



Contents

ISSUE 107 Sept 2012

Editor

Stephen Ross

Graphic Design

Henry Pippan

Web Design

Henry Pippan

Graphics and GIS

Geographics Team

© Commonwealth of Australia 2012

ISSN 1035-9338

Geoscience Australia

GPO Box 378

Canberra ACT 2601 Australia

Cnr Jerrabomberra Avenue &

Hindmarsh Drive

Symonston ACT 2609 Australia

www.ga.gov.au

Chief Executive Officer

Dr Chris Pigram

Subscriptions

Online subscriptions

www.ga.gov.au/about-us/

news-media/subscribe/index.jsp

Editorial enquiries & Feedback

Steve Ross

p: +61 2 6249 9263

f: +61 2 6249 9926

e: ausgeomail@ga.gov.au

Sales Centre

p: +61 2 6249 9966

f: +61 2 6249 9960

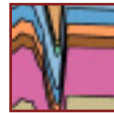
e: sales@ga.gov.au

GPO Box 378

Canberra ACT 2601 Australia

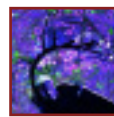
CEO comment

2



Petroleum potential of the Arrowie and Georgina basins 3

Deep seismic reflection data supports petroleum systems maturation modelling



The 40th Anniversary of Landsat

7

Australia's 33 year archive of Landsat data



Mapping new sandstone-hosted uranium terranes in South Australia

10

Survey highlights potential new discoveries

In brief

Marine environmental data assists offshore CO₂ storage assessment of Vlaming Sub-basin 16

Marine environmental data to shed light on CO₂ storage in Petrel Sub-basin 18

Scientists investigate Victorian earthquake 20

Product news

New National ASTER maps show land surface mineralogy 21

Northern Territory Energy Assessment 22

New and updated Basin Lithostratigraphy charts for 2012 22

New geophysical datasets released 23

Shaping a Nation: A Geology of Australia 24

The geology of Uluru and Kata Tjuta uncovered 24

Events

27



CEO comment



Dr Chris Pigram – CEO Geoscience Australia

This issue includes an article showing the application of airborne electromagnetic (AEM) surveying to mapping uranium mineral systems for uranium exploration in the Lake Frome region of South Australia. This area is Australia's premier sandstone-hosted uranium province, and hosts the only In Situ Recovery uranium mines currently operating in Australia, at Beverley and Honeymoon. The Frome AEM Survey is the last, but largest, of the three regional AEM surveys flown under the Onshore Energy Security Program, and covers roughly 10 per cent of the area of South Australia. The article discusses the application of regional AEM surveying for mapping under-cover geology in this highly prospective area, that has led to a much better mapping of palaeovalleys that host uranium mineral systems, as well as the sedimentary and fault systems that control uranium transport and deposition.

A report has been provided on the interpretation of the deep seismic reflection profiles from the Arrowie Basin in South Australia and the Burke River Structural Zone of the Georgina Basin in northwest Queensland. The research focused on their stratigraphic and structural architecture and was consequently utilised in petroleum systems maturation modeling to increase the understanding of their petroleum potential.

July 2012 marked the 40th anniversary of the Landsat, a series of satellites which has provided Australia with valuable images for over three decades. According to NASA, the Landsat series of satellites has produced 'the longest unbroken data stream of Earth's surface as seen from space'. Geoscience Australia is now preparing for Landsat 8 which will be ready for launch in February 2013 and will ensure the continuity of medium resolution satellite imagery of the type that supports a huge range of government programs.

This issue provides preliminary analyses from two marine surveys undertaken by Geoscience Australia to provide seabed environmental information to support assessments of CO₂ storage potential of the Vlaming and Petrel Sub-basins. Data from these multi-disciplinary studies are currently being assessed, and the outputs from this work will be used to inform and support the ongoing National CO₂ Infrastructure Plan (NCIP) being undertaken by the Department of Resources, Energy and Tourism.

Geoscience Australia and the CSIRO joined with several Australian State and Territory government agencies and international organisations to produce the ASTER maps which will provide mining and exploration companies with more accurate and detailed information than ever before. These first continent-wide scale maps of their type in the world provide detailed information on mineral components of rocks and soil, as well as a zoom capability which allows geoscientists to view images from thousands of kilometres wide to just a few kilometres.

Amazing geological features are the subject of *Uluru and Kata Tjuta: a geological guide* which was recently released by Geoscience Australia. Readers and visitors will find this book a valuable resource to assist their awareness, understanding and enjoyment of this special place.



Dr Chris Pigram
CEO Geoscience Australia

Petroleum potential of the Arrowie and Georgina basins

Deep seismic reflection data supports petroleum systems maturation modelling

Lidena Carr, Russell Korsch and Heike Struckmeyer



In 2006 the Australian Government expanded Geoscience Australia's program of seismic acquisition, data enhancement and client access through the commitment of almost \$134 million over five years to the Energy Security Initiative.

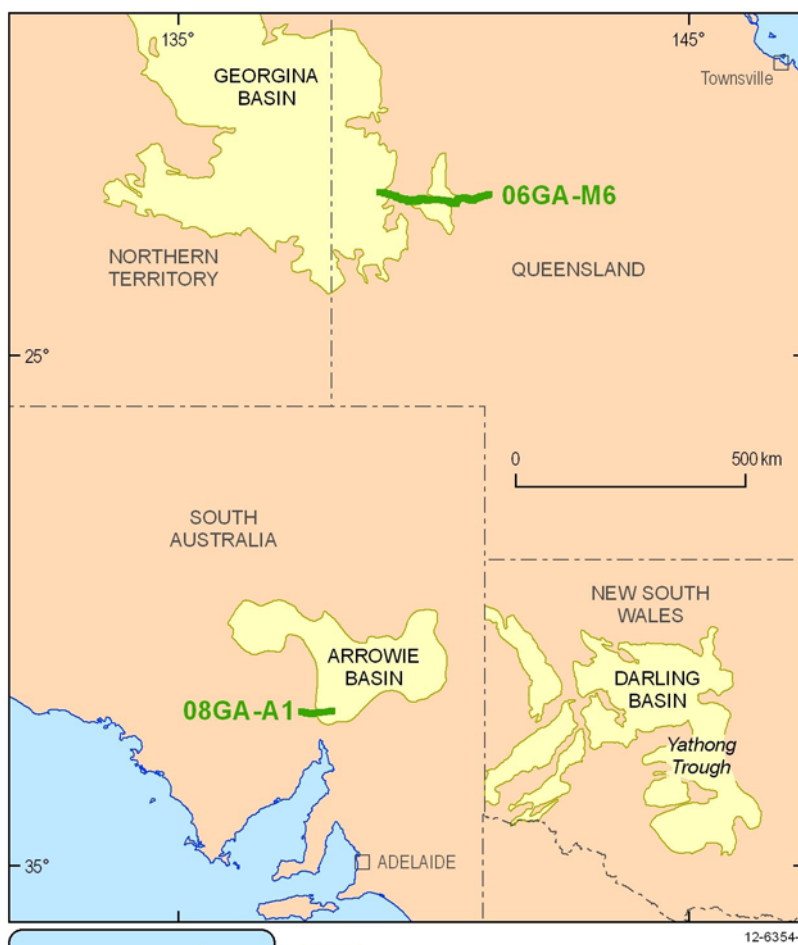


Figure 1. Map showing the locations of seismic lines 08GA-A1 across the Arrowie Basin in South Australia and 06GA-M6 across the Burke River Structural Zone in Queensland.

The focus of the Onshore Energy Security Program (OESP) was to stimulate exploration for energy resources, including non renewable resources such as hydrocarbons, uranium and thorium as well as renewable geothermal energy resources. The OESP was carried out under the National Geoscience Agreement between the Australian, state and Northern Territory governments. As part of the OESP, deep seismic reflection data were acquired across several frontier sedimentary basins to stimulate petroleum exploration.

This article reports on the interpretation of the deep seismic reflection profiles from the Arrowie Basin in South Australia and the Burke River Structural Zone of the Georgina Basin in northwest Queensland. The research focussed on their stratigraphic and structural architecture and was consequently utilised in petroleum systems maturation modelling to increase the understanding of their petroleum potential.

