986	igneous intermediate intrusive	Pilbara	2946	1.07	3.13	GSWA-GA unpublished
59363#2	igneous felsic intrusive	Pilbara	3420	1.84	3.47	GSWA-GA unpublished
59363	igneous felsic intrusive	Pilbara	3420	2.11	3.45	GSWA-GA unpublished
179713	igneous felsic volcanic	Pilbara	3470	1.73	3.52	GSWA-GA unpublished
160235	igneous mafic volcanic	Pilbara	3200	1.48	3.31	GSWA-GA unpublished
98049027AR	igneous mafic intrusive	Pilbara	2970	0.4	3.2	GSWA-GA unpublished
142492	igneous mafic intrusive	Pilbara	2950	-1.53	3.33	GSWA-GA unpublished
168936	igneous mafic intrusive	Pilbara	3016	0.33	3.25	GSWA-GA unpublished
142212	igneous mafic volcanic	Pilbara	2970	-0.75	3.29	GSWA-GA unpublished
142223	igneous mafic volcanic	Pilbara	2970	-0.64	3.28	GSWA-GA unpublished
176737	igneous mafic volcanic	Pilbara	3010	-0.02	3.27	GSWA-GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
142350	igneous mafic volcanic	Pilbara	2970	-1.52	3.35	GSWA-GA unpublished
176722	igneous mafic volcanic	Pilbara	3200	-6.55	3.92	GSWA-GA unpublished
160240	igneous mafic volcanic	Pilbara	3270	0.26	3.46	GSWA-GA unpublished
174391	igneous mafic volcanic	Pilbara	2950	-0.16	3.23	GSWA-GA unpublished
174430	igneous mafic volcanic	Pilbara	3200	-0.57	3.47	GSWA-GA unpublished
174431	igneous mafic volcanic	Pilbara	3200	-1.52	3.54	GSWA-GA unpublished
174434	igneous mafic volcanic	Pilbara	3200	1.32	3.32	GSWA-GA unpublished
174445	igneous mafic volcanic	Pilbara	3120	1.4	3.25	GSWA-GA unpublished
142288	igneous mafic volcanic	Pilbara	2970	-0.85	3.3	GSWA-GA unpublished
127378	igneous felsic volcanic	Pilbara	3117	1.63	3.23	GSWA-GA unpublished
142858	igneous mafic intrusive	Pilbara	3000	5.29	2.86	GSWA-GA unpublished
142534	igneous felsic intrusive	Pilbara	3100	1.63	3.22	GSWA-GA unpublished
142536	igneous felsic intrusive	Pilbara	3100	1.38	3.24	GSWA-GA unpublished
160501	igneous felsic intrusive	Pilbara	2990	-0.81	3.31	GSWA-GA unpublished
160502	igneous felsic intrusive	Pilbara	2990	-1.34	3.35	GSWA-GA unpublished
59244#2	igneous felsic intrusive	Pilbara	3313	0.47	3.48	GSWA-GA unpublished
142661	igneous felsic intrusive	Pilbara	3068	1.15	3.23	GSWA-GA unpublished
142869	igneous felsic intrusive	Pilbara	3244	-0.28	3.48	GSWA-GA unpublished
174438	igneous intermediate volcanic	Pilbara	3120	2.04	3.2	GSWA-GA unpublished
180232	igneous intermediate volcanic	Pilbara	3120	1.74	3.23	GSWA-GA unpublished
174451	igneous mafic volcanic	Pilbara	3120	2.05	3.2	GSWA-GA unpublished
174454	igneous mafic volcanic	Pilbara	3120	2.11	3.2	GSWA-GA unpublished
180229	igneous mafic volcanic	Pilbara	3120	1.59	3.24	GSWA-GA unpublished
174460	igneous mafic volcanic	Pilbara	3115	1.49	3.24	GSWA-GA unpublished
142535	igneous felsic intrusive	Pilbara	3236	1.26	3.36	GSWA-GA unpublished
142893	igneous felsic intrusive	Pilbara	2982	-1.14	3.33	GSWA-GA unpublished
174312	igneous felsic intrusive	Pilbara	2940	-2.06	3.36	GSWA-GA unpublished
174463	igneous mafic volcanic	Pilbara	3115	2.17	3.19	GSWA-GA unpublished
143810	igneous felsic intrusive	Pilbara	3244	-1.27	3.56	GSWA-GA unpublished
136844	igneous felsic intrusive	Pilbara	2997	-1.44	3.36	GSWA-GA unpublished
142431	igneous felsic intrusive	Pilbara	3270	0.88	3.42	GSWA-GA unpublished
142432	igneous felsic intrusive	Pilbara	3270	0.47	3.45	GSWA-GA unpublished
142870r	igneous felsic	Pilbara	3366	-0.85	3.63	GSWA-GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
142430	igneous felsic intrusive	Pilbara	2970	-1.48	3.34	GSWA-GA unpublished
142870	igneous felsic intrusive	Pilbara	3366	-1.06	3.64	GSWA-GA unpublished
142433	igneous felsic intrusive	Pilbara	3270	0	3.48	GSWA-GA unpublished
143805	igneous felsic intrusive	Pilbara	3252	-0.81	3.53	GSWA-GA unpublished
59270	igneous felsic intrusive	Pilbara	3317	1.49	3.41	GSWA-GA unpublished
59244	igneous felsic intrusive	Pilbara	3313	0.32	3.5	GSWA-GA unpublished
142874	igneous felsic intrusive	Pilbara	3242	0.12	3.45	GSWA-GA unpublished
174497	igneous mafic volcanic	Pilbara	3115	0.75	3.3	GSWA-GA unpublished
148881	igneous felsic intrusive	Pilbara	3270	1.34	3.38	GSWA-GA unpublished
98049100	igneous felsic intrusive	Pilbara	2850	0.74	3.08	GSWA-GA unpublished
160678	igneous felsic intrusive	Pilbara	2940	-4.73	3.56	GSWA-GA unpublished
160650	igneous felsic intrusive	Pilbara	3200	-0.56	3.47	GSWA-GA unpublished
160642	igneous felsic intrusive	Pilbara	3000	-4.86	3.62	GSWA-GA unpublished
174318	igneous felsic intrusive	Pilbara	2940	-3.27	3.45	GSWA-GA unpublished
160646	igneous felsic intrusive	Pilbara	3200	1.67	3.3	GSWA-GA unpublished
97045162	igneous felsic intrusive	Pilbara	2930	0.2	3.18	GSWA-GA unpublished
160760#2	igneous felsic intrusive	Pilbara	3200	-2.01	3.58	GSWA-GA unpublished
153188	igneous felsic intrusive	Pilbara	3484	1.25	3.57	GSWA-GA unpublished
174489	igneous mafic volcanic	Pilbara	3115	1.56	3.24	GSWA-GA unpublished
98049136	igneous felsic intrusive	Pilbara	2940	3.19	2.97	GSWA-GA unpublished
142170	igneous felsic intrusive	Pilbara	3421	-1.34	3.71	GSWA-GA unpublished
142263	igneous mafic intrusive	Pilbara	2970	-0.29	3.25	GSWA-GA unpublished
97045021	igneous felsic intrusive	Pilbara	2930	1.17	3.11	GSWA-GA unpublished
174185	igneous felsic intrusive	Pilbara	3300	-0.34	3.53	GSWA-GA unpublished
160797	igneous felsic intrusive	Pilbara	2940	-2.16	3.37	GSWA-GA unpublished
160794	igneous felsic intrusive	Pilbara	2940	-2.41	3.39	GSWA-GA unpublished
160685	igneous felsic intrusive	Pilbara	2940	-4.09	3.52	GSWA-GA unpublished
142020	igneous felsic intrusive	Pilbara	3165	1.06	3.32	GSWA-GA unpublished
142019	igneous felsic intrusive	Pilbara	3165	-0.39	3.42	GSWA-GA unpublished
160794#2	igneous felsic intrusive	Pilbara	2940	-3.22	3.45	GSWA-GA unpublished
179775	igneous intermediate volcanic	Pilbara	3515	1.71	3.56	GSWA-GA unpublished
142347	igneous mafic intrusive	Pilbara	2948	0.04	3.21	GSWA-GA unpublished
142260	igneous mafic intrusive	Pilbara	2948	-0.08	3.22	GSWA-GA unpublished

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
142359	igneous intermediate volcanic	Pilbara	2950	-0.88	3.28	GSWA-GA unpublished
142193	igneous intermediate volcanic	Pilbara	2970	-1.51	3.35	GSWA-GA unpublished
169025	igneous felsic volcanic	Pilbara	2948	-1.53	3.33	GSWA-GA unpublished
168934	igneous felsic intrusive	Pilbara	2988	-39.6	6.23	GSWA-GA unpublished
179871	igneous felsic volcanic	Pilbara	3432	0.87	3.55	GSWA-GA unpublished
160760	igneous felsic intrusive	Pilbara	3200	-3.16	3.66	GSWA-GA unpublished
179718	igneous intermediate volcanic	Pilbara	3470	1.05	3.57	GSWA-GA unpublished
179806	igneous mafic volcanic	Pilbara	3515	0.89	3.62	GSWA-GA unpublished
176740	igneous mafic volcanic	Pilbara	3000	-2.13	3.42	GSWA-GA unpublished
179782	igneous mafic volcanic	Pilbara	3515	0.93	3.62	GSWA-GA unpublished
179760	igneous mafic volcanic	Pilbara	3515	1.4	3.58	GSWA-GA unpublished
179737	igneous mafic volcanic	Pilbara	3460	0.86	3.58	GSWA-GA unpublished
179873	igneous felsic volcanic	Pilbara	3432	1.24	3.53	GSWA-GA unpublished
176747	igneous mafic volcanic	Pilbara	3000	-2.04	3.41	GSWA-GA unpublished
174479	igneous mafic volcanic	Pilbara	3200	1.66	3.3	GSWA-GA unpublished
179791	igneous intermediate volcanic	Pilbara	3515	0.64	3.64	GSWA-GA unpublished
179731	igneous mafic volcanic	Pilbara	3475	0.77	3.6	GSWA-GA unpublished
174477	igneous mafic volcanic	Pilbara	3200	2.56	3.23	GSWA-GA unpublished
3808	igneous felsic volcanic	Pilbara	3480	-0.11	3.67	Jahn et al. 1981
3807	igneous felsic volcanic	Pilbara	3480	0.14	3.65	Jahn et al. 1981
3806	igneous felsic volcanic	Pilbara	3480	1.1	3.58	Jahn et al. 1981
3809	igneous intermediate volcanic	Pilbara	3480	1.42	3.55	Jahn et al. 1981
15255	igneous felsic intrusive	Pilbara	3470	0.39	3.62	McCulloch 1987
49250	igneous felsic volcanic	Pilbara	3470	0.45	3.62	McCulloch 1987
26218	igneous felsic intrusive	Pilbara	2925	-6.67	3.7	McCulloch 1987
15207	igneous felsic intrusive	Pilbara	2851	-4.12	3.44	McCulloch 1987
JS44	igneous felsic intrusive	Pilbara	2990	0.33	3.22	Smith et al. (1998)
JS35	igneous felsic intrusive	Pilbara	3013	0.67	3.22	Smith et al. (1998)
JS42	igneous felsic intrusive	Pilbara	2925	-0.62	3.24	Smith et al. (1998)
JS33	igneous felsic intrusive	Pilbara	3114	0.98	3.28	Smith et al. (1998)
JS20	igneous felsic intrusive	Pilbara	3114	1.96	3.21	Smith et al. (1998)
JS25	igneous felsic intrusive	Pilbara	3024	-1.29	3.38	Smith et al. (1998)
JS43	igneous felsic intrusive	Pilbara	3265	0.2	3.46	Smith et al. (1998)

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
JS17	igneous felsic intrusive	Pilbara	3261	-0.2	3.49	Smith et al. (1998)
84770094	igneous mafic intrusive	Pilbara	2925	-0.21	3.21	Sun & Hoatson 1992
84770061	igneous mafic intrusive	Pilbara	2925	-0.3	3.22	Sun & Hoatson 1992
84770060	igneous mafic intrusive	Pilbara	2925	-0.4	3.23	Sun & Hoatson 1992
84770052	igneous mafic intrusive	Pilbara	2925	-0.06	3.2	Sun & Hoatson 1992
84770048	igneous mafic intrusive	Pilbara	2925	-0.2	3.21	Sun & Hoatson 1992
84770083	igneous felsic intrusive	Pilbara	2990	0.19	3.24	Sun & Hoatson 1992
84770094	igneous mafic intrusive	Pilbara	2925	-0.41	3.23	Sun & Hoatson 1992
84770045	igneous mafic intrusive	Pilbara	2925	-0.71	3.25	Sun & Hoatson 1992
84770045	igneous mafic intrusive	Pilbara	2925	-0.63	3.24	Sun & Hoatson 1992
83330136	igneous mafic intrusive	Pilbara	2925	-0.3	3.22	Sun & Hoatson 1992
88330196	igneous mafic intrusive	Pilbara	3016	-0.82	3.33	Sun & Hoatson 1992
87330127	igneous mafic intrusive	Pilbara	3016	0.66	3.22	Sun & Hoatson 1992
86330069	igneous mafic intrusive	Pilbara	3016	0.28	3.25	Sun & Hoatson 1992
86330020	igneous mafic intrusive	Pilbara	2000	3.16	2.18	Sun & Hoatson 1992
88330213	igneous mafic intrusive	Pilbara	3016	-0.24	3.29	Sun & Hoatson 1992
84770046	igneous mafic intrusive	Pilbara	2925	-0.18	3.21	Sun & Hoatson 1992
84770048	igneous mafic intrusive	Pilbara	2925	-0.43	3.23	Sun & Hoatson 1992
84770003	igneous ultramafic intrusive	Pilbara	2925	-0.36	3.22	Sun & Hoatson 1992
86330008	igneous ultramafic intrusive	Pilbara	3016	-0.44	3.3	Sun & Hoatson 1992
85770174	igneous ultramafic intrusive	Pilbara	2925	-0.36	3.22	Sun & Hoatson 1992
84770042	igneous ultramafic intrusive	Pilbara	2925	-0.44	3.23	Sun & Hoatson 1992
84770021	igneous ultramafic intrusive	Pilbara	2925	-0.11	3.2	Sun & Hoatson 1992
83330172	igneous mafic intrusive	Pilbara	3016	-0.36	3.3	Sun & Hoatson 1992
83330141	igneous ultramafic intrusive	Pilbara	2925	-0.26	3.21	Sun & Hoatson 1992
83330145	igneous ultramafic intrusive	Pilbara	2925	-0.46	3.23	Sun & Hoatson 1992
85770172	igneous mafic intrusive	Pilbara	2925	-0.51	3.23	Sun & Hoatson 1992
85770179	igneous mafic intrusive	Pilbara	2925	-0.15	3.21	Sun & Hoatson 1992
54998	igneous felsic intrusive	Pilbara	2950	-1.27	3.31	Tyler et al. 1992
18481	igneous felsic intrusive	Pilbara	2851	-4.22	3.45	Tyler et al. 1992
18484	igneous felsic intrusive	Pilbara	2851	-4.77	3.49	Tyler et al. 1992
18487	igneous felsic intrusive	Pilbara	2851	-4.23	3.45	Tyler et al. 1992
76316	igneous felsic intrusive	Pilbara	2897	-1.92	3.32	Tyler et al. 1992

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
85332	igneous felsic intrusive	Pilbara	2950	-1.53	3.33	Tyler et al. 1992
85320	igneous felsic intrusive	Pilbara	2950	-2.39	3.4	Tyler et al. 1992
85317	igneous felsic intrusive	Pilbara	2950	-0.1	3.22	Tyler et al. 1992
85313	igneous felsic intrusive	Pilbara	2950	-1.21	3.31	Tyler et al. 1992
76319	igneous felsic intrusive	Pilbara	2838	-1.81	3.26	Tyler et al. 1992
76339	igneous felsic intrusive	Pilbara	2838	-3.75	3.41	Tyler et al. 1992
76307	igneous felsic intrusive	Pilbara	2897	-1.93	3.32	Tyler et al. 1992
76338	high grade metamorphic rock	Pilbara	3285	1.75	3.36	Tyler et al. 1992
54999	igneous felsic intrusive	Pilbara	2950	-0.95	3.29	Tyler et al. 1992
85338	igneous intermediate intrusive	Pilbara	2950	-2.22	3.38	Tyler et al. 1992
99969014B	igneous felsic intrusive	Yilgarn	2693	2.96	2.78	Barley et al. 2003
99969014A	igneous felsic intrusive	Yilgarn	2693	-1.04	3.08	Barley et al. 2003
99967009	igneous felsic intrusive	Yilgarn	2650	1.31	2.87	Barley et al. 2003
99967018	igneous felsic intrusive	Yilgarn	2640	0.45	2.92	Barley et al. 2003
2000969003	igneous felsic intrusive	Yilgarn	2703	2.53	2.82	Barley et al. 2003
2000969004	igneous felsic intrusive	Yilgarn	2703	2.19	2.84	Barley et al. 2003
2000969006	igneous felsic intrusive	Yilgarn	2664	2.94	2.76	Barley et al. 2003
99969017	igneous felsic intrusive	Yilgarn	2650	1.71	2.84	Barley et al. 2003
2001967045	igneous felsic intrusive	Yilgarn	2649	0.45	2.93	Barley et al. 2003
2001967053A	igneous felsic intrusive	Yilgarn	2770	0.15	3.05	Barley et al. 2003
2001967053B	igneous felsic intrusive	Yilgarn	2650	0.02	2.96	Barley et al. 2003
96969087	igneous felsic intrusive	Yilgarn	2660	1.45	2.86	Barley et al. 2003
2001967009	igneous felsic intrusive	Yilgarn	2630	0.32	2.92	Barley et al. 2003
2001969122	igneous felsic intrusive	Yilgarn	2939	1.06	3.13	Barley et al. 2003
2001969005	igneous felsic intrusive	Yilgarn	2667	3.61	2.71	Barley et al. 2003
97969049	igneous felsic intrusive	Yilgarn	2640	-2.48	3.14	Barley et al. 2003
MQ	sedimentary	Yilgarn	2660	1.53	2.86	Barley et al. 2003
2001969001	igneous felsic intrusive	Yilgarn	2632	0.17	2.94	Barley et al. 2003
KU-3	sedimentary	Yilgarn	2660	1.91	2.83	Barley et al. 2003
115571	igneous felsic intrusive	Yilgarn	2665	0.99	2.9	Barley et al. 2003
115559	igneous felsic intrusive	Yilgarn	2638	0.65	2.91	Barley et al. 2003
115552	igneous felsic intrusive	Yilgarn	2665	2.11	2.82	Barley et al. 2003
115542	igneous felsic intrusive	Yilgarn	2690	2.44	2.82	Barley et al. 2003

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
MB	sedimentary	Yilgarn	2660	2.89	2.76	Barley et al. 2003
115595	igneous felsic intrusive	Yilgarn	2675	0.61	2.94	Barley et al. 2003
109358	igneous felsic intrusive	Yilgarn	2667	1.38	2.88	Barley et al. 2003
E338	sedimentary	Yilgarn	2660	2.88	2.76	Barley et al. 2003
2001969103	igneous intermediate intrusive	Yilgarn	2645	2.32	2.79	Barley et al. 2003
96969087	igneous felsic intrusive	Yilgarn	2660	1.1	2.89	Barley et al. 2003
YN1	sedimentary	Yilgarn	2660	2.35	2.8	Barley et al. 2003
CKD-37	igneous mafic intrusive	Yilgarn	2690	-1.11	3.08	Barley et al. 2003
CKD-35	igneous mafic intrusive	Yilgarn	2690	-3.39	3.25	Barley et al. 2003
96969022	igneous felsic intrusive	Yilgarn	2710	2.17	2.85	Barley et al. 2003
96969038	igneous felsic intrusive	Yilgarn	2673	1.93	2.84	Barley et al. 2003
96969055	igneous felsic intrusive	Yilgarn	2755	2.17	2.89	Barley et al. 2003
115587	igneous felsic intrusive	Yilgarn	2655	1.55	2.85	Barley et al. 2003
101381	igneous felsic intrusive	Yilgarn	2675	1.97	2.84	Barley et al. 2003
97969225A	igneous felsic intrusive	Yilgarn	2753	1.07	2.97	Barley et al. 2003
2001969044	igneous felsic intrusive	Yilgarn	2647	-1.58	3.08	Barley et al. 2003
2001967041A	igneous felsic intrusive	Yilgarn	2803	0.86	3.03	Barley et al. 2003
2001967017A	igneous felsic intrusive	Yilgarn	2667	0.54	2.94	Barley et al. 2003
2001967013	igneous felsic intrusive	Yilgarn	2640	-2.21	3.12	Barley et al. 2003
2000969007	igneous felsic intrusive	Yilgarn	2662	1.8	2.84	Barley et al. 2003
98969144	igneous felsic intrusive	Yilgarn	2640	-2.91	3.18	Barley et al. 2003
2001969053C	igneous felsic intrusive	Yilgarn	2809	2.83	2.89	Barley et al. 2003
98967116D	igneous felsic intrusive	Yilgarn	2640	1.47	2.85	Barley et al. 2003
2001969055B	igneous felsic intrusive	Yilgarn	2665	0.28	2.96	Barley et al. 2003
98276	igneous felsic intrusive	Yilgarn	2665	2.8	2.77	Barley et al. 2003
2001969007	igneous felsic intrusive	Yilgarn	2659	1.26	2.88	Barley et al. 2003
2001969033A	igneous felsic intrusive	Yilgarn	2716	-0.44	3.05	Barley et al. 2003
2001969035	igneous felsic intrusive	Yilgarn	2660	1.53	2.86	Barley et al. 2003
2001969039	igneous felsic intrusive	Yilgarn	2650	0.69	2.91	Barley et al. 2003
2001969058	igneous felsic intrusive	Yilgarn	2650	1.54	2.85	Barley et al. 2003
2001969108	igneous felsic intrusive	Yilgarn	2650	1.27	2.87	Barley et al. 2003
98967124	igneous felsic intrusive	Yilgarn	2675	1.12	2.9	Barley et al. 2003
97969045	igneous felsic intrusive	Yilgarn	2640	-0.61	3	Barley et al. 2003

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
MB	sedimentary	Yilgarn	2660	2.28	2.8	Barley et al. 2003
2001969019B	igneous felsic intrusive	Yilgarn	2638	-0.15	2.97	Barley et al. 2003
2001967039	igneous felsic intrusive	Yilgarn	2658	0.09	2.97	Barley et al. 2003
99967004	igneous felsic intrusive	Yilgarn	2640	1.07	2.88	Barley et al. 2003
96969019	igneous felsic intrusive	Yilgarn	2714	1.9	2.88	Barley et al. 2003
2001969019A	igneous felsic intrusive	Yilgarn	2668	1.02	2.9	Barley et al. 2003
2001967014	igneous	Yilgarn	2687	-6.59	3.49	Barley et al. 2003
2001969111B	igneous felsic intrusive	Yilgarn	2710	2.18	2.85	Barley et al. 2003
2001967019A	igneous felsic intrusive	Yilgarn	2675	0.39	2.96	Barley et al. 2003
2001969113	igneous felsic intrusive	Yilgarn	2640	1.12	2.87	Barley et al. 2003
KU-1	sedimentary	Yilgarn	2660	-2.05	3.13	Barley et al. 2003
JC1	sedimentary	Yilgarn	2660	0.34	2.95	Barley et al. 2003
K308	igneous mafic intrusive	Yilgarn	2680	2.58	2.8	Bateman et al. 2001
K300	igneous mafic intrusive	Yilgarn	2680	2.39	2.81	Bateman et al. 2001
K304	igneous mafic intrusive	Yilgarn	2680	2.97	2.77	Bateman et al. 2001
K297	igneous mafic intrusive	Yilgarn	2680	3.04	2.76	Bateman et al. 2001
K292	igneous mafic intrusive	Yilgarn	2680	2.78	2.78	Bateman et al. 2001
K360	igneous mafic volcanic	Yilgarn	2690	2.9	2.78	Bateman et al. 2001
K354	igneous mafic volcanic	Yilgarn	2690	-1.3	3.1	Bateman et al. 2001
K350	igneous mafic volcanic	Yilgarn	2690	-0.92	3.07	Bateman et al. 2001
K281	igneous mafic volcanic	Yilgarn	2680	4.58	2.65	Bateman et al. 2001
K403	igneous mafic intrusive	Yilgarn	2675	2.51	2.8	Bateman et al. 2001
K402	igneous mafic intrusive	Yilgarn	2675	2.64	2.79	Bateman et al. 2001
K396	igneous mafic intrusive	Yilgarn	2675	3.17	2.75	Bateman et al. 2001
K355	igneous mafic volcanic	Yilgarn	2690	-2.11	3.16	Bateman et al. 2001
K399	igneous mafic intrusive	Yilgarn	2675	2.88	2.77	Bateman et al. 2001
K280	igneous mafic intrusive	Yilgarn	2680	3.84	2.7	Bateman et al. 2001
K365	igneous mafic volcanic	Yilgarn	2690	1.95	2.85	Bateman et al. 2001
K372	igneous mafic volcanic	Yilgarn	2700	2.84	2.79	Bateman et al. 2001
K374	igneous mafic volcanic	Yilgarn	2700	2.4	2.83	Bateman et al. 2001
K375	igneous mafic volcanic	Yilgarn	2700	2.89	2.79	Bateman et al. 2001
K397	igneous mafic intrusive	Yilgarn	2675	3.69	2.71	Bateman et al. 2001
K400	igneous mafic intrusive	Yilgarn	2675	3.38	2.73	Bateman et al. 2001