Arrowie Basin, South Australia

In 2008 Geoscience Australia, in conjunction with Primary Industries and Resources South Australia (PIRSA), acquired a

60 kilometre long deep seismic line (08GA-A1) across the western part of the Arrowie Basin, immediately to the west of the central Flinders Ranges (Figure 1). This part of the basin has received almost no attention for hydrocarbon exploration since the shallow Wilkatana 1 well was drilled in the 1950s, to a maximum depth of 670 metres. Some of these wells located 15 kilometres to the south of the seismic line encountered non-commercial bituminous hydrocarbons in the Cambrian succession (SANTOS 1957). Petroleum systems maturation modelling in the Arrowie Basin was carried out using the interpretation of stratigraphy and architecture of seismic line 08GA-A1. A full description of the parameters used for the modelling is included in Carr et al. (2012).

Georgina Basin, Northwest Queensland: Burke River Structural Zone

In 2006 Geoscience Australia, in conjunction with the Geological Survey of Queensland, the Predictive Mineral Discovery Cooperative Research Centre and Zinifex Limited, acquired a 283 kilometre long deep seismic reflection transect (06GA-M6) across the Burke River Structural Zone of the Georgina Basin in northwestern Queensland (Figure 1). This line was part of a larger, ~900 kilometre long seismic survey across the Mount Isa Province (Hutton and Korsch 2008). Only limited exploration has occurred in this region although the southern Georgina Basin is considered to be a significant potential hydrocarbon region, and includes a largely unexplored Middle Cambrian petroleum system (Ambrose et al. 2001; Boreham and Ambrose 2007).

Following the discovery of hydrocarbon indicators in water bores drilled into the Cambrian succession, exploration has included several petroleum exploration wells. Although there were numerous oil and gas shows and solid bitumen has been recovered from drillcore (Volk et al 2007) the wells proved unsuccessful for hydrocarbons (Ambrose et al. 2001). Draper (2007) suggested that an early Paleozoic carbonate petroleum system was present in the Georgina Basin in Queensland, and he considered that, although the Toko Syncline is more prospective, the Burke River Structural Zone is still worthy of further exploration. The Georgina Basin has been the subject of recent exploration, for both unconventional and conventional hydrocarbons, including the drilling of the Macintyre 2 well within the basin (Baraka Energy and Resources 2011). Petroleum systems maturation modelling in the Georgina Basin was conducted utilising information from the interpretation of the stratigraphy and architecture of seismic line 06GA-M6. A full description of the input parameters and modelling are available in Carr et al. (2012).

Results

The Arrowie Basin seismic data show an asymmetrical basin architecture, with the basin attaining a maximum depth of ~3800 metres. Several sequence boundaries mapped in this seismic section are correlated with the sequence boundaries between the major Neoproterozoic stratigraphic groups in the Adelaide Rift System. In the eastern most part of the seismic section a series of east-dipping thrust faults disrupt the stratigraphic section.

Petroleum systems maturation modelling conducted in the Arrowie Basin indicates that the generation and expulsion of hydrocarbons from mature source rocks occurred early during the burial history, and mostly prior to the Late Cambrian, consistent with previous findings (Figure 2). Potential Cambrian source rocks are probably immature to mature for oil generation at the modelled site in the basin. In contrast, potential Neoproterozoic source rocks are likely to be mature to overmature for oil generation, and immature to mature for gas generation. With hydrocarbon systems clearly present in the Arrowie Basin, future work, possibly with a focus on unconventional Cambrian hydrocarbons, is warranted.

Seismic data across the Burke River Structural Zone of the Georgina Basin show that the basin is about 65 kilometres wide, with a half graben geometry, being bounded in the west by a

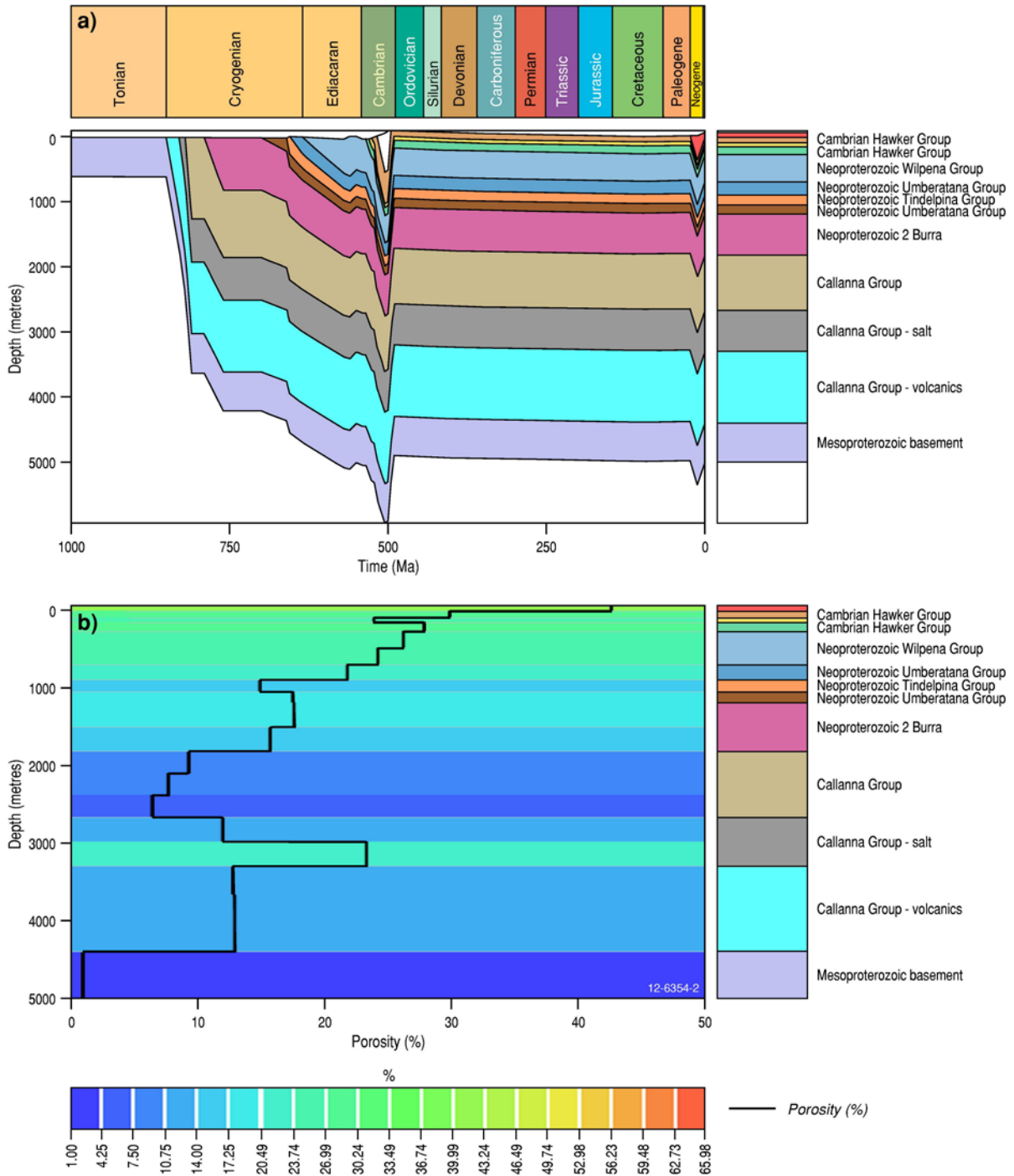


Figure 2. Results from petroleum systems maturation modelling in the Arrowie Basin showing: **a)** burial history plot modelled with rapid late Proterozoic and Cambrian burial and minor uplift in the last five million years; **b)** predicted porosity versus depth.

rift border fault. The basinal succession attains a maximum thickness of ~2800 metres, with the stratigraphy being relatively flat-lying and thickening towards the basin bounding fault. Petroleum systems maturation modelling for the Burke River Structural Zone indicates that potential Cambrian source rocks are likely to be oil mature. Significant generation and expulsion probably occurred early in the

burial history in response to Cambrian-Ordovician loading. Expulsion occurred after trap formation in the Neoproterozoic-Cambrian but before later trap formation in the Devonian. The

required long preservation time and unroofing are the major risk factors within the basin.

The main outcomes of the OESP have been the collection, interpretation and delivery of precompetitive data, significantly improving knowledge about Australian onshore frontier basins. This work has assisted in identifying the types of potential petroleum exploration targets to be expected in the onshore basins, and reducing exploration risk. It also provides baseline information for the future assessment of conventional and unconventional petroleum resources in Australia.