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
K363	igneous mafic volcanic	Yilgarn	2690	1.35	2.9	Bateman et al. 2001
92969025	igneous felsic intrusive	Yilgarn	2680	1.06	2.91	Champion & Sheraton 1997
92969113A	igneous felsic intrusive	Yilgarn	2670	-0.33	3.01	Champion & Sheraton 1997
92969111	igneous felsic intrusive	Yilgarn	2650	0.75	2.91	Champion & Sheraton 1997
92969105	igneous felsic intrusive	Yilgarn	2660	-0.55	3.02	Champion & Sheraton 1997
92969101	igneous felsic intrusive	Yilgarn	2670	2.31	2.81	Champion & Sheraton 1997
92969091	igneous felsic intrusive	Yilgarn	2650	1.14	2.88	Champion & Sheraton 1997
92969087	igneous felsic intrusive	Yilgarn	2670	2.24	2.81	Champion & Sheraton 1997
93969030C	igneous felsic intrusive	Yilgarn	2670	1.91	2.84	Champion & Sheraton 1997
93969030A	igneous felsic intrusive	Yilgarn	2670	1.46	2.87	Champion & Sheraton 1997
93901	igneous felsic intrusive	Yilgarn	2657	3.64	2.7	Champion & Sheraton 1997
93906	igneous felsic intrusive	Yilgarn	2665	1.08	2.9	Champion & Sheraton 1997
92969084	igneous felsic intrusive	Yilgarn	2680	-0.94	3.06	Champion & Sheraton 1997
92963318	igneous felsic intrusive	Yilgarn	2665	1.81	2.84	Champion & Sheraton 1997
93969021	igneous felsic intrusive	Yilgarn	2665	1.36	2.88	Champion & Sheraton 1997
92969031	igneous felsic intrusive	Yilgarn	2664	0.55	2.94	Champion & Sheraton 1997
94969584B	igneous felsic intrusive	Yilgarn	2661	1.51	2.86	Champion & Sheraton 1997
92969124	igneous felsic intrusive	Yilgarn	2650	0.42	2.93	Champion & Sheraton 1997
92969104B	igneous felsic	Yilgarn	2700	1.19	2.92	Champion & Sheraton 1997
92967064	igneous felsic intrusive	Yilgarn	2703	1.68	2.88	Champion & Sheraton 1997
92969004	igneous felsic intrusive	Yilgarn	2680	-0.91	3.06	Champion & Sheraton 1997
92969015	igneous felsic intrusive	Yilgarn	2680	1.28	2.89	Champion & Sheraton 1997

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
92969016	igneous felsic intrusive	Yilgarn	2680	0.48	2.95	Champion & Sheraton 1997
92969022	igneous felsic intrusive	Yilgarn	2642	-1.76	3.09	Champion & Sheraton 1997
92963213	igneous felsic intrusive	Yilgarn	2680	-1.3	3.09	Champion & Sheraton 1997
92969082	igneous felsic intrusive	Yilgarn	2665	0.96	2.91	Champion & Sheraton 1997
93969049	igneous felsic intrusive	Yilgarn	2650	1.85	2.83	Champion & Sheraton 1997
92963431	igneous intermediate intrusive	Yilgarn	2664	1.65	2.85	Champion & Sheraton 1997
92963013A	igneous mafic intrusive	Yilgarn	2685	-2.92	3.22	Champion & Sheraton 1997
92969016B	high grade metamorphic rock	Yilgarn	2690	0.81	2.94	Champion & Sheraton 1997
92969024	igneous felsic	Yilgarn	2680	0.66	2.94	Champion & Sheraton 1997
92969067	igneous felsic	Yilgarn	2678	1.02	2.91	Champion & Sheraton 1997
92969080A	igneous felsic	Yilgarn	2648	0.5	2.93	Champion & Sheraton 1997
92969048	igneous mafic intrusive	Yilgarn	2400	-1.4	2.86	Champion & Sheraton 1997
95969727B	igneous felsic intrusive	Yilgarn	2655	1.8	2.83	Champion & Sheraton 1997
95969725B	igneous felsic intrusive	Yilgarn	2655	0.76	2.91	Champion & Sheraton 1997
92969115	igneous felsic intrusive	Yilgarn	2650	1.3	2.87	Champion & Sheraton 1997
95969704K	igneous felsic intrusive	Yilgarn	2655	1.24	2.88	Champion & Sheraton 1997
92969122	igneous felsic intrusive	Yilgarn	2680	0.17	2.98	Champion & Sheraton 1997
92969082	igneous felsic intrusive	Yilgarn	2665	0.82	2.92	Champion & Sheraton 1997
92969073	igneous felsic intrusive	Yilgarn	2680	1.37	2.89	Champion & Sheraton 1997
92969071	igneous felsic intrusive	Yilgarn	2650	-1.93	3.11	Champion & Sheraton 1997
92969054	igneous felsic intrusive	Yilgarn	2640	-1.69	3.08	Champion & Sheraton 1997

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
92969052	igneous felsic intrusive	Yilgarn	2650	-1.13	3.05	Champion & Sheraton 1997
92969051	igneous felsic intrusive	Yilgarn	2665	1.69	2.85	Champion & Sheraton 1997
92969038	igneous felsic intrusive	Yilgarn	2676	1.11	2.9	Champion & Sheraton 1997
92969032	igneous felsic intrusive	Yilgarn	2664	0.27	2.96	Champion & Sheraton 1997
94969584	igneous felsic intrusive	Yilgarn	2661	2.01	2.82	Champion & Sheraton 1997
94969580	igneous felsic intrusive	Yilgarn	2665	1.03	2.9	Champion & Sheraton 1997
95969716B	igneous felsic intrusive	Yilgarn	2655	2.48	2.78	Champion & Sheraton 1997
92969068	igneous felsic intrusive	Yilgarn	2640	-4.32	3.28	Champion & Sheraton 1997
92964658	igneous felsic intrusive	Yilgarn	2653	-4.47	3.3	Champion & Sheraton 1997
CD339W3 795.6m	igneous mafic volcanic	Yilgarn	2690	-2.15	3.16	Chauvel et al. 1985
KD330 1140.5ft	igneous ultramafic	Yilgarn	2705	4.18	2.7	Chauvel et al. 1985
OB1	igneous mafic intrusive	Yilgarn	2690	-1.25	3.09	Chauvel et al. 1985
CD339 256.6m	igneous mafic volcanic	Yilgarn	2690	-1.9	3.14	Chauvel et al. 1985
CD339 547.9m	igneous mafic volcanic	Yilgarn	2690	-1.84	3.14	Chauvel et al. 1985
CD339 591.8m	igneous mafic volcanic	Yilgarn	2690	-1.42	3.11	Chauvel et al. 1985
CD339W3 1041.7m	igneous mafic volcanic	Yilgarn	2700	2	2.86	Chauvel et al. 1985
CD339W3 1041.7m_r	igneous mafic volcanic	Yilgarn	2700	2.52	2.82	Chauvel et al. 1985
KA1	igneous mafic volcanic	Yilgarn	2705	3.01	2.78	Chauvel et al. 1985
KA2	igneous ultramafic	Yilgarn	2705	4.67	2.66	Chauvel et al. 1985
KD330	igneous mafic volcanic	Yilgarn	2700	1.63	2.88	Chauvel et al. 1985
KD330 1100.5ft	igneous ultramafic	Yilgarn	2705	3.12	2.78	Chauvel et al. 1985
KA12	sedimentary	Yilgarn	2705	-0.12	3.02	Chauvel unpub in Arndt & Jenner 1986
6033/479.7	igneous ultramafic	Yilgarn	2705	5.1	2.63	Claoue-Long et al. 1984
1025/624	igneous mafic volcanic	Yilgarn	2705	2.64	2.81	Claoue-Long et al. 1984
1029/3366	igneous mafic volcanic	Yilgarn	2705	1.81	2.88	Claoue-Long et al. 1984
1029/4780	igneous mafic volcanic	Yilgarn	2705	2.49	2.82	Claoue-Long et al. 1984

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
29/501.5	igneous ultramafic	Yilgarn	2705	4.39	2.68	Claoue-Long et al. 1984
UMH97	igneous ultramafic	Yilgarn	2705	7.57	2.44	Claoue-Long et al. 1984
UMH62	igneous ultramafic	Yilgarn	2705	5.31	2.61	Claoue-Long et al. 1984
UMH72	igneous ultramafic	Yilgarn	2705	5.63	2.59	Claoue-Long et al. 1984
UMH74	igneous ultramafic	Yilgarn	2705	4.76	2.65	Claoue-Long et al. 1984
UMH81	igneous ultramafic	Yilgarn	2705	4.14	2.7	Claoue-Long et al. 1984
1020a507.3	igneous mafic volcanic	Yilgarn	2700	1.15	2.92	Claoue-Long et al. 1984
1020a/158.2	igneous mafic volcanic	Yilgarn	2690	-1.99	3.15	Claoue-Long et al. 1984
1020a/268.6	igneous mafic volcanic	Yilgarn	2700	0.97	2.93	Claoue-Long et al. 1984
1020a/473.2	igneous mafic volcanic	Yilgarn	2690	-0.56	3.04	Claoue-Long et al. 1984
6033/222.8	ultraigneous mafic volcanic	Yilgarn	2705	4.1	2.7	Claoue-Long et al. 1984
29/456.0	igneous ultramafic	Yilgarn	2705	6.69	2.51	Claoue-Long et al. 1984
71902	igneous felsic intrusive	Yilgarn	2700	-5.77	3.44	De Laeter et al. 1985
71187	igneous felsic intrusive	Yilgarn	2640	-7.1	3.49	De Laeter et al. 1985
77589	igneous	Yilgarn	3640	0.16	3.78	De Laeter et al. 1985
71940	igneous	Yilgarn	3350	-3.12	3.79	De Laeter et al. 1985
69627	igneous	Yilgarn	3640	-1.1	3.87	De Laeter et al. 1985
99969142	igneous felsic intrusive	Yilgarn	2747	-1.74	3.18	Fletcher & McNaughton 2002b
97969138	igneous felsic intrusive	Yilgarn	2627	-3.5	3.21	Fletcher & McNaughton 2002b
99969164A	igneous felsic intrusive	Yilgarn	2742	0.75	2.99	Fletcher & McNaughton 2002b
99969096	igneous felsic intrusive	Yilgarn	2639	-4.55	3.3	Fletcher & McNaughton 2002b
99969066	igneous felsic intrusive	Yilgarn	2730	-3	3.26	Fletcher & McNaughton 2002b
99969063	igneous felsic intrusive	Yilgarn	2630	-3.68	3.23	Fletcher & McNaughton 2002b
99969049	igneous felsic intrusive	Yilgarn	2640	-4.18	3.27	Fletcher & McNaughton 2002b
99967141	igneous felsic intrusive	Yilgarn	2745	-3.82	3.33	Fletcher & McNaughton 2002b
99967114	igneous felsic intrusive	Yilgarn	2630	-3.47	3.21	Fletcher & McNaughton 2002b
99967066	igneous felsic intrusive	Yilgarn	2645	-4.05	3.27	Fletcher & McNaughton 2002b

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
99967055	igneous felsic intrusive	Yilgarn	2641	-3.63	3.23	Fletcher & McNaughton 2002b
99967049A	igneous felsic intrusive	Yilgarn	2787	-1.26	3.18	Fletcher & McNaughton 2002b
99969093B	igneous felsic intrusive	Yilgarn	3007	0.04	3.26	Fletcher & McNaughton 2002b
99964016C	igneous felsic intrusive	Yilgarn	2756	-1.45	3.16	Fletcher & McNaughton 2002b
94962258A	igneous felsic intrusive	Yilgarn	2667	1.12	2.9	Fletcher & McNaughton 2002b
99967082C	high grade metamorphic rock	Yilgarn	2940	-1.57	3.33	Fletcher & McNaughton 2002b
99967170A	igneous mafic intrusive	Yilgarn	2680	1.73	2.86	Fletcher & McNaughton 2002b
99967176	igneous intermediate intrusive	Yilgarn	2657	1.17	2.88	Fletcher & McNaughton 2002b
99967174A	igneous intermediate intrusive	Yilgarn	2657	1.8	2.84	Fletcher & McNaughton 2002b
98969003	igneous felsic intrusive	Yilgarn	2659	0.03	2.97	Fletcher & McNaughton 2002b
98967008	igneous felsic intrusive	Yilgarn	2660	0.94	2.9	Fletcher & McNaughton 2002b
97969256B	igneous felsic intrusive	Yilgarn	2663	1.03	2.9	Fletcher & McNaughton 2002b
97967153	igneous felsic intrusive	Yilgarn	2630	0.24	2.93	Fletcher & McNaughton 2002b
97967152	igneous felsic intrusive	Yilgarn	2645	1.21	2.87	Fletcher & McNaughton 2002b
97967150	igneous felsic intrusive	Yilgarn	2645	1.18	2.87	Fletcher & McNaughton 2002b
96969044	igneous felsic intrusive	Yilgarn	2665	1.87	2.84	Fletcher & McNaughton 2002b
99964100	igneous felsic intrusive	Yilgarn	2743	-1.1	3.13	Fletcher & McNaughton 2002b
97969248	igneous felsic intrusive	Yilgarn	2650	0.93	2.9	Fletcher & McNaughton 2002b
97967069A	igneous felsic intrusive	Yilgarn	2644	0.79	2.9	Fletcher & McNaughton 2002b
97969209	igneous felsic intrusive	Yilgarn	2620	-1.32	3.04	Fletcher & McNaughton 2002b
97969249	igneous felsic intrusive	Yilgarn	2655	3.52	2.7	Fletcher & McNaughton 2002b

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
97969245	igneous felsic intrusive	Yilgarn	2640	0.14	2.95	Fletcher & McNaughton 2002b
97969243	igneous felsic intrusive	Yilgarn	2655	0.57	2.93	Fletcher & McNaughton 2002b
97969237	igneous felsic intrusive	Yilgarn	2625	-0.77	3	Fletcher & McNaughton 2002b
97969223	igneous felsic intrusive	Yilgarn	2660	0.41	2.94	Fletcher & McNaughton 2002b
97969044	igneous felsic intrusive	Yilgarn	2640	-1.14	3.04	Fletcher & McNaughton 2002b
96969087	igneous felsic intrusive	Yilgarn	2660	1.06	2.89	Fletcher & McNaughton 2002b
97967069B	igneous felsic intrusive	Yilgarn	2680	-0.46	3.03	Fletcher & McNaughton 2002b
96969080A	igneous felsic intrusive	Yilgarn	2671	-0.38	3.01	Fletcher & McNaughton 2002b
96969076	igneous felsic intrusive	Yilgarn	2686	1.81	2.86	Fletcher & McNaughton 2002b
96969046	igneous felsic intrusive	Yilgarn	2647	1.3	2.87	Fletcher & McNaughton 2002b
97969201	igneous felsic intrusive	Yilgarn	2623	-3.66	3.22	Fletcher & McNaughton 2002b
97969126	igneous mafic intrusive	Yilgarn	1201	4.51	1.42	Fletcher & McNaughton 2002b
98969055	igneous felsic intrusive	Yilgarn	2712	-2.95	3.24	Fletcher & McNaughton 2002b
98969045	igneous felsic intrusive	Yilgarn	2700	0.65	2.96	Fletcher & McNaughton 2002b
98969044	igneous felsic intrusive	Yilgarn	2650	0.19	2.95	Fletcher & McNaughton 2002b
98969042	igneous felsic intrusive	Yilgarn	2630	-2.91	3.17	Fletcher & McNaughton 2002b
98969025	igneous felsic intrusive	Yilgarn	2661	-2.24	3.14	Fletcher & McNaughton 2002b
98969019	igneous felsic intrusive	Yilgarn	2640	-2.74	3.16	Fletcher & McNaughton 2002b
98968104	igneous felsic intrusive	Yilgarn	2813	3.78	2.82	Fletcher & McNaughton 2002b
98967100A	igneous felsic intrusive	Yilgarn	2630	-3.39	3.2	Fletcher & McNaughton 2002b
97969202	igneous felsic intrusive	Yilgarn	2656	-0.58	3.01	Fletcher & McNaughton 2002b

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
97969125	igneous felsic intrusive	Yilgarn	2617	-2.85	3.15	Fletcher & McNaughton 2002b
97969104	igneous felsic intrusive	Yilgarn	2682	-4.03	3.3	Fletcher & McNaughton 2002b
97969102B	igneous felsic intrusive	Yilgarn	2737	-0.82	3.1	Fletcher & McNaughton 2002b
97969090	igneous felsic intrusive	Yilgarn	2656	-1.12	3.05	Fletcher & McNaughton 2002b
97969082A	igneous felsic intrusive	Yilgarn	2682	-4.3	3.32	Fletcher & McNaughton 2002b
97969023	igneous felsic intrusive	Yilgarn	2640	-2.54	3.15	Fletcher & McNaughton 2002b
96969012	igneous felsic intrusive	Yilgarn	2633	-4.33	3.28	Fletcher & McNaughton 2002b
98967102E	igneous felsic	Yilgarn	2699	-2.79	3.22	Fletcher & McNaughton 2002b
98969033	igneous felsic	Yilgarn	2671	-4.03	3.29	Fletcher & McNaughton 2002b
97969212	igneous felsic intrusive	Yilgarn	2685	0.24	2.98	Fletcher & McNaughton 2002b
20807a	igneous	Yilgarn	2670	-2.63	3.18	Fletcher et al 1983a
60734	igneous felsic	Yilgarn	3350	-2.64	3.75	Fletcher et al 1983a
60735	igneous	Yilgarn	3640	-0.01	3.79	Fletcher et al 1983a
60721	igneous	Yilgarn	3000	-0.09	3.26	Fletcher et al 1983a
Errabiddy	igneous felsic	Yilgarn	2500	-15.08	3.98	Fletcher et al 1983a
69623	igneous felsic	Yilgarn	3000	-1.41	3.36	Fletcher et al 1983a
60723	high grade metamorphic rock	Yilgarn	3000	-1.81	3.39	Fletcher et al 1983a
54161A	high grade metamorphic rock	Yilgarn	2700	-6.31	3.48	Fletcher et al 1983b
76-181	high grade metamorphic rock	Yilgarn	2700	-4.73	3.36	Fletcher et al 1983b
55810C	igneous felsic intrusive	Yilgarn	2640	-0.94	3.03	Fletcher et al 1983b
63206	igneous felsic	Yilgarn	2680	0.64	2.94	Fletcher et al. 1984
44484D	igneous felsic volcanic	Yilgarn	2950	1.18	3.13	Fletcher et al. 1984
44484G	igneous felsic volcanic	Yilgarn	2950	0.71	3.16	Fletcher et al. 1984
44484H	igneous ultramafic	Yilgarn	2950	-0.28	3.24	Fletcher et al. 1984
63213	igneous mafic volcanic	Yilgarn	2705	1.8	2.88	Fletcher et al. 1984
63209	igneous ultramafic	Yilgarn	2705	2.65	2.81	Fletcher et al. 1984
63210	igneous ultramafic	Yilgarn	2705	2.73	2.81	Fletcher et al. 1984
63217	igneous felsic	Yilgarn	2680	1.28	2.89	Fletcher et al. 1984

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
63202	igneous felsic	Yilgarn	2680	1.38	2.89	Fletcher et al. 1984
44484Q	igneous felsic volcanic	Yilgarn	2950	-0.66	3.27	Fletcher et al. 1984
44484S	igneous felsic volcanic	Yilgarn	2950	0	3.22	Fletcher et al. 1984
44484U	igneous felsic volcanic	Yilgarn	2950	0.94	3.14	Fletcher et al. 1984
49578	igneous mafic intrusive	Yilgarn	2950	0.45	3.18	Fletcher et al. 1984
49585	igneous mafic intrusive	Yilgarn	2950	-1.05	3.3	Fletcher et al. 1984
44484E	igneous ultramafic	Yilgarn	2950	-5.54	3.63	Fletcher et al. 1984
44484N	igneous mafic intrusive	Yilgarn	2950	0.73	3.16	Fletcher et al. 1984
44484M	igneous mafic intrusive	Yilgarn	2950	1.8	3.08	Fletcher et al. 1984
63211	igneous mafic volcanic	Yilgarn	2705	2.09	2.85	Fletcher et al. 1984
63656	igneous mafic volcanic	Yilgarn	2950	1.87	3.08	Fletcher et al. 1984
71180	igneous felsic intrusive	Yilgarn	2750	-3.15	3.29	Fletcher et al. 1984
63662	igneous mafic volcanic	Yilgarn	2950	0.35	3.19	Fletcher et al. 1984
63667	igneous mafic volcanic	Yilgarn	2950	0.37	3.19	Fletcher et al. 1984
63672	igneous mafic volcanic	Yilgarn	2950	-0.44	3.25	Fletcher et al. 1984
63673	igneous mafic volcanic	Yilgarn	2950	1.63	3.09	Fletcher et al. 1984
63676	igneous mafic volcanic	Yilgarn	2950	1.9	3.07	Fletcher et al. 1984
71178	igneous volcanic	Yilgarn	2750	-3.13	3.29	Fletcher et al. 1984
71179	igneous intermediate volcanic	Yilgarn	2750	-3.32	3.3	Fletcher et al. 1984
63655	igneous mafic volcanic	Yilgarn	2950	0.53	3.18	Fletcher et al. 1984
56434C	igneous	Yilgarn	3000	-0.75	3.31	Fletcher et al. 1985
56434A	metamorphic protolith unknown	Yilgarn	2650	-5.05	3.35	Fletcher et al. 1985
52478D	igneous felsic intrusive	Yilgarn	2612	-2.78	3.14	Fletcher et al. 1985
52475F	igneous felsic intrusive	Yilgarn	2612	-3.07	3.17	Fletcher et al. 1985
36937A	igneous felsic intrusive	Yilgarn	2630	-0.87	3.01	Fletcher et al. 1985
1671	high grade metamorphic rock	Yilgarn	2800	-1.64	3.21	Fletcher et al. 1985
30711	igneous felsic intrusive	Yilgarn	2630	-2.5	3.14	Fletcher et al. 1985
56434B	igneous felsic	Yilgarn	3000	-1.12	3.34	Fletcher et al. 1985
1670	high grade metamorphic rock	Yilgarn	2800	0.43	3.06	Fletcher et al. 1985
77353	igneous felsic intrusive	Yilgarn	2950	-0.94	3.29	Fletcher et al. 1994
40597A	igneous felsic intrusive	Yilgarn	2681	0.88	2.93	Fletcher et al. 1994
40597F	igneous felsic intrusive	Yilgarn	2663	1.79	2.84	Fletcher et al. 1994
W-15	igneous felsic intrusive	Yilgarn	3000	3.03	3.03	Fletcher et al. 1994

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
W-13	igneous felsic intrusive	Yilgarn	2700	0.6	2.96	Fletcher et al. 1994
59926	igneous felsic intrusive	Yilgarn	3000	2.52	3.07	Fletcher et al. 1994
59925	igneous felsic intrusive	Yilgarn	3000	2.24	3.09	Fletcher et al. 1994
WH-5	igneous felsic intrusive	Yilgarn	2700	-2.38	3.19	Fletcher et al. 1994
17808	igneous felsic intrusive	Yilgarn	2700	-1.63	3.13	Fletcher et al. 1994
77346	igneous felsic intrusive	Yilgarn	2950	-5.94	3.66	Fletcher et al. 1994
80313	igneous felsic intrusive	Yilgarn	3000	-0.56	3.3	Fletcher et al. 1994
17808	igneous felsic intrusive	Yilgarn	2700	-1.75	3.14	Fletcher et al. 1994
77334	igneous felsic intrusive	Yilgarn	2690	-2.85	3.21	Fletcher et al. 1994
77337A	igneous felsic intrusive	Yilgarn	2690	-1.88	3.14	Fletcher et al. 1994
77392	igneous felsic intrusive	Yilgarn	2690	-4.98	3.37	Fletcher et al. 1994
77391	igneous felsic intrusive	Yilgarn	2690	-2.05	3.15	Fletcher et al. 1994
77366	igneous felsic intrusive	Yilgarn	2753	-2.45	3.24	Fletcher et al. 1994
77362	igneous felsic intrusive	Yilgarn	2918	-0.03	3.19	Fletcher et al. 1994
17810	igneous felsic intrusive	Yilgarn	2720	0.84	2.96	Fletcher et al. 1994
17810	igneous felsic intrusive	Yilgarn	2720	-0.05	3.03	Fletcher et al. 1994
77350	igneous felsic intrusive	Yilgarn	2950	-3.17	3.45	Fletcher et al. 1994
77272	igneous felsic intrusive	Yilgarn	3000	-0.26	3.28	Fletcher et al. 1994
59047	igneous felsic intrusive	Yilgarn	2644	1.64	2.84	Fletcher et al. 1994
40592A	igneous felsic intrusive	Yilgarn	2650	0.23	2.95	Fletcher et al. 1994
59046A	igneous intermediate intrusive	Yilgarn	2644	2.03	2.81	Fletcher et al. 1994
77270	igneous felsic intrusive	Yilgarn	3000	0.84	3.19	Fletcher et al. 1994
80322	high grade metamorphic rock	Yilgarn	3000	-2.9	3.48	Fletcher et al. 1994
80316	high grade metamorphic rock	Yilgarn	3000	0.91	3.19	Fletcher et al. 1994
59046C	igneous intermediate intrusive	Yilgarn	2644	1.42	2.85	Fletcher et al. 1994
80309	igneous felsic intrusive	Yilgarn	3000	-1.51	3.37	Fletcher et al. 1994
40591A	igneous felsic intrusive	Yilgarn	2650	0.8	2.91	Fletcher et al. 1994
71123	igneous felsic intrusive	Yilgarn	2680	-4.47	3.33	Fletcher et al. 1994
87975	igneous felsic intrusive	Yilgarn	2640	-1.57	3.08	Fletcher et al. 1994
87955	igneous felsic intrusive	Yilgarn	2660	-4.66	3.33	Fletcher et al. 1994
81884	igneous felsic intrusive	Yilgarn	2680	-2.01	3.14	Fletcher et al. 1994
71124	igneous felsic intrusive	Yilgarn	2680	-2.05	3.15	Fletcher et al. 1994
71122	igneous felsic intrusive	Yilgarn	2680	-4.47	3.33	Fletcher et al. 1994