References

- Ambrose GJ, Kruse PD & Putnam PE. 2001. Geology and hydrocarbon potential of the southern Georgina Basin, Australia. *APPEA Journal* 41: 139–163.
- Baraka Energy and Resources. 2011. ASX Announcement: Elevated Hydrocarbon Shows Recorded from MacIntyre-2, Southern Georgina Basin, Australia. Available at: www.barakaenergy.com.au/announcements.php (accessed: December 2011).
- Boreham CJ & Ambrose GJ. 2007. Cambrian petroleum systems in the southern Georgina Basin, Northern Territory, Australia. In Munson TJ & Ambrose GJ (eds). Proceedings of the Central Australian Basins Symposium, Alice Springs, 16-18th August, 2005. *Northern Territory Geological Survey, Special Publication 2*: 254–281.
- Carr LK, Korsch RJ, Struckmeyer H, Jones LEA, Holzschuh J, Costelloe RD & Meixner AJ. 2012. The architecture and petroleum potential of Australia's onshore sedimentary basins from deep seismic reflection data and petroleum systems maturation modelling: the Arrowie, Georgina and Darling Basins. *Geoscience Australia Record* 2012/36.
- Draper J. 2007. Georgina Basin – an early Palaeozoic carbonate petroleum system in Queensland. *APPEA Journal* 47: 105–124.
- Hutton LJ & Korsch RJ. 2008. Deep seismic reflection interpretations, Mount Isa and Isa-Georgetown surveys. In Digging Deeper 6 Seminar Extended Abstracts. *Queensland Geological Record* 2008/06.
- SANTOS. 1957. Arrowie Basin: Wilkatana Well Completion Report numbers 1-19b. *Primary Industry and Resources South Australia Open File Envelope* No. 8577.
- Volk H, George SC, Kempton RH, Liu K, Ahmed M & Ambrose GJ. 2007. Petroleum migration in the Georgina Basin: Evidence from the geochemistry of oil inclusions. In Munson TJ & Ambrose GJ (eds). Proceedings of the Central Australian Basins Symposium, Alice Springs, 16–18 August, 2005. *Northern Territory Geological Survey, Special Publication 2*: 282–303.
- This work was presented at the Central Australian Basin Symposium on the 16 and 17 July, in Alice Springs.

Related articles/websites

The architecture and petroleum potential of Australia's onshore sedimentary basins from deep seismic reflection data and petroleum systems maturation modelling: the Arrowie, Georgina and Darling Basins (*Geoscience Australia Record* 2012/36).

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=71976

For more information

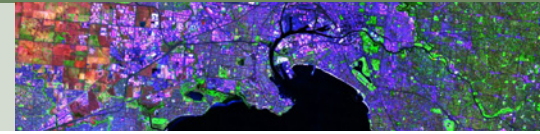
email ausgeomail@ga.gov.au



The 40th Anniversary of Landsat

Australia's 33 year archive of Landsat data

Luke Piotrowicz



July 2012 marked the 40th anniversary of the Landsat, a series of satellites, which has provided Australia with unique, wonderful and incredibly valuable images for over three decades.

On the 23 July 1972, the Earth Resources Technology Satellite, which came to be known as Landsat 1, was launched by NASA. The Landsat missions were the brain-child of the Director of the U.S. Geological Survey (USGS), William Pecora. Pecora first proposed the idea of a remote sensing satellite program to gather facts about the natural resources of our planet in 1965. Seven Landsat satellites have been launched since 1972. The latest in the series, Landsat 8, is ready for launch in January 2013 (See Table 1).

As stated in the NASA Landsat overview, the Landsat series of satellites has produced “the longest unbroken data stream of Earth’s surface as seen from space”. Images from Landsat have provided the world with unprecedented information on land cover changes and their residual effects since 1972.

Landsat instruments have a moderate spatial-resolution. Individual houses cannot be seen on a Landsat image, but large man-made objects such as highways are visible, so human-scale processes like urban development, agriculture and deforestation can be detected and mapped, as can geological features and vegetation.

Australia’s role in Landsat began in October 1979 when the Australian Landsat Station was opened by then Minister for Industry and Commerce, The Hon Phillip Lynch. The Australian Landsat Station could receive data from the Landsat satellites as they passed over Australia, so Landsat images of Australia, including some offshore regions and parts of Indonesia and Western Papua New Guinea, could be captured for the first time. Since then, Geoscience Australia has collected over 666 000 Landsat scenes. Over 50 per cent of the Landsat images distributed by Geoscience Australia are over two years old.

Landsat images of Australia are still collected every day. The satellite transmits information to Geoscience Australia’s nine metre satellite dish at Alice Springs, which tracks Landsat 7

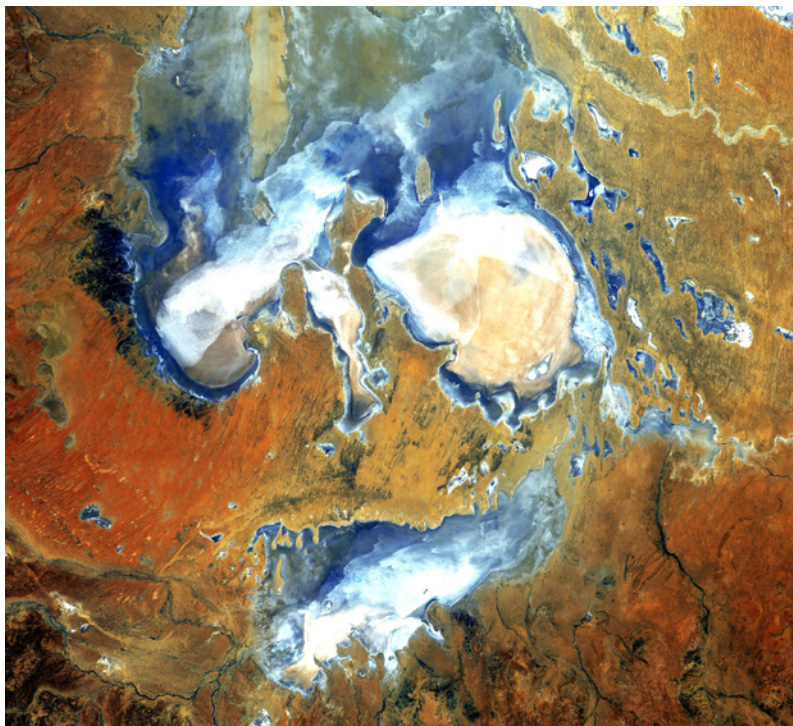


Figure 1. The scary face of Lake Eyre. Captured on 6th May 2006, in this Landsat image Lake Eyre appears as a scary face. The image won fifth place in the Earth as Art competition held by USGS in July 2012.

Table 1.

Satellite	Launch Date	Period of Operation
Landsat 1	23 July 1972	Decommissioned 6 January 1978
Landsat 2	22 January 1975	Decommissioned 25 February 1982
Landsat 3	5 March 1978	Decommissioned 31 March 1983
Landsat 4	16 July 1982	Decommissioned June 2001
Landsat 5	1 March 1984	Thematic Mapper stopped acquiring data 18 November 2011
Landsat 6	October 1993	Failed on Launch
Landsat 7	15 April 1999	Operating in SLC-Off Mode after May 2003
Landsat 8	February 2013	Due to be launched February 2013

each time it passes over the continent – generally three ‘passes’ each day, but over different parts of the continent. Today, however, Alice Springs receives data from a number of satellites, and Geoscience Australia also operates a satellite antenna at Hobart which can receive data from Landsat 7 whilst it is over New Zealand and even parts of Antarctica. The Alice Springs ground station also helps the USGS and NASA to operate their satellites, by providing communications from the satellites as they pass over Australia when they are not directly visible to mission controllers in the USA.

Landsat imagery now underpins many government and private activities. The Australian archive of Landsat images, now 33 years in duration, has become an invaluable resource for mapping the continent and monitoring changes in land use and the environment. Perhaps surprisingly, the archive of data becomes more, rather than less, useful through time. The archive is continuously being re-used as advances in science and technology make it possible to tackle more difficult questions about the past and present state of the continent.

Getting the data to the users has been a challenge throughout the 40 years of Landsat. In 1980, processing a single 263 megabyte Landsat image required 4 hours of computer processing time. Few organisations had the computers to handle such data, and standard practice was to print the image and for users to work with a hard-copy.

Computers have increased in power since 1980, but at the same time the volumes of data have increased because the satellite instruments are more sophisticated, and user requirements have changed. In 2012 the user community is expecting not one image of a site, but hundreds of images captured over time, each fully calibrated

for sensor variations and the effects of terrain and atmosphere, to detect and measure changes in the landscape. Getting the data to the users therefore remains a problem to this day.

In 2011 the Australian Government (Australian Space Research Program) funded a project called Unlocking the Landsat Archive (or ULA). The ULA project aims to improve access to Landsat data for Australia by processing and calibrating at least the last decade of Landsat data (about 250 000 images) and making these available on-line. The project will also prototype an analysis system that will use advanced supercomputing facilities to produce information from the images for reporting and decision making.

The ULA project will load the calibrated Landsat datasets into a National Data Grid in the National Computational Infrastructure (NCI) at the Australian National University. The National Data Grid (NDG) is a consistent approach to continental observations from satellites (and other sources), including different spatial-resolutions of satellite imagery.

The ULA project partners are Geoscience Australia, Lockheed Martin Australia (LMA), the Australian National University (ANU) – National Computational Infrastructure (NCI), the Victorian Partnership for Advanced Computing (VPAC) and the Cooperative Research Centre for Spatial Information (CRC-SI).

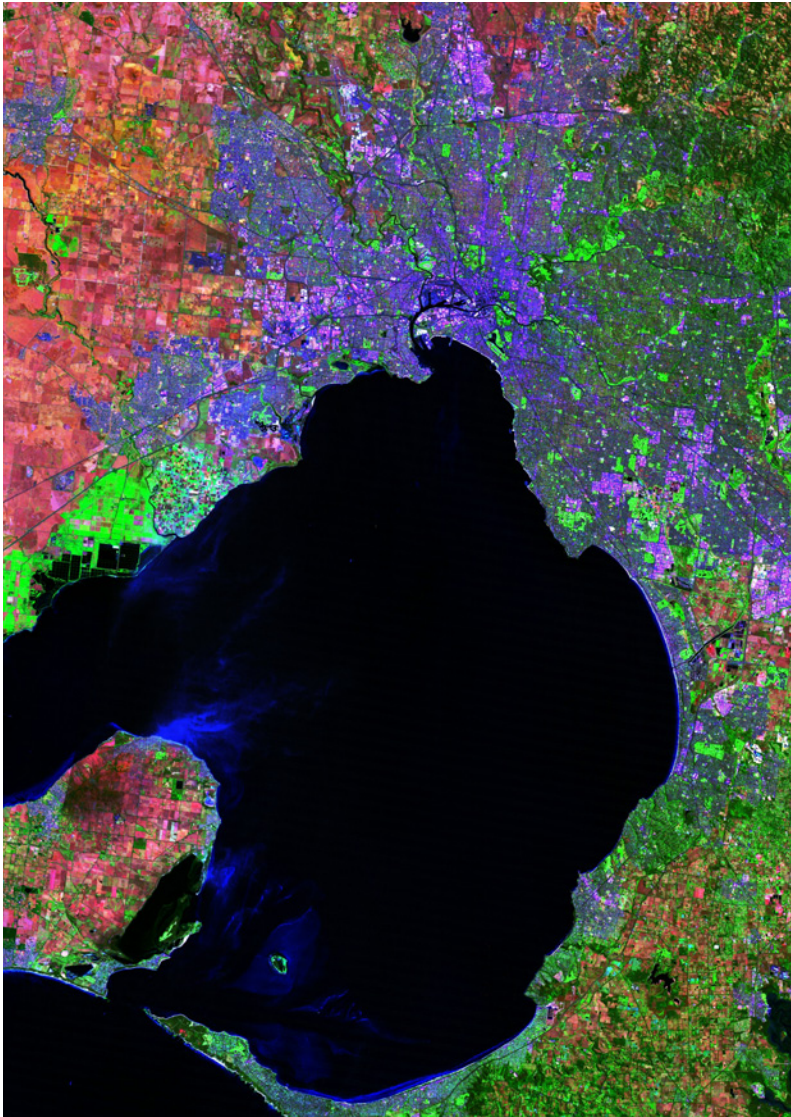


Figure 2. Melbourne in 'false colour'. Satellites generally observe in slightly different wavelengths of light to those that we see. Satellite images are therefore false-colour, but can enhance features like urbanization (mauve-purple in this image), irrigated areas and wet forests (green here), and dry grasslands (red-brown here).

Related articles/websites

USGS Earth as Art

<http://eros.usgs.gov/imagegallery/>

For more information

email ausgeomail@ga.gov.au

Geoscience Australia is now preparing for Landsat 8, which is ready for launch in February 2013. If successfully launched and commissioned, Landsat 8 will continue the Landsat record of Australia.

Some Landsat images are both science and art. The USGS tracks the more 'artistic' Landsat images through the 'Earth as Art' initiative. From the millions of Landsat scenes that now exist, 126 aesthetic front runners were selected, in July 2012, for the ultimate 'Earth as Art' competition. In the finals, Australia made 5th place with the 'scary face' of Lake Eyre (Figure 1).

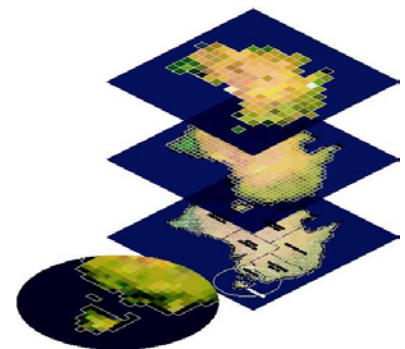


Figure 3. The Unlocking the Landsat Archive project will calibrate ten years of Australian Landsat data and load it into a standardized data-grid for analysis.



© Commonwealth of Australia 2012.

Mapping new sandstone-hosted uranium terranes in South Australia

Survey highlights potential new discoveries



Ian C. Roach and Subhash Jaireth

Airborne electromagnetic (AEM) data describe the electrical conductivity of the ground. Electrical conductivity of the ground can be caused by electrically conductive minerals such as clays, sulphides and graphite, but also by saline groundwater. The AEM data can be used to map the stratigraphy and shape of shallow sedimentary basins and paleochannel/paleovalley systems, which may be indistinguishable using other geophysical methods like gravity and magnetics. The data can also be used for mapping groundwater resources.

Geoscience Australia has flown three regional AEM surveys in:

- Western Australia (Paterson Province; Roach 2010)
- Northern Territory (Pine Creek region; Craig 2011)
- South Australia (Lake Frome region; Roach 2012)

as part of the Onshore Energy Security Program (Geoscience Australia 2011). The raw AEM data have been mathematically inverted using in-house software (the GA Layered Earth Inversion or GA-LEI) to produce geologically validated ground conductivity models that are suitable for interpretation (Hutchinson et al 2011).

The Lake Frome region of South Australia is Australia's premier sandstone-hosted uranium province. The region hosts Australia's only two operating In Situ Recovery (ISR) uranium mines at Beverley and Honeymoon (Figure 1), as well as many other deposits and prospects hosted in paleochannel systems within paleovalleys. Paleovalleys are the buried remains of ancient river systems, which are often hidden beneath surface cover (such as sand dunes) in the landscape. These have been described in more detail in the Lake Frome region by Jaireth et al (2010) and as a concept by Clarke (2009). Exploration interest has expanded beyond the Lake Frome region to include the Blanchewater area between the northern Flinders Ranges and Lake Blanche (Figure 1), where there is potential for similar uranium deposits.

The Frome airborne electromagnetic (AEM) survey is the subject of an interpretation report recently published jointly by Geoscience Australia and the Geological Survey of South Australia (Roach 2012). The report provides interpretations of regional AEM data that highlight the potential of this area for sandstone-hosted uranium deposits.

Architecture of sandstone-hosted uranium systems

Sandstone-hosted uranium deposits are generated by reduction-oxidation (redox) chemical reactions. Uranium is dissolved and transported in oxidised groundwaters and is reduced to form uranium oxides, generally formed in proximity to redox fronts within a sandstone aquifer. The architecture of a fertile uranium system is defined by:

- A source region containing readily leachable uranium
- Highly permeable sandstone sediments (aquifers) confined within less permeable shaly sediments (aquitards)
- A suitable *in situ* or mobile reductant
- An effective hydrogeological setting which connects the above three elements.