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
71122	igneous felsic intrusive	Yilgarn	2680	-4.58	3.34	Fletcher et al. 1994
56478	igneous felsic intrusive	Yilgarn	2675	-1.71	3.12	Fletcher et al. 1994
56477	igneous felsic intrusive	Yilgarn	2630	-2.81	3.16	Fletcher et al. 1994
71125	igneous felsic intrusive	Yilgarn	2660	-2.16	3.14	Fletcher et al. 1994
96969046	igneous felsic intrusive	Yilgarn	2647	1.33	2.86	GA unpublished
2003967007N	igneous mafic volcanic	Yilgarn	2800	0.27	3.07	GA unpublished
2003967007D	igneous mafic volcanic	Yilgarn	2800	1.14	3.01	GA unpublished
2003967007A	igneous mafic volcanic	Yilgarn	2800	0.45	3.06	GA unpublished
96969076	igneous felsic intrusive	Yilgarn	2686	1.84	2.86	GA unpublished
2003969018	igneous mafic volcanic	Yilgarn	2700	2.3	2.83	GA unpublished
96969034	igneous felsic intrusive	Yilgarn	2652	1.99	2.82	GA unpublished
94969596	igneous felsic	Yilgarn	2738	0.52	3	GA unpublished
96969025	igneous felsic intrusive	Yilgarn	2641	0.82	2.9	GA unpublished
96969019	igneous felsic intrusive	Yilgarn	2714	2.83	2.81	GA unpublished
94969608	igneous felsic intrusive	Yilgarn	2650	1.27	2.87	GA unpublished
2003967007Z	igneous felsic intrusive	Yilgarn	2800	-0.52	3.13	GA unpublished
94962355	igneous felsic intrusive	Yilgarn	2650	1.14	2.88	GA unpublished
2003969013	igneous mafic intrusive	Yilgarn	2700	-0.05	3.01	GA unpublished
2003969019	igneous mafic volcanic	Yilgarn	2700	-2.68	3.21	GA unpublished
2003967007S	ultraigneous mafic volcanic	Yilgarn	2800	2.71	2.89	GA unpublished
2003967007U	ultraigneous mafic volcanic	Yilgarn	2800	-0.07	3.1	GA unpublished
2003967012	igneous mafic intrusive	Yilgarn	2700	2.28	2.84	GA unpublished
96969002	igneous felsic intrusive	Yilgarn	2631	-3.43	3.21	GA unpublished
96969010	igneous felsic intrusive	Yilgarn	2659	-1.56	3.09	GA unpublished
96969012	igneous felsic intrusive	Yilgarn	2633	-3.65	3.23	GA unpublished
98967052A	igneous felsic intrusive	Yilgarn	2652	1.09	2.89	J. Dunphy unpublished data
98967051	igneous felsic intrusive	Yilgarn	2645	0.52	2.92	J. Dunphy unpublished data
98967050A	igneous felsic intrusive	Yilgarn	2672	-0.09	2.99	J. Dunphy unpublished data
98967052B	igneous felsic	Yilgarn	2711	0.38	2.99	J. Dunphy unpublished data
98967050B	igneous felsic	Yilgarn	2711	1.09	2.93	J. Dunphy unpublished data

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
KD6012/1009.5	igneous ultramafic	Yilgarn	2705	2.47	2.83	Lesher & Arndt 1995
KD6033/476.3	igneous ultramafic	Yilgarn	2705	4.83	2.65	Lesher & Arndt 1995
KD6033/477.4	igneous ultramafic	Yilgarn	2705	2.09	2.85	Lesher & Arndt 1995
KD6033/222.8	ultraigneous mafic volcanic	Yilgarn	2705	3.08	2.78	Lesher & Arndt 1995
KD6033/426.7	igneous ultramafic	Yilgarn	2705	0.5	2.97	Lesher & Arndt 1995
88-28	igneous	Yilgarn	3731	1.48	3.76	Maas & McCulloch 1991
86-6	igneous	Yilgarn	3380	-0.71	3.63	Maas & McCulloch 1991
86-11	igneous	Yilgarn	3350	-1.56	3.67	Maas & McCulloch 1991
80-187b	igneous felsic intrusive	Yilgarn	2655	2.09	2.81	McCulloch & Compston 1981
KR3	ultraigneous mafic volcanic	Yilgarn	2705	4.48	2.67	McCulloch & Compston 1981
71-751	igneous felsic intrusive	Yilgarn	2662	1.77	2.84	McCulloch & Compston 1981
71-752	igneous felsic intrusive	Yilgarn	2662	1.9	2.83	McCulloch & Compston 1981
80-187a	igneous felsic intrusive	Yilgarn	2655	2.05	2.82	McCulloch & Compston 1981
80-188	igneous felsic volcanic	Yilgarn	2680	-0.13	3	McCulloch & Compston 1981
72-910	igneous mafic volcanic	Yilgarn	2700	3.42	2.75	McCulloch & Compston 1981
72-42br	ultraigneous mafic volcanic	Yilgarn	2705	-1.03	3.09	McCulloch & Compston 1981
72-42b	ultraigneous mafic volcanic	Yilgarn	2705	-0.28	3.03	McCulloch & Compston 1981
80-185	igneous mafic volcanic	Yilgarn	2700	3.01	2.78	McCulloch & Compston 1981
72-41	igneous felsic intrusive	Yilgarn	2662	1.72	2.85	McCulloch & Compston 1981
72-916	igneous mafic volcanic	Yilgarn	2700	3.21	2.77	McCulloch & Compston 1981
80-184	igneous mafic volcanic	Yilgarn	2700	4.9	2.64	McCulloch & Compston 1981
72-5	igneous mafic volcanic	Yilgarn	2705	3.79	2.73	McCulloch & Compston 1981
80-186	ultraigneous mafic volcanic	Yilgarn	2700	7.04	2.48	McCulloch & Compston 1981
72-19	igneous mafic volcanic	Yilgarn	2705	3.03	2.78	McCulloch & Compston 1981

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
72-13	igneous mafic volcanic	Yilgarn	2705	3.16	2.77	McCulloch & Compston 1981
71-909	igneous felsic intrusive	Yilgarn	2660	0.57	2.93	McCulloch 1987
71-736	igneous felsic intrusive	Yilgarn	2655	-0.14	2.98	McCulloch 1987
71-742	igneous felsic intrusive	Yilgarn	2638	1.06	2.88	McCulloch 1987
72-864	igneous felsic intrusive	Yilgarn	2661	-1.39	3.08	McCulloch 1987
77-41	igneous felsic intrusive	Yilgarn	2664	1.45	2.87	McCulloch et al. 1983a
77-41	igneous felsic intrusive	Yilgarn	2664	0.8	2.92	McCulloch et al. 1983a
77-42	igneous felsic intrusive	Yilgarn	2664	1.95	2.83	McCulloch et al. 1983a
77-43	igneous felsic intrusive	Yilgarn	2664	1.08	2.9	McCulloch et al. 1983a
77-55	igneous felsic	Yilgarn	2722	-2.46	3.21	McCulloch et al. 1983a
77-53	igneous felsic	Yilgarn	2722	-0.45	3.06	McCulloch et al. 1983a
77-54	igneous felsic	Yilgarn	2722	-1.85	3.17	McCulloch et al. 1983a
77-47	igneous	Yilgarn	2668	-0.96	3.05	McCulloch et al. 1983a
77-45	igneous	Yilgarn	2668	-2.56	3.17	McCulloch et al. 1983a
77-1111	igneous	Yilgarn	2700	0.49	2.97	McCulloch et al. 1983b
77-1110	igneous	Yilgarn	2700	-2	3.16	McCulloch et al. 1983b
GA 4518	high grade metamorphic rock	Yilgarn	2700	-0.57	3.05	McCulloch et al. 1983b
77-1086	igneous felsic intrusive	Yilgarn	2670	-0.04	2.99	McCulloch et al. 1983b
77-1130	igneous felsic intrusive	Yilgarn	2670	-1.12	3.07	McCulloch et al. 1983b
GA4137	high grade metamorphic rock	Yilgarn	2700	-8.34	3.64	McCulloch et al. 1983b
GA4138	high grade metamorphic rock	Yilgarn	2700	-7.3	3.56	McCulloch et al. 1983b
76-265	high grade metamorphic rock	Yilgarn	2700	-4.87	3.37	McCulloch et al. 1983b
77-1133	high grade metamorphic rock	Yilgarn	2700	-4.74	3.36	McCulloch et al. 1983b
GA 4270	high grade metamorphic rock	Yilgarn	2700	-7.59	3.58	McCulloch et al. 1983b
GA 4488	high grade metamorphic rock	Yilgarn	2700	-3	3.23	McCulloch et al. 1983b
GA 4488	high grade metamorphic rock	Yilgarn	2700	-3.79	3.29	McCulloch et al. 1983b
GA 4498	high grade metamorphic rock	Yilgarn	2700	-4.44	3.34	McCulloch et al. 1983b
GA4139	high grade metamorphic rock	Yilgarn	2700	-7.42	3.57	McCulloch et al. 1983b
88-192	igneous felsic intrusive	Yilgarn	2685	-2.12	3.16	Nutman et al. 1993
88-171	igneous	Yilgarn	2918	-1.59	3.31	Nutman et al. 1993
88-195	igneous felsic intrusive	Yilgarn	2620	-3.41	3.2	Nutman et al. 1993
89-457	igneous felsic intrusive	Yilgarn	2753	-0.56	3.09	Nutman et al. 1993
88-167	igneous	Yilgarn	3300	2.03	3.36	Nutman et al. 1993

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
88-183	igneous	Yilgarn	2920	2.87	2.98	Nutman et al. 1993
88-22	igneous	Yilgarn	2994	-1.44	3.36	Nutman et al. 1993
88-30	igneous	Yilgarn	2920	-3.83	3.48	Nutman et al. 1993
Y5	igneous felsic intrusive	Yilgarn	2680	-6.96	3.51	Nutman et al. 1993
88-189	igneous felsic intrusive	Yilgarn	2679	-4.25	3.31	Nutman et al. 1993
88-186	igneous felsic intrusive	Yilgarn	2672	-7.24	3.53	Nutman et al. 1993
91-615	igneous	Yilgarn	2994	-1.63	3.38	Nutman et al. 1993
84-81	igneous	Yilgarn	3662	1.23	3.72	Nutman et al. 1993
84-83	igneous	Yilgarn	3483	-0.14	3.67	Nutman et al. 1993
84-97	igneous felsic intrusive	Yilgarn	2638	-7.17	3.5	Nutman et al. 1993
88-179	igneous felsic intrusive	Yilgarn	2643	-4.3	3.28	Nutman et al. 1993
88-180	igneous felsic intrusive	Yilgarn	3302	-3.89	3.8	Nutman et al. 1993
88-196	igneous felsic intrusive	Yilgarn	2648	-9.29	3.66	Nutman et al. 1993
88-176	igneous	Yilgarn	3466	1.95	3.5	Nutman et al. 1993
88-187b	igneous felsic intrusive	Yilgarn	2656	-5.28	3.37	Nutman et al. 1993
88-175	igneous	Yilgarn	3439	1.05	3.54	Nutman et al. 1993
88-26	igneous	Yilgarn	3600	-0.87	3.82	Nutman et al. 1993
88-25	igneous	Yilgarn	3600	0.12	3.75	Nutman et al. 1993
88-191	igneous	Yilgarn	3597	1.7	3.63	Nutman et al. 1993
88-181	igneous	Yilgarn	3119	-4.04	3.66	Nutman et al. 1993
88-168	igneous	Yilgarn	3298	-2.18	3.67	Nutman et al. 1993
88-165	igneous	Yilgarn	3480	2.33	3.48	Nutman et al. 1993
88-182	igneous felsic intrusive	Yilgarn	2748	-6.86	3.56	Nutman et al. 1993
88-31	igneous	Yilgarn	3600	-0.49	3.8	Nutman et al. 1993
88-188	igneous felsic intrusive	Yilgarn	2654	-6.27	3.44	Nutman et al. 1993
88-187a	igneous felsic intrusive	Yilgarn	2680	-4.21	3.31	Nutman et al. 1993
87-305	igneous felsic intrusive	Yilgarn	2620	-6.97	3.47	Nutman et al. 1993
84-96	igneous felsic intrusive	Yilgarn	3302	-2.53	3.7	Nutman et al. 1993
88-23	igneous felsic	Yilgarn	3300	-3.8	3.79	Nutman et al. 1993
88-197	igneous	Yilgarn	3489	-0.04	3.67	Nutman et al. 1993
89-456	igneous	Yilgarn	3626	2.07	3.62	Nutman et al. 1993
88-27	igneous	Yilgarn	3623	-2.41	3.96	Nutman et al. 1993
84-82	igneous	Yilgarn	3633	0.81	3.73	Nutman et al. 1993

Sample_id	LithologyGroup	Province	Age (Ma)	εNd	T_{2DM}	Reference
88-169	igneous	Yilgarn	3005	0.14	3.25	Nutman et al. 1993
88-173	igneous	Yilgarn	3730	1.77	3.73	Nutman et al. 1993
90-411	igneous	Yilgarn	3600	-1.17	3.85	Nutman et al. 1993
99964003	igneous felsic intrusive	Yilgarn	2745	-4.53	3.39	Oliver 1999
97967038G	igneous felsic intrusive	Yilgarn	2656	1.04	2.89	Oliver 1999
97969034	igneous felsic intrusive	Yilgarn	2640	-0.85	3.02	Oliver 1999
97969063	igneous felsic intrusive	Yilgarn	2684	-3.6	3.27	Oliver 1999
83524	igneous felsic intrusive	Yilgarn	2700	0.35	2.98	Watkins & Hickman 1990
81564	igneous felsic volcanic	Yilgarn	2810	1.05	3.02	Watkins & Hickman 1990
83551	igneous felsic intrusive	Yilgarn	2602	-4.93	3.3	Watkins & Hickman 1990
83478	igneous felsic intrusive	Yilgarn	2700	-0.15	3.02	Watkins & Hickman 1990
83478	igneous felsic intrusive	Yilgarn	2700	-0.27	3.03	Watkins & Hickman 1990
83474	igneous felsic intrusive	Yilgarn	2700	-0.65	3.06	Watkins & Hickman 1990
83407	igneous felsic intrusive	Yilgarn	2641	-4.28	3.28	Watkins & Hickman 1990
83399	igneous felsic intrusive	Yilgarn	2920	1.58	3.07	Watkins & Hickman 1990
83399	igneous felsic intrusive	Yilgarn	2920	1.46	3.08	Watkins & Hickman 1990
83339	igneous felsic intrusive	Yilgarn	2920	-2.22	3.36	Watkins & Hickman 1990
83305	igneous felsic intrusive	Yilgarn	2920	1.51	3.08	Watkins & Hickman 1990
74474	igneous felsic intrusive	Yilgarn	2760	1.2	2.97	Watkins & Hickman 1990
74459	igneous felsic intrusive	Yilgarn	2681	-0.31	3.02	Watkins & Hickman 1990
81711A	igneous felsic intrusive	Yilgarn	2760	0.53	3.02	Watkins & Hickman 1990

Appendix C. Bibliography for compiled isotopic and geochronological data.

Appendix Table C.1 List of data sources used in Appendix 2. Locations of data also provided. Data sources denoted by asterisk are for references used for geochronology, location or other details, but not Sm-Nd isotopic data. Full bibliographic details are given in the general references.

Data Source	Location
Allen 2000	Tasman
Allen et al. 1997	Tasman
Allen et al. 1998*	Tasman
Arndt & Jenner 1986	WA
Arndt et al. 1991*	WA
Arndt et al. 2001	WA
Ashley et al. 1996	SA-VIC
Bagas 2004*	WA
Bagas et al. 2010	NT
Barley and Pickard 1999*	WA
Barley et al. 2003	WA
Bateman et al. 2001	WA
Bickle et al. 1989	WA
Bickle et al. 1993	WA
Bierlein & Betts 2004	NT
Bierlein et al. 2011	NT
Black & McCulloch 1984	NT, Tasman
Black & McCulloch 1990	Tasman
Black & Withnall 1993*	Tasman
Black 1994*	Tasman
Black and Shaw 1992*	NT
Black and Shaw 1995*	NT
Black et al. 1992	Tasman
Black et al. 1998*	NT
Black et al. 2005*	Tasman
Black et al. 2010	Tasman
Blevin 2010*	Tasman
Brauhart & Morant, 2000	WA
Bryant et al. 1997	Tasman

Data Source	Location
Budd 2006*	SA-VIC
Budd and Skirrow 2007	SA-VIC
Budd et al. 2001*	NT
Buick et al .1995*	WA
Buick et al. 2002*	WA
Bultitude & Champion 1992*	Tasman
Bultitude et al. 1997*	Tasman
Carson et al. 2006*	Tasman
Carson et al. 2009*	NT
Cassidy et al. 2006*	WA
Cawood et al. 2010*	Tasman
Champion & Sheraton 1997	WA
Champion 1991	Tasman
Champion & Bultitude 2013a	QLD, Tasman
Champion & Bultitude 2013b	Tasman
Chauvel et al. 1985	WA
Claoue-Long et al. 1984	WA
Compston 1995*	NT
Compston et al. 1986*	WA
Cooper et al 1988*	NT
Cowley and Fanning 1992	SA-VIC
Creaser 1989; cited in Johnson and McCulloch 1995	SA-VIC
Creaser 1995	SA-VIC
Creaser and Cooper 1993*	SA-VIC
Cross & Blevin 2010*	Tasman
Cross et al. 2004*	NT
Cross & Crispe 2007*	NT
Cross et al. 2005*	NT
Cross et al. 2012*	Tasman
De Laeter et al. 1985	WA
Donchak et al. 2007*	Tasman
Dunphy et al. 2003*	WA
Edgoose et al. 2004	NT
Elburg et al. 2003	SA-VIC
Elburg et al. 2012	SA-VIC
Fanning et al. 1981*	SA
Fanning et al. 2009*	Tasman

Data Source	Location
Fanning 2012	Tasman
Fanning unpublished	Tasman
Fitzsimons & Buchan 2005*	WA
Fletcher and McNaughton 2002a*	WA
Fletcher and McNaughton 2002b	WA
Fletcher et al 1983a	WA
Fletcher et al 1983b	WA
Fletcher et al. 1984	WA
Fletcher et al. 1985	WA
Fletcher et al. 1994	WA
Fletcher et al. 2001*	WA
Foden et al. 1995	NT
Foden et al. 1999*	SA-VIC
Foden et al. 2002	SA-VIC
Foden et al. 2006*	SA-VIC
Fraser and Neumann 2010*	SA-VIC
Fraser et al. 2010	SA-VIC
GA Shen-Su Sun	NT, WA
GA unpublished	NT, SA-VIC, Tasman, WA
GA-GSQ unpublished	Tasman
GA-GSWA unpublished	WA
Glikson et al. 1996	NT
Griffin et al. 2000	WA
GSQ-Fanning unpublished	Tasman
Healy et al. 2004	Tasman
Hensel et al. 1985	Tasman
Hergt et al. 2007	SA-VIC
Hill et al. 1992*	WA
Hoatson et al. 2005	NT
Hollis et al. 2009*	NT
Howard et al. 2011	SA-VIC
Hutton et al. 1997*	Tasman
Ickert & Williams 2011*	Tasman
Ireland et al. 2002*	SA-VIC
J. Dunphy unpublished data	WA
Jackson et al. 2005*	NT
Jahn et al. 1981	WA

Data Source	Location
Johnson 1993*	SA-VIC
Johnson and Cross 1995*	SA-VIC
Johnson and McCulloch 1995	SA-VIC
Johnson et al. 2011*	WA
Kemp et al. 2005*	Tasman
Kemp et al. 2009	Tasman
Kinny et al. 1988*	WA
Knutson and Sun in Blewett et al. 1997	Tasman
Knutson in Withnall et al. 1997	Tasman
Kositcin et al. 2011*	NT
Lambeck et al. 2012	NT
Leitch et al. 2010*	Tasman
Lesher & Arndt 1995	WA
Maas & McCulloch 1991	WA
Maas et al. 1987	NT
Mackenzie 1993*	Tasman
Maidment et al 2005*	NT
Maidment et al. 2010*	WA
Mark 2001	NT
McCulloch & Chappell 1982	Tasman
McCulloch & Compston 1981	WA
McCulloch 1987	NT, SA-VIC, WA
McCulloch et al. 1983a	WA
McCulloch et al. 1983b	WA
McDonald et al. 1997	NT
Morand et al. 2003*	SA-VIC
Mortimer et al. 1988*	SA-VIC
Murgulov 2006*	Tasman
Murgulov et al. 2007*	Tasman
Myers 1994*	WA
Nelson 1997*	WA
Nelson et al. 1989	NT
Nelson et al. 1995	WA
Neumann & Kositcin 2011*	Tasman
Neumann 2001, cited in Elburg et al. 2003	SA-VIC
Neumann et al. 2006*	NT
Neumann et al. 2009*	NT

Data Source	Location
Nieuwland & Compston 1981*	WA
NTGS unpublished	NT
Nutman et al., 1993	WA
Oliver (1999) cited in Fletcher et al. 2002b	WA
Page 1981*	NT
Page 1983*	NT
Page and Laing 1992*	SA-VIC
Page & Sun 1988	NT
Page & Williams 1988*	NT
Page et al. 1980*	NT
Page et al. 1995*	NT
Page et al. 2000*	NT
Page et al. 2005*	SA-VIC
Payne et al. 2010	SA-VIC
Raveggi et al. 2008	SA-VIC
Reid et al. 2009	SA-VIC
Rich 2000, cited in Swain et al. 2005	SA-VIC
Schaefer 1998, cited in Swain et al. 2005	SA-VIC
Scott et al. 2000*	NT
Scrimgeour and Raith 2001	NT
Scrimgeour et al. 1999*	NT
Scrimgeour et al. 2005	NT
Sheppard et al. 2003	WA
Sheppard et al. 2004	WA
Sheppard et al. 2010*	WA
Sircombe et al. 2007*	WA
Sivell and McCulloch 1997	NT
Sivell et al. 1985*	NT
Skirrow et al. 2007	SA-VIC
Smith 2001	NT
Smith et al. (1998)	WA
Smithies et al. 2007	WA
Smithies et al. 2010	NT
Sun & Hoatson 1992	WA
Sun and Higgins 1996	Tasman
Sun et al. 1995	NT
Swain et al. 2005	SA-VIC

Data Source	Location
Swain et al. 2008	SA-VIC
Szpunar and Fraser 2010	SA-VIC
Turner et al. 1992	SA-VIC
Turner et al. 1993a	SA-VIC
Turner et al. 1993b	SA-VIC
Tyler et al. (1992)	WA
van Kranendonk 2006*	WA
Vos et al. 2006	Tasman
Wade et al. 2006	NT
Wade et al. 2007	SA
Wade et al. 2008	NT
Wade et al. 2012	SA-VIC
Watkins & Hickman 1990	WA
Whelan et al. 2007	SA-VIC
Wiedenbeck and Watkins 1993*	WA
Wilde 2001*	WA
Wilde and Murphy (1990)*	WA
Windrim & McCulloch 1986	NT
Windrim et al 1984	NT
Withnall et al. 1997*	Tasman
Withnall et al. 2005*	Tasman
Woodhouse 2002, cited in Swain et al. 2005	SA-VIC
Woods 1997 cited in Bateman et al. 2001*	WA
Worden et al. 2008*	NT
Wyborn & Sun 1993	Tasman
Wyborn et al. 1988	NT
Wyborn et al. 1988/GA unpublished	NT
Wyborn et al. 1998	NT
Young et al. 2002*	NT
Zhao and Cooper 1992*	NT
Zhao and McCulloch 1993	NT
Zhao and McCulloch 1995	NT
Zhao et al. 1993	NT

Appendix D. Calculating a crustal growth curve for Australia using Nd model age data

The methodology adopted here follows the general approach of McCulloch (1987), with a number of modifications. Two-stage model ages (T_{2DM}) were used with model ages calculated using a linear depleted mantle growth curve (ε_{Nd} of 0.0 at time = 4.5 Ga and +10 at time = 0 Ga). This differs from McCulloch (1987), who although adopting a linear depleted mantle evolution curve, assumed depletion commenced at 2.7 Ga (i.e., the mantle was chondritic (ε_{Nd} of 0.0) prior to 2.5 Ga). One result of the different depleted mantle growth curves will be that model ages as calculated in this work will be (100–300 Ma) older than those of McCulloch (1987). The use of a two-stage model age, however, means that there is not a simple relationship between model ages of this work and those of McCulloch (1987).

The Australia crustal growth curve was calculated by a successive weighted approach, with weightings based on relative surface areas. Growth curves (based on 100 Ma intervals) were calculated firstly for subprovinces, then successively for provinces ands, up until the six broad elements of Australia: the West Australian Element (WAE), South Australian Element (SAE), North Australian Element (NAE), the Pinjarra Element, the Central Australia Element (CAE) and the Tasman Element (Appendix Table D.1, Appendix Figure D.1, Appendix Figure D.2). Distribution of the six elements (and their components) follows the usage of Blewett et al. (2012) and Huston et al. (2012). The relative surface areas of these were utilised to weight relative contributions from each element to produce the final growth curve for the continent.