In the northern Flinders Ranges, uranium-enriched rocks occur in the Mount Painter Inlier (Mount Neill Granite with up to 380 parts per million (ppm) uranium and Hot Springs Gneiss up to 470 ppm uranium; Fraser and Neumann 2010) and the Mount Babbage Inlier (Yerilla Granite up to 270 ppm uranium; Fraser and Neumann 2010). Uranium occurs primarily as the mineral uraninite, which is

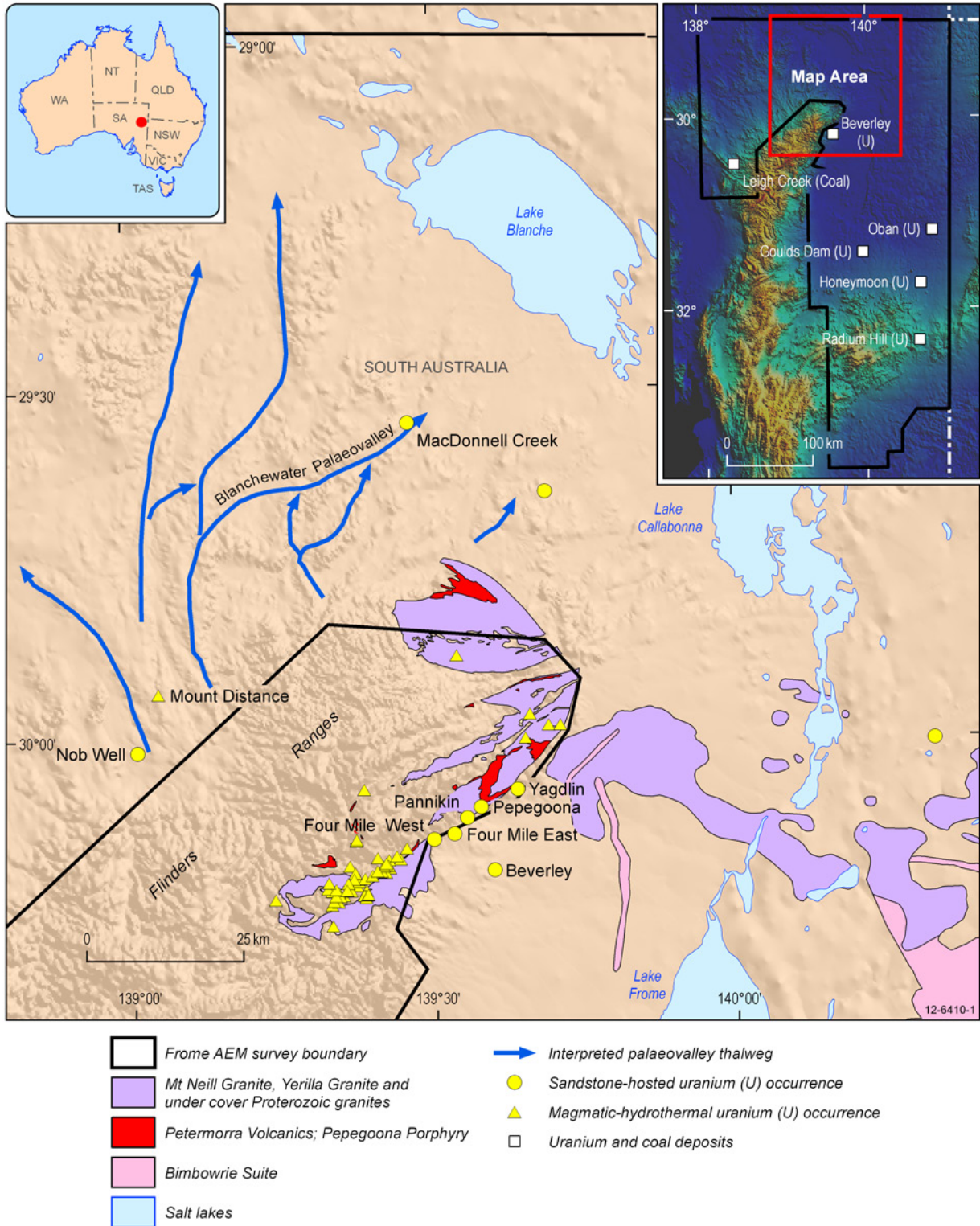


Figure 1. The map shows the solid geology of uranium-bearing granites of the Mount Painter and Mount Babbage inliers (Mt Neill and Yerrilla granites) and known uranium occurrences (from SARIG), major lakes and interpreted palaeovalley/palaeochannel courses overlain on a digital elevation model of the region. The uranium-bearing granites outcrop in the northern Flinders Ranges, but occur under cover elsewhere. The inset map shows the location of the Blanchewater area and the Frome AEM Survey.

highly soluble in oxidised groundwater. These rocks also contain several uranium-bearing accessory minerals such as monazite, allanite, xenotime and zircon. In addition to uranium-enriched felsic rocks,

the inliers also host a number of magmatic-hydrothermal and epithermal uranium deposits and

prospects such as Mount Gee, Mount Painter and Radium Ridge, which can provide leachable uranium.

Once dissolved, uranium is transported laterally by groundwater through fractured rock and sedimentary aquifers into paleochannels nestled within paleovalleys until it meets a suitable reductant. The reductant may be solid (normally carbonaceous material like plant remains or lignite, but also minerals like pyrite), liquid (oil) or gas (a hydrocarbon such as methane or another gas such as hydrogen sulphide; Jaireth et al 2008).

In sandstone-hosted uranium deposits paleochannels/paleovalleys define the shape and size of the hydrogeological system which can transport geologically realistic quantities of uranium to the redox front in the aquifer. The Frome AEM Survey has been able to map the paleochannel/paleovalley systems and delineate the broad distribution of sand- and shale-dominated facies within the sediments filling them.

In the Blanchewater area, mineral explorers are searching for uranium deposits in paleochannels/paleovalleys filled primarily with Cenozoic Eyre Formation sediments. These are known to host most of the uranium mineralisation in the Lake Frome region (for example, Four Mile East, Pannikin, Pepegoona, Honeymoon, Oban, Junction Dam and Goulds Dam). Explorers are also searching secondarily for mineralised Namba Formation sediments which may also host uranium mineralisation (for example, Beverley and Yagdlin). More information on the sandstone-hosted uranium deposits of the southern Lake Frome region is included in Skirrow (2009), Jaireth et al (2010) and Wilson (2012).

Mapping paleochannel/paleovalley systems in the Blanchewater area

Recent reports by exploration companies working in the Blanchewater area highlight the area's potential, with a new discovery in the Blanchewater Paleovalley at MacDonnell Creek (Figure 1). Data from the Frome AEM Survey have not only confirmed the existence of the system but defined its shape and size more accurately. In addition, major fault systems, which have controlled uranium movement and deposition underlining the high potential of this area to form sandstone-hosted uranium deposits, have also been mapped.

In Figure 2, AEM data are displayed as conductivity sections compared to the regional surface geology map at MacDonnell Creek to illustrate the contrasting electrical conductivity conditions of the top 400 metres of the ground. Conductors in the two conductivity sections in the image correlate with geological features in the geology map. These are the Mesozoic Marree Subgroup of the Eromanga Basin, which contains the Bulldog Shale (a pyrite-bearing black shale, recognised as a strong electrical conductor) and the Oodnadatta

Formation (another relatively conductive sandy clay unit). A number of other Cenozoic sedimentary units can be mapped within the conductivity sections including the sand-rich Eyre Formation (a relatively electrically resistive unit in this image) and the clay-rich Namba Formation (which includes a relatively conductive layer near its base, interpreted to be a salt water-filled sandy layer). Interpretations are only possible with the addition of surface and borehole geological information; a number of boreholes are included in Figure 2, highlighting the correlation between the borehole geology and electrical conductivity in the conductivity sections.