Crustal growth curves were calculated for each province, subprovince, mafic and felsic grouping. Curves were based on 100 Ma intervals expressed as percentages. These percentage-based curves were then weighted (by relative surface area) to calculate growth curves for larger entities. This process was repeated until curves were calculated for the six elements and for the onshore Australian continent. Province and subprovince subdivisions are from van Kranendonk et al. (2007), Cassidy et al. (2006), Glen et al. (2012), for the Pilbara Craton, Yilgarn Craton and Tasman Element. Other subdivisions were based on province and subprovince boundaries in Blewett et al. (2012) and Huston et al. (2012), and as defined by Geoscience Australia (Stewart et al. in prep).

A number of provinces and subprovinces contain significant amounts of isotopic data for mafic (and ultramafic) igneous rocks, e.g., the Eastern Goldfields Superterrane and Youanmi Terrane of the Yilgarn Craton. For these regions the mafic rocks have been treated separately from the felsic rocks and a weighted crustal growth curve for the region was calculated accordingly.

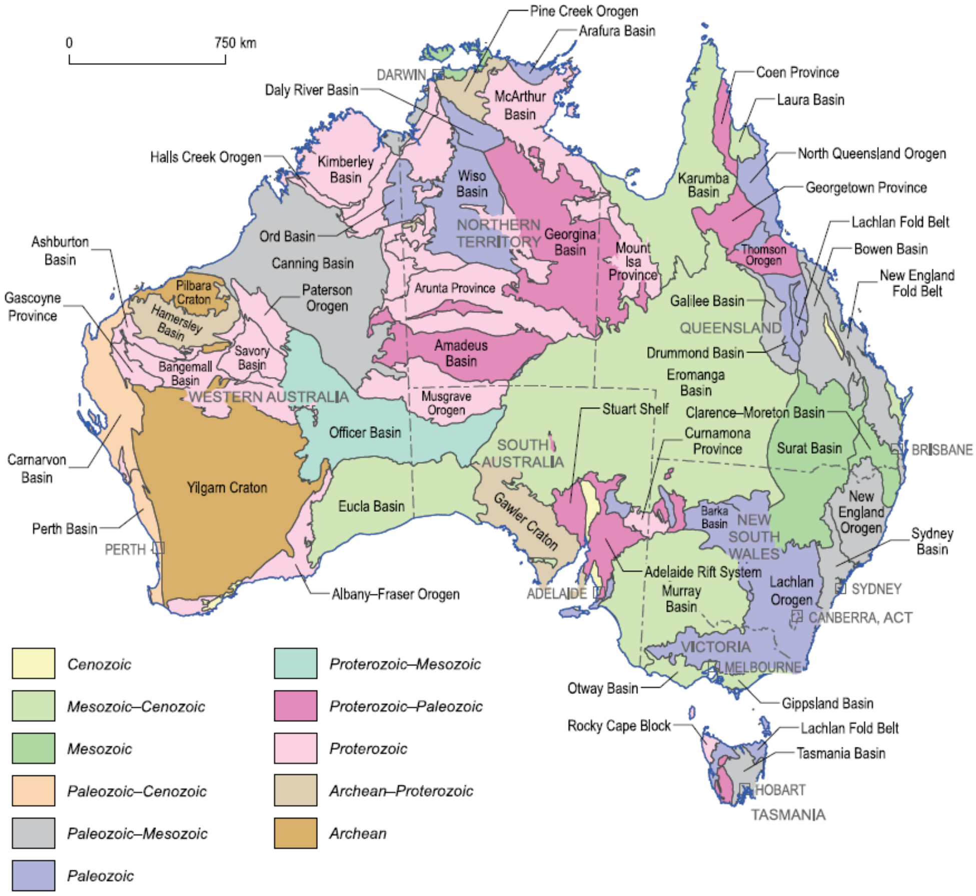
S-type granites (i.e., with a wholly or very significant sediment input) have been excluded from calculations. Such rocks are only significant within the Tasman, especially the Lachlan, and Mossmans. Calculations show that inclusion of these rocks would increase the number of older model ages in the Lachlan, but conversely decrease the range of model ages in the Mossman.

Appendix Table D.1 Subdivision of geological elements and component provinces, subprovinces and geological regions. Number of isotopic analyses used for characterising each province is also shown (in Comments field).

	Cratons, Provinces, Subprovinces	Subprovinces and regions	Comments
West Australian Element (WAE)	Yilgarn Craton (71%)	1. EGST Mafic 2. EGST Felsic 3. Narryer Terrane 4. SW Gneiss Terrane 5. Youanmi Terrane Mafic 6. Youanmi Terrane Felsic	EGST and Youanmi Terrane comprised of 20:80 Mafic:Felsic. 433 samples.
	Pilbara Craton (21%)	1. East Pilbara Mafic 2. East Pilbara Felsic 3. West Pilbara Mafic 4. West Pilbara Felsic 5. Fortescue region 6. Whundo 7. Kurrana Terrane	East and West Pilbara composed of Mafic and Felsic components. 255 samples.
	Gascoyne region (Capricorn) (8%)	1. Gascoyne	Limited data confined to Gascoyne region in the southwest. Rest of this (largely undercover) block assumed to be similar in composition.
South Australian Element (SAE)	Gawler Craton (90.5%)	1. Gawler Mafic 2. Gawler Felsic	154 samples
	Curnamona Craton (9.5%)	1. Curnamona	49 samples
North Australian Element (NAE)	Northern NAE (42.2%)	1. Pine Creek 2. Tanami 3. Tennant Creek	Lumped together because of small sample set. Comprises large part of NAE however. 43 samples.
	Isa (12.9%)	1. Isa	93 samples
	Arunta Aileron province only (13.3%)	1. Aileron Province	No data for Irindina Province. 72 samples.
	Warumpi Province (8.3%)	1. Warumpi	17 samples
	Kimberley (6.2%)	1. Kimberley Mafic 2. Kimberley Felsic	Data largely from Halls Creek (and some from King Leopold). No data from basement to Kimberley Basin; assumed same as Halls Creek/King Leopold but possibly older, perhaps Archean. 30 samples.
	Georgetown (17.2%)	1. Georgetown-Coen region	Significant part of region under cover. Some drill hole samples but largely unknown basement ages. 128 samples.

	Cratons, Provinces, Subprovinces	Subprovinces and regions	Comments
Central Australian Element	Albany-Fraser (32.7%)	1. Albany-Fraser	Limited sample set. 20 samples.
	Paterson-Rudall (40%)	1. Paterson 2. Rudall	26 samples. Samples confined to limited outcrop area, as much of the region is undercover. Assumed to be largely similar to the exposed rocks. May not be correct especially for basement below canning basin.
	Musgraves (27.6%)	1. Musgraves	Data largely from the western Musgraves so possibly not representative. Limited isotopic data available for the felsic and mafic Giles magmatism which is relatively juvenile. 94 samples.
Tasman Element	Delamerian (14.4%)	1. South-Australia, western Victoria and western NSW	74 samples. West Tasmania samples included with Lachlan
	Lachlan (27.4%)	1. Lachlan	Data not evenly distributed with large gaps. Little data for Victoria. 95 samples (148 if S-types included).
	Macquarie 'Arc' (2.1%)	1. Macquarie 'arc' region	27 samples. Surface area of Macquarie Arc not well constrained.
	Thomson (36.4%)	1. Thomson	Most samples from exposed north-eastern and eastern components. Most of is not exposed with limited sub-surface samples. 52 samples
	Greenvale Province (0.4%)	1. Greenvale	Small number of samples, though probably representative. 8 samples.
	Mossman (3%)	1. Mossman	36 samples (50 if S-types included).
	New England (16.3%)	1. New England	Well sampled although mafic component may be underrepresented. 155 samples.

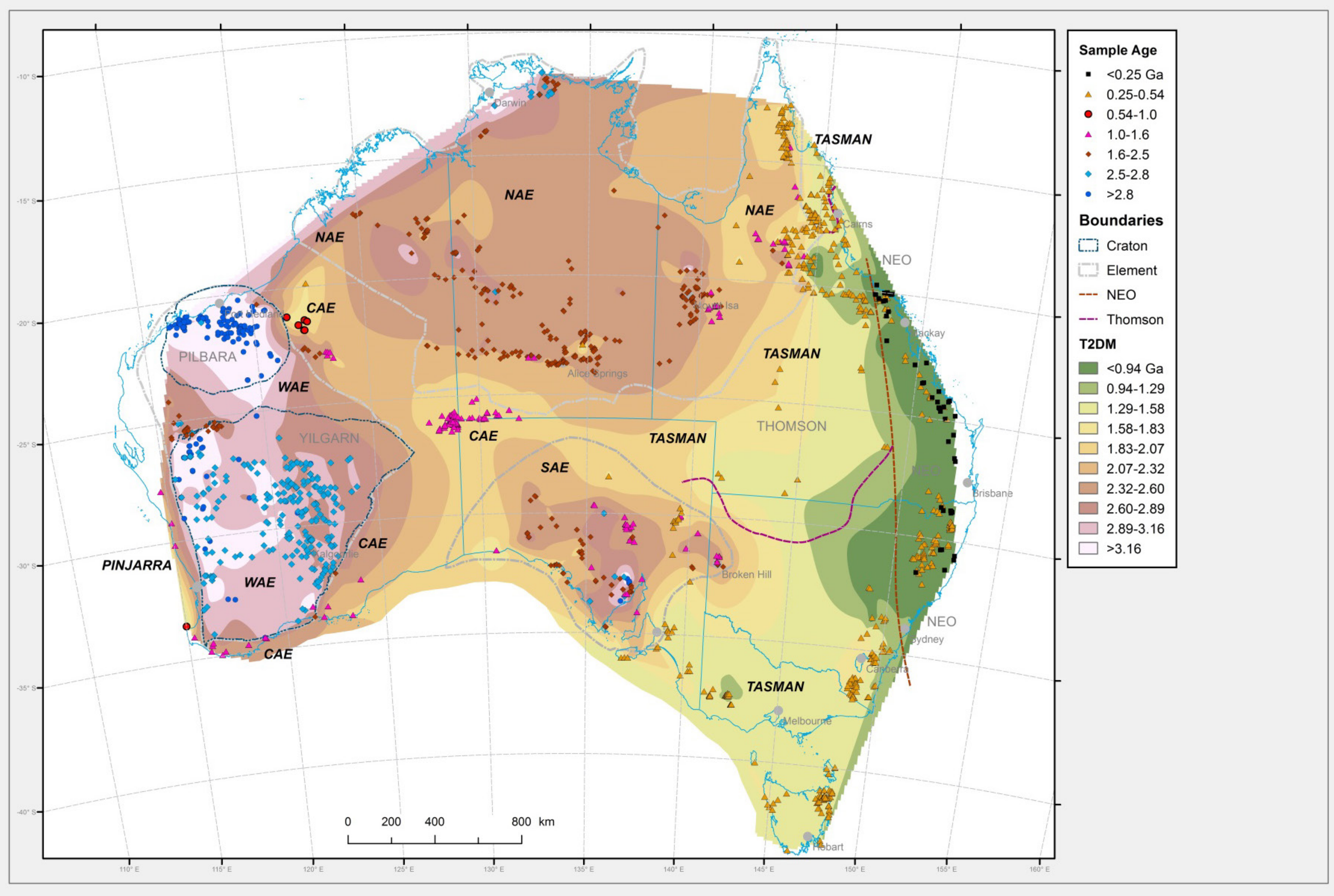
Appendix Figure D.1 The 2008 definition of major crustal elements in Australia (after the Hoatson et al. (2008) revision of Shaw et al. (1995)). The oldest is the West Australian Element and the youngest is the Tasman Element. The zone between the West Australian, South Australian and North Australian elements is made up of Proterozoic- to Paleozoic-ageds, termed the Central Australian Element. Figure from Blewett et al. (2012).