Geological interpretations from the conductivity sections, together with solid geology and a digital elevation model, were used to compile a 3-dimensional model of the Blanchewater and wider northern Flinders Ranges area (Figure 3). This model illustrates the interpreted Mesozoic-Cenozoic unconformity which separates the Eromanga Basin (containing the Marree Subgroup; below) and the Lake Eyre Basin (containing the Eyre and Namba formations; above). It also includes the outcropping uranium-rich granite source rocks of the Mount Painter and Mount Babbage inliers in the northern Flinders Ranges. The uranium-bearing granites continue under cover of the Eromanga and Lake Eyre basins, as shown in Figure 1. Offsets in conductors in the conductivity sections (Figure 2) generally correlate with faults mapped at the surface and have

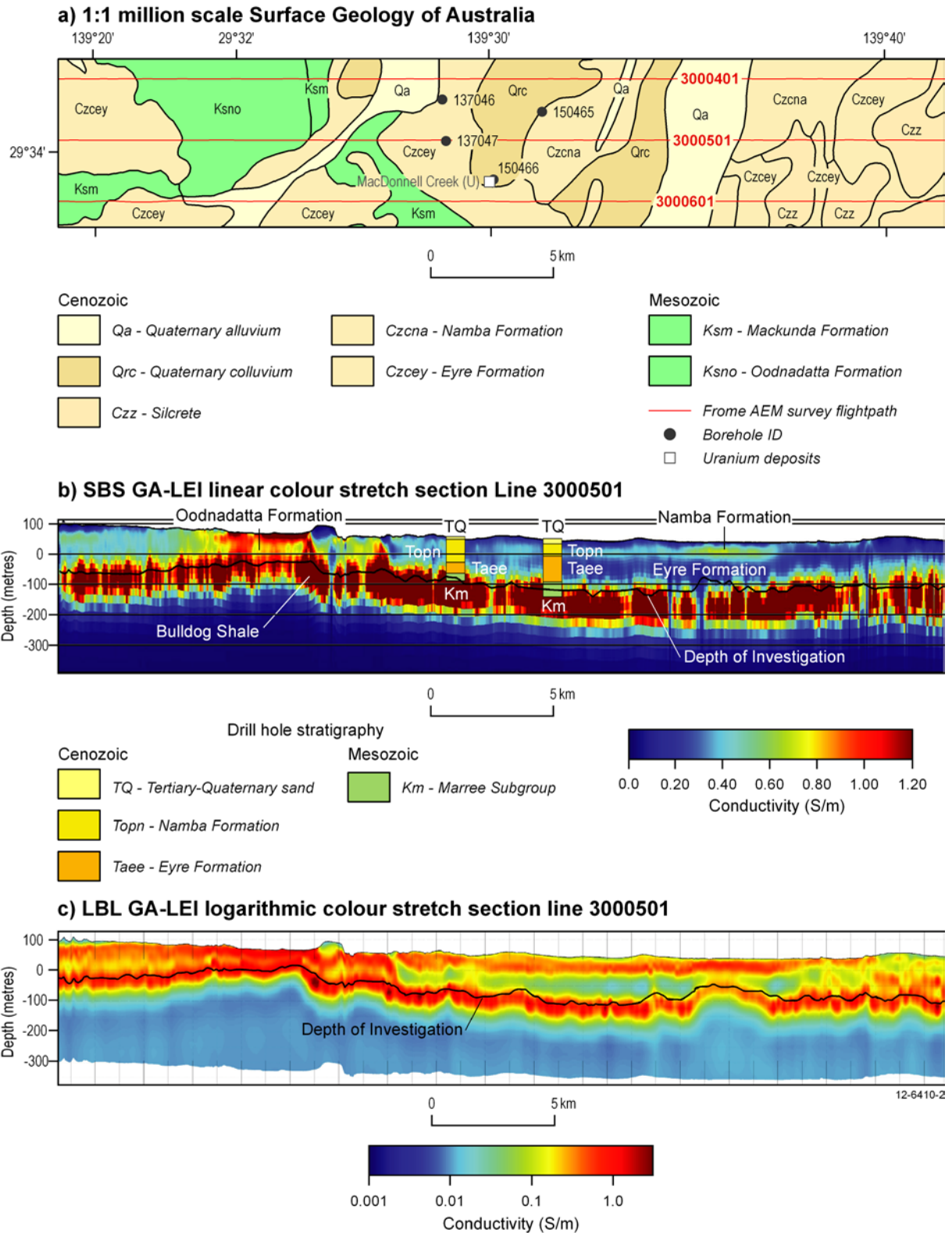


Figure 2. Surface geological map and AEM conductivity sections of flight line 3000501 in the Blanchewater area. Sedimentary units in the surface geology map (top) are correlated with conductivity features in the two conductivity sections (middle, bottom). Two different GA Layered Earth Inversion (GA-LEI) products have been generated for the Blanchewater area: a sample-by-sample GA-LEI (SBS GA-LEI), which enhances vertical features (middle); and a line-by-line GA-LEI (LBL GA-LEI), which enhances horizontal features (bottom). Stratigraphic drill holes plotted over the SBS GA-LEI conductivity section (middle) are used to correlate conductivity features with under-cover geology. The diagram is modified from Costelloe and Roach (2012) and includes the Surface Geology of Australia map of Raymond (2010).

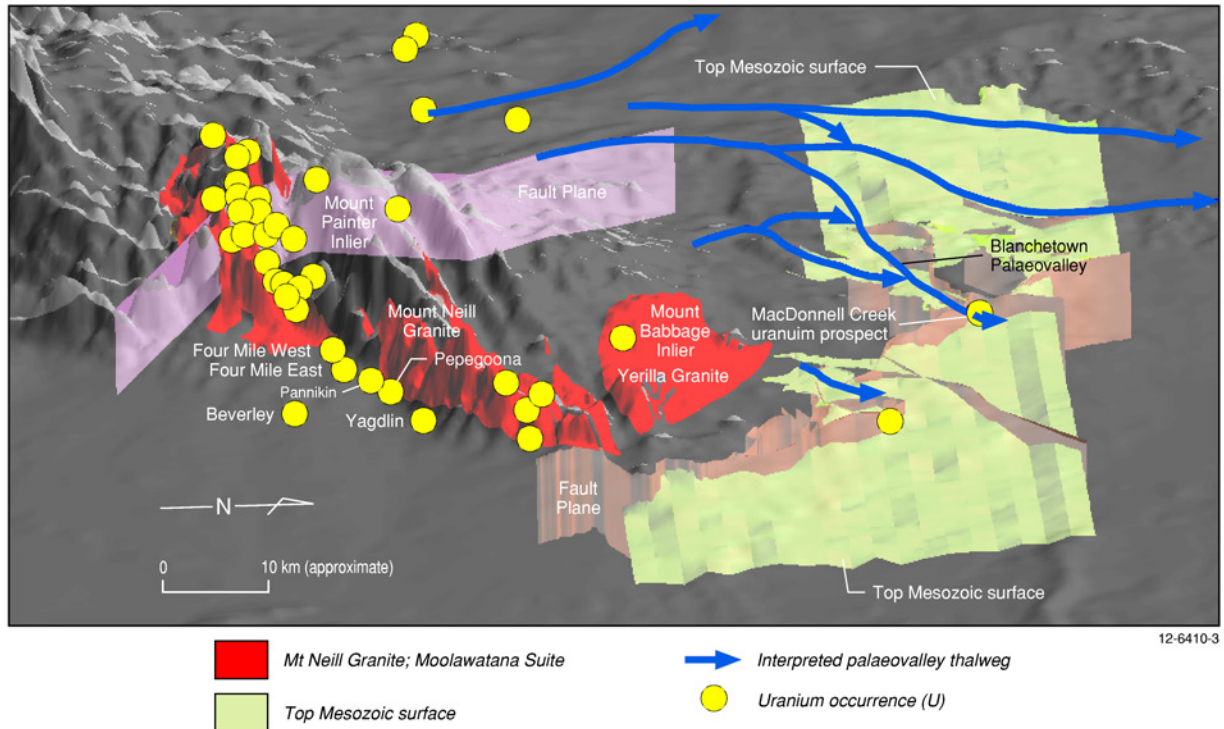


Figure 3. 3D model of the northern Flinders Ranges and Blanchewater region. The model shows solid geology of uranium-bearing granites of the Mount Painter and Mount Babbage inliers and known uranium occurrences (from SARIG) draped over the digital elevation model (shown partially transparent here) and interpreted palaeochannel/palaeovalley courses. A series of neotectonically-active faults offset the interpreted Mesozoic-Cenozoic unconformity which is the boundary between the underlying Eromanga Basin and the overlying Lake Eyre Basin. Some of the faults were mapped by Sheard et al (1996). Uranium-rich groundwaters are interpreted to drain from the Yerilla Granite of the Mount Babbage Inlier (and perhaps the Mount Neill Granite of the Mount Painter Inlier) into the Blanchewater Palaeovalley, depositing uranium at redox fronts on the down-thrown side of the fault system.

been used to more fully map the large, neotectonically-active fault system that wraps around the northern Flinders Ranges. The AEM data have also mapped previously unknown faults under sedimentary cover. Fault offsets of up to 200 metres have been measured in some conductivity sections. Conditions suitable for uranium deposition in the Eyre Formation occur north of the large fault system shown wrapping around the north of the northern Flinders Ranges in Figure 3. On the down-thrown side to the north of the fault system sediments are protected from physical erosion and from chemical stripping of uranium mineralisation by oxidised groundwater. On the up-thrown side, to the south of the fault system closer to the Flinders Ranges, the Namba Formation and some Eyre Formation appear to have been removed by erosion.