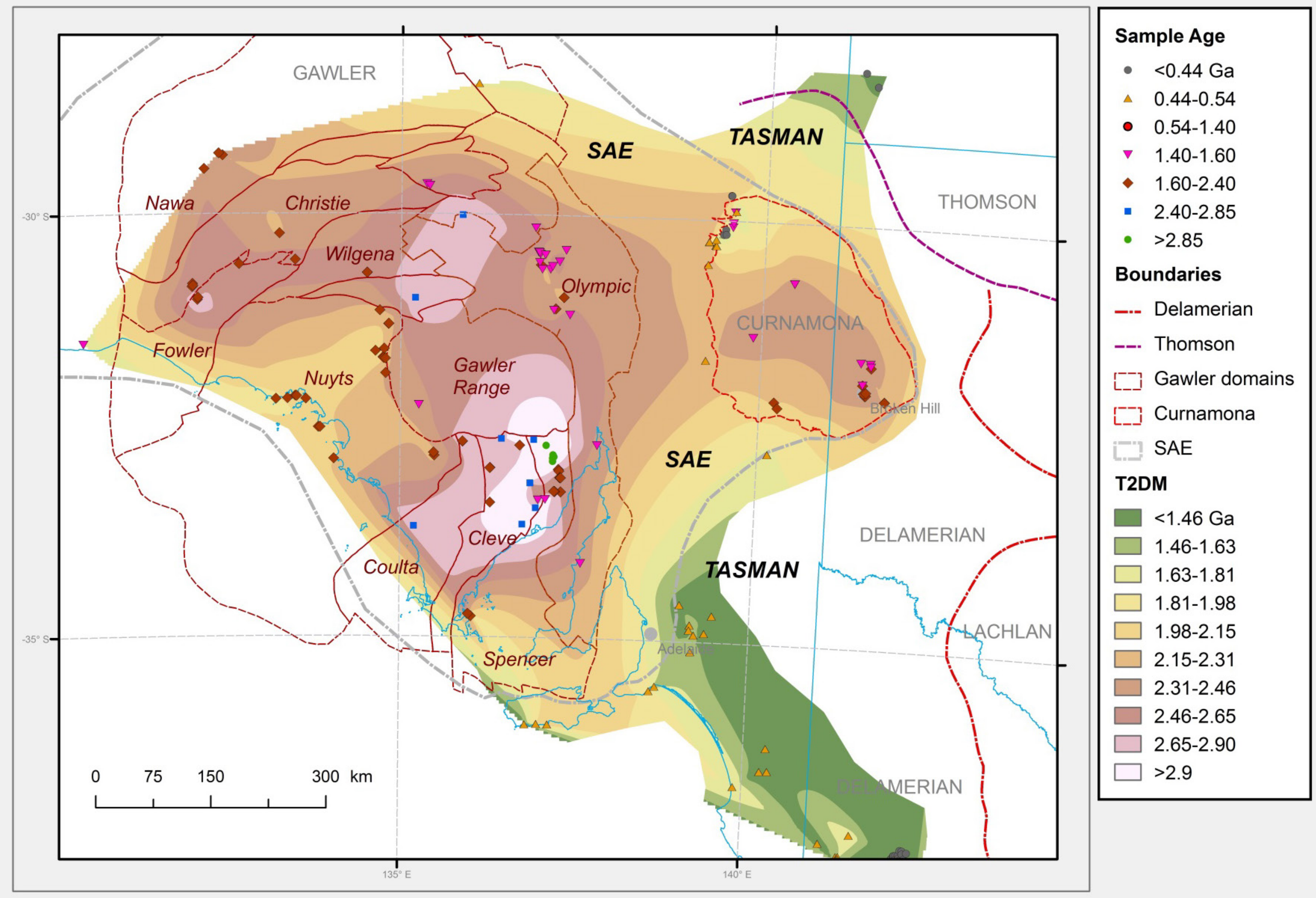
Appendix Figure D.2 Major onshore geological regions of Australia, with the major cratons, inliers,ic belts and Phanerozoic sedimentary basins shown. Figure from Blewett et al. (2012).

Appendix E. T_{2DM} images Including S-type granites

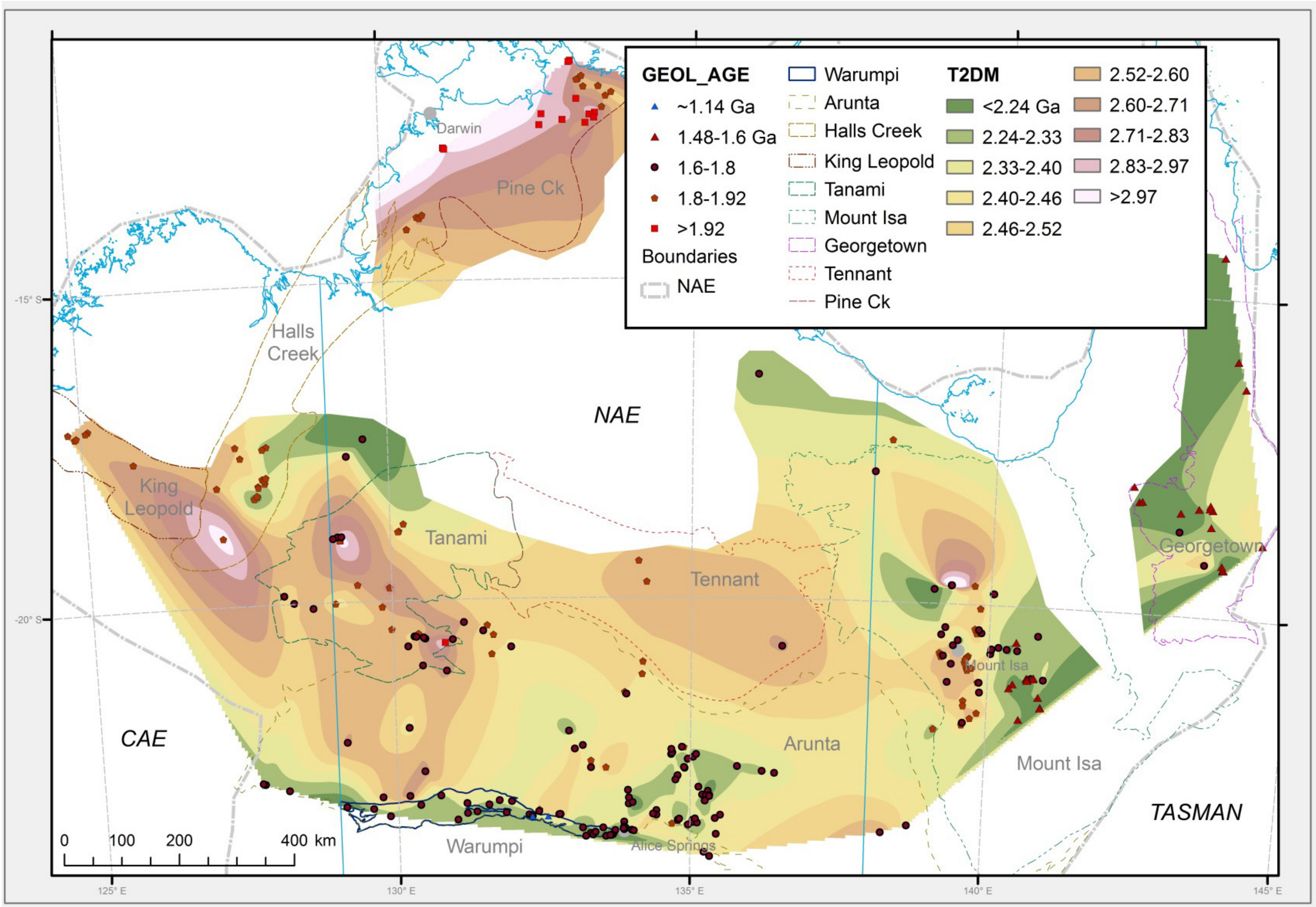
Two-stage depleted mantle model age (T_{2DM}) grids incorporating S-type granite isotopic data were also calculated. Resultant grids (Australia – Appendix Figure E.1; South Australia Element – Appendix Figure E.2; North Australia Element – Appendix Figure E.3; Tasman Element – Appendix Figure E.4), are largely very similar to those calculated without S-type granites, with only slight differences, largely in the intervals used in the colour ramp. The West Australian Element (WAE) region has no S-type granites so has not been replotted.



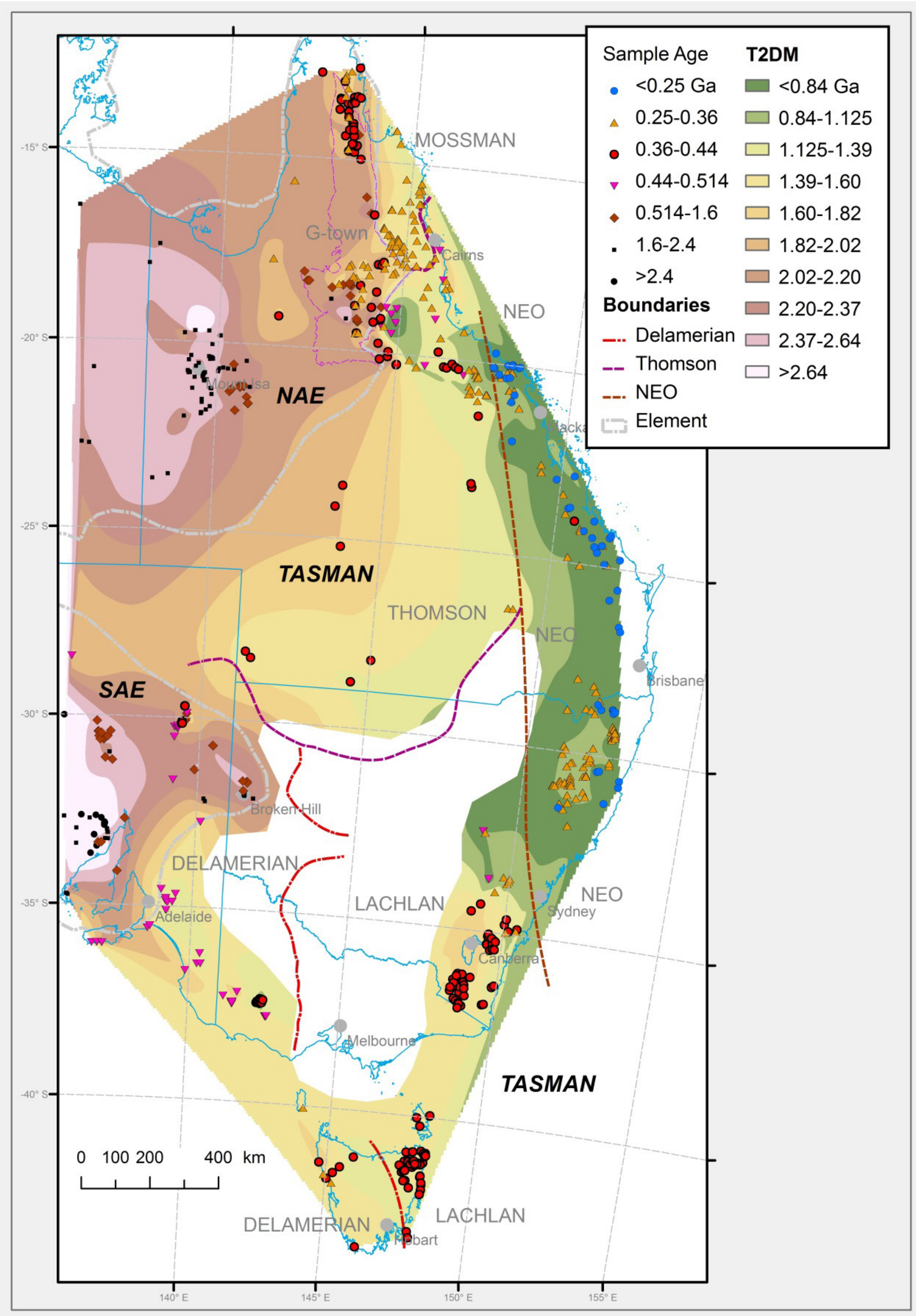
Appendix Figure E.1 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for Australia. Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap® (see main text). Also shown are North, West, South and Central Australian elements (NAE, WAE, SAE, CAE), the Pinjarra and Tasman elements, the Archean Pilbara and Yilgarn cratons and Phanerozoic Thomson (TO) and New England (NEO) orogens. Grid constructed from 1495 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. The boundary between the CAE and Tasman elements is uncertain and not shown.



Appendix Figure E.2 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for the South Australian Element (SAE) and surrounding Tasman Element. Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap® (see main text). Also shown are the Gawler and Curnamona cratons, domains of the Gawler Craton, and the Delamerian, Lachlan and Thomson orogens of the Tasman Element. Grid constructed from 232 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. These areas have been partially masked.



Appendix Figure E.3 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for Proterozoic and older units in the North Australian Element (NAE). Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap® (see main text). Also shown are the Pine Creek, Halls Creek, King Leopold, Tanami, Tennant Creek, Arunta, Warumpi, Mount Isa and Georgetown regions of the NAE. Grid constructed from 329 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. These areas have been partially masked.



Appendix Figure E.4 Gridded Nd two-stage depleted mantle model age (T_{2DM}) map for the Tasman Element and surrounding regions (South (SAE) and North (NAE) Australian elements).Isotopic data (colour coded by magmatic age) used to create the grid are also shown (Data and data sources are in Appendix B and Appendix C). Grid created in ArcMap® (see main text). Also shown are the Delamerian, Lachlan, Thomson and Mossman orogens of the Tasman Element, and the Georgetown region (G-town) of the NAE. Grid constructed from 758 data points. Grid colours in areas with no samples are purely based on interpolation and may have no relationship with underlying crust. These areas have been partially masked.