Implications for uranium prospectivity

The MacDonnell Creek uranium discovery in the Blanchewater Paleovalley highlights the potential of the Blanchewater area for new uranium discoveries. Mapping using regional AEM allows explorers to interpret the links between source regions of leachable uranium (containing ~250 ppm uranium) and deposition sites, demonstrating

the importance of locating the major factors controlling uranium mineral systems. In this example, uranium is most likely sourced from the Mount Babbage Inlier, although the Mount Painter Inlier should not be discounted as a source, with uranium perhaps supplied by groundwater passing through a major fault system potentially linking it with the upper Blanchewater Paleovalley indicated in Figure 3. Uranium was (and perhaps still is) transported by groundwater through the Blanchewater Paleovalley and has been deposited in carbonaceous Eyre Formation sediments, principally on the down-thrown side of the fault system shown in Figure 3. The regional AEM data allow users to locate similar

groundwater flow systems which may also carry uranium-rich waters to suitable reduction sites along the down-thrown side of this major fault system that influences the landscape of the northern Flinders Ranges.

Although the Eyre Formation is considered to be the most important uranium host, sand lenses in the Namba Formation may also be prospective for uranium mineralisation. The analysis presented in this article can be used in other areas of the Lake Frome region where the Frome AEM survey has similarly been able to map the architecture of the paleochannel/paleovalley-type sandstone-hosted uranium deposits. For more information about the features described here please see the detailed interpretations in the Frome AEM Survey interpretation record (Roach 2012).

References

- Clarke JDA., 2009. Palaeovalley, palaeodrainage, and palaeochannel - what's the difference and why does it matter? *Transactions of the Royal Society of South Australia* 133:1.
- Costelloe MT & Roach IC. 2012. The Frome AEM Survey, uncovering 10% of South Australia. *Preview* 158 (June 2012).
- Craig MA (ed). 2011. Geological and energy implications of the Pine Creek region airborne electromagnetic (AEM) survey, Northern Territory, Australia. Geoscience Australia, Canberra. *Geoscience Australia Record* 2011/18. Available at https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=71854
- Fraser GL & Neumann NL. 2010. New SHRIMP U-Pb zircon ages from the Gawler Craton and Curnamona Province, South Australia, 2008-2010. Geoscience Australia, Canberra. *Geoscience Australia Record* 2010/16. Available at: www.ga.gov.au/servlet/BigObjFileManager?bigobjid=GA17485.
- Geoscience Australia. 2011. Energy Security Program Achievements - Towards Future Energy Discovery. Geoscience Australia, Canberra. Available at: <https://www.ga.gov.au/servlet/BigObjFileManager?bigobjid=GA19973>.
- Hutchinson DK, Brodie RC & Costelloe MT. 2011. Frome Embayment TEMPEST™ AEM Survey: Inversion Report. Geoscience Australia, Canberra. (GEOCAT #72589).
- Jaireth S, Clarke J & Cross A. 2010. Exploring for sandstone-hosted uranium deposits in paleovalleys and paleochannels. *AusGeo News* 97.
- Jaireth S, McKay A & Lambert I. 2008. Association of large sandstone uranium deposits with hydrocarbons. *AusGeo News* 89. Available at: www.ga.gov.au/servlet/BigObjFileManager?bigobjid=GA11117.
- Raymond OL. 2010. Surface geology of Australia 1:1 000 000 scale. Geoscience Australia, Canberra. Available at: www.ga.gov.au/mapconnect/.
- Roach IC (ed). 2010. Geological and energy implications of the Paterson Province airborne electromagnetic (AEM) survey, Western Australia. Geoscience Australia, Canberra. *Geoscience Australia Record* 2010/12. Available at: https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=70302.
- Roach IC (ed). 2012. The Frome airborne electromagnetic (AEM) survey, South Australia: implications for energy, minerals and regional geology.

Geoscience Australia-Geological Survey of South Australia. *Geoscience Australia Record* 2012/040-DMITRE Report Book 2012/00003. Available at: https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=73713.

SARIG. South Australian Resources Information Geoserver. Available at: www.sarig.pir.sa.gov.au/.

Sheard MJ, Reid PW & White MR. 1996. Northern Flinders Ranges Geology. Geological Atlas 1:75 000 series, Geological Survey of South Australia, Adelaide.

Skirrow RG (ed). 2009. Uranium ore-forming systems of the Lake Frome Region, South Australia: Regional spatial controls and exploration criteria. Geoscience Australia, Canberra. *Geoscience Australia Record* 2009/40. Available at: www.ga.gov.au/servlet/BigObjFileManager?bigobjid=GA16103.

Wilson T. 2012. Uranium and uranium mineral systems in South Australia - Second edition. Department for Manufacturing, Innovation, Trade, Resources and Energy, South Australia, Adelaide. Report Book 2012/00009. Available at: <https://sarigbasis.pir.sa.gov.au/WebtopEw/ws/samref/sarig1/image/DDD/RB201200009.pdf>.

Related articles/websites

Geological and energy implications of the Paterson Province airborne electromagnetic (AEM) survey, Western Australia (*Geoscience Australia Record* 2010/12)

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=70302

Geological and energy implications of the Pine Creek region airborne electromagnetic (AEM) survey, Northern Territory, Australia. Geoscience Australia, Canberra. *Geoscience Australia Record* 2011/18.

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=71854



© Commonwealth of Australia 2012.

For more information

email ausgeomail@ga.gov.au

Marine environmental data assists offshore CO₂ storage assessment of Vlaming Sub-basin

Geoscience Australia is currently undertaking marine surveys to provide seabed environmental information to support assessments of the CO₂ storage potential of several offshore sedimentary basins¹. The surveys are being undertaken under the Australian Government's National CO₂ Infrastructure Plan (NCIP) to help identify sites suitable for the long term storage of CO₂ within reasonable distances of major sources of CO₂ emissions².

Detailed seabed data was recently captured in two selected areas of the Rottneest Shelf, Western Australia, using the RV *Southern Supporter*, to help inform an assessment of the CO₂ storage potential for the Vlaming Sub-basin. The Vlaming Sub-basin was previously identified by the Carbon Storage Taskforce (2009) as potentially suitable for CO₂ storage (Figure 1a). The principal aim of Geoscience Australia's marine survey was to look for evidence of any past or current gas or fluid seepage at the seabed, and to determine whether the location of these features are related to basin structures, such as faults that have been identified in a number of seismic lines, that may extend up to the seabed. The survey also mapped seabed biota in the areas of interest because some communities may be associated with seepage. This research addresses key questions on the regional seal integrity of the South Perth Shale and the potential for containment of CO₂ in the Early Cretaceous Gage Sandstone (Figure 1).

Multibeam sonar bathymetry and seabed backscatter data, and acoustic sub-bottom profiler (chirper) data were acquired over 653 km² of seabed (Figure 1a). These geophysical data were used to select sites for sampling the seabed, and 89 sediment grab samples and 12 lines of towed underwater video footage were obtained.

The two study areas are part of a shallow water (< 100 m) carbonate-dominated shelf with very little sediment (sediment starved). Several key seabed features were identified using the new geophysical data, and are being investigated in order to understand the relationship between the present seabed and the geological history of this shelf, and to provide an understanding of possible fluid seepage from the underlying Vlaming Sub-basin.

Preliminary analysis of the new data show that they will greatly increase our understanding of the geomorphology and benthic habitats of the Rottneest Shelf. In particular, a number of features may represent sites of past fluid seepage and their recognition provides fresh insight into the evolution of this continental shelf. These include: in Area 1, northwest trending linear structures, suggestive of faults, present on the seabed. Area 2 in particular (Figure 1b) is characterised by extensive beds of free-living coralline red algae (rhodoliths), with rhodoliths having accumulated along

parabolic ridges on the seabed in approximately 35 m water depth (Figure 1b); and individual mounds overlain by rhodoliths, are present in water depths of 80–85 m below present sea-level. Rhodoliths are particularly important in marine ecosystems, providing a transitional niche between rocky reef and sandy areas.

Geological processes operate on a variety of spatial and temporal scales, and have given rise to the present form of the seabed in the study areas. Inshore of the parabolic ridges, which are likely to be remnants of coastal dunes deposited during periods of lower sea-level (Brooke *et al.*, 2010), the shelf is mostly sediment starved with Quaternary limestone cropping out on the seabed. A spatial correlation between a number of ridges on the seafloor, sitting in depths of 85 to 35 m below present sea-level, and the sub-surface geology, is suggestive of links between faults that run through the deeper Vlaming Sub-basin, fluid seepage and the modern seabed. The drowned relict coastal dunes formed with sub-aerial exposure of the Rottneest Shelf during periods of low sea-level. Further analysis of the survey data should help clarify whether the location of the seabed ridges is linked to past seepage from the basin.

Detailed analyses of the seabed sediment samples (geochemical, sedimentological and biological) from these locations, and further processing of the geophysical data will be completed in

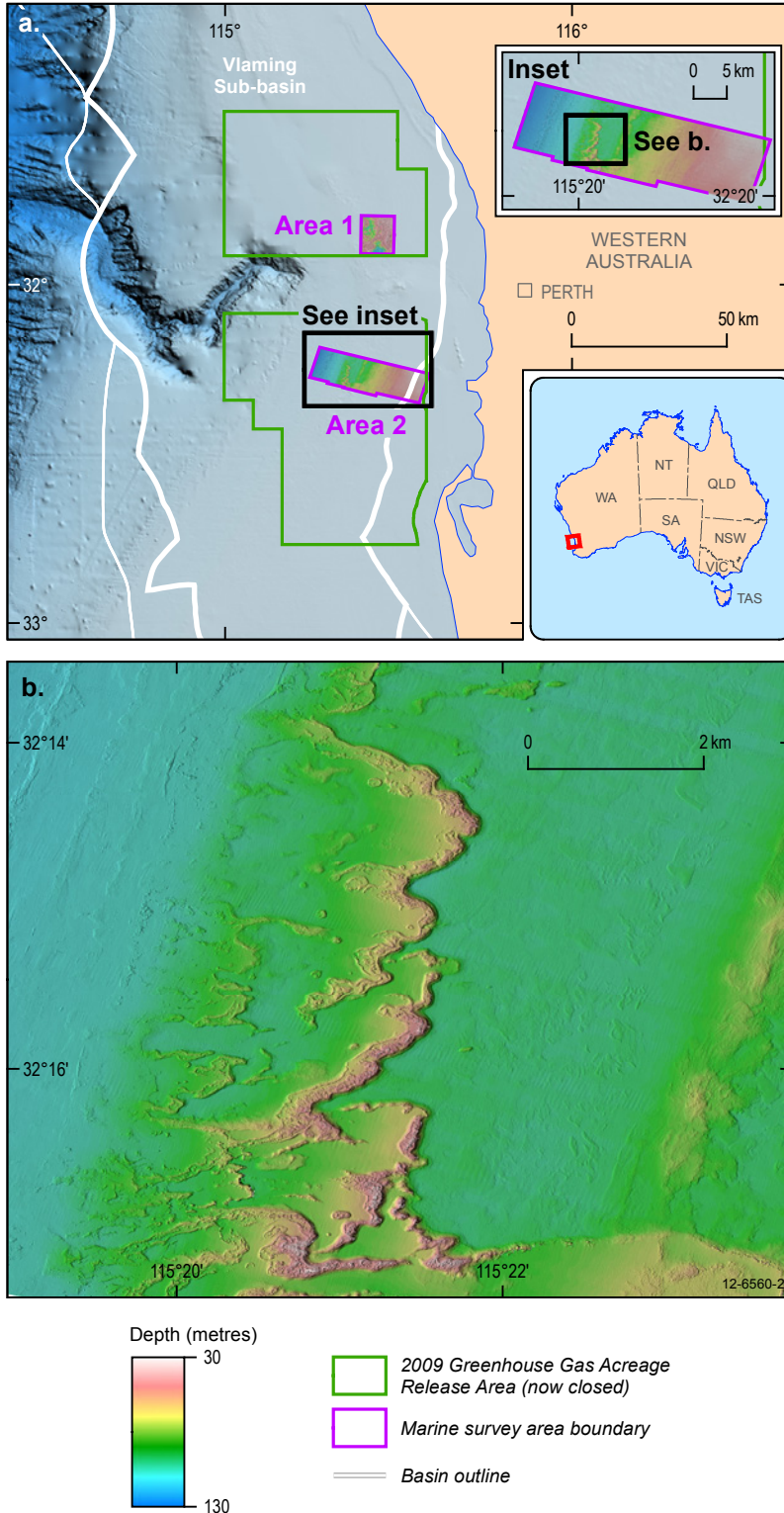


Figure 1a. Location of study areas (Areas 1 and 2) on the Rottneest Shelf, Western Australia showing the offshore 2009 Greenhouse Gas (GHG) acreage release areas (now closed, green boxes); **1b.** Area 2, southwest of Rottneest Island with large parabolic ridges (sites of rhodolith accumulation) rising up to 10 m above the seabed.

December 2012. Results of the analysis of these data will be published in Geoscience Australia Records, map products, and other publications to support the NCIP work.

References

Carbon Storage Taskforce 2009, National Carbon Mapping and Infrastructure Plan – Australia: Concise Report, Department of Resources, Energy and Tourism, Canberra.

Brooke, B., Creasey, J., Sexton, M., 2010. Broad-scale geomorphology and benthic habitats of the Perth coastal plain and Rottneest Shelf, Western Australia, identified in a merged topographic and bathymetric digital relief model. *International Journal of Remote Sensing*, 31, 6223-6237.

Related articles/websites

¹Greenhouse Gas Storage
www.ga.gov.au/ghg.html

²Carbon Capture and Storage Flagships program
www.ret.gov.au/energy/clean/ccs/ccsfp/Pages/default.aspx

National CO₂ Infrastructure Plan
www.ret.gov.au/energy/clean/ccs/geological/nco2infplan/Pages/default.aspx

For more information

email ausgeomail@ga.gov.au or
email tanya.whiteway@ga.gov.au

Marine environmental data to shed light on CO₂ storage in Petrel Sub-basin

In May 2012, Geoscience Australia, in collaboration with the Australian Institute of Marine Science (AIMS), carried out a marine environmental survey in the Petrel Sub-basin, northern Australia. The purpose of the survey was to gather pre-competitive geophysical and biophysical data on seabed environments within targeted areas of the Petrel Sub-basin to help facilitate an assessment of CO₂ storage potential in these areas. The survey was undertaken as part of the Australian Government's National Low Emission Coal Initiative (NLECI¹).

These new data will support the regional assessment of CO₂ storage prospectivity in the Petrel Sub-basin and contribute to the nation's knowledge of its environmental assets.

The Petrel Sub-basin (Figure 1a), located beneath the Joseph Bonaparte Gulf, northern Australia, was identified in 2009 in the Carbon Storage Taskforce Report as potentially suitable for geological storage of CO₂ because of its favourable geological setting and proximity to offshore gas and petroleum resources. More than 650 km² of the seabed in the central Gulf were mapped to characterise their benthic habitats, using Geoscience Australia's shallow-water multibeam sonar system onboard the AIMS research vessel, Solander. The two study areas were located within the boundaries of the Petrel Sub-basin and one of the 2009 Greenhouse Gas acreage release areas (now closed) (Figure 1a). The survey involved the acquisition of approximately 5300 line kilometres of multibeam sonar data, to enable geomorphic mapping, and 650 line kilometres of multi-channel shallow sub-bottom profile data to investigate possible fluid pathways in the shallow subsurface geology. Seabed samples, including biota and sediment, were collected at 13 stations, to characterise the seabed environment and identify evidence of possible seepage. Conductivity, temperature and depth measurements of the water column were also collected at ten locations to characterise its vertical structure and help identify possible seepage. Finally, measurements of waves, tides and ocean currents were acquired at two stations (one within each survey area) to help characterise the regional oceanographic processes.

The northern study area is characterised by steep to vertically-sided flat-topped banks, which stand 30–40 m above the surrounding seabed, whereas palaeo-channels (valleys formed during periods of

lower sea level), plains, ridges and pockmark fields are the primary geomorphic features in the southern area (Figure 1b). Preliminary analysis of sediment samples indicate that the plains are comprised of fine- to medium-grained sands, and muds, whereas palaeo-channels (valleys) comprise coarse- to very coarse-grained sands. Large areas (~380 km²) of the seabed in the southern area contain pockmarks (small shallow depressions in the seabed); those on the plains and in valleys are commonly up to three metres deep and 30 m in diameter. Larger pockmarks (>10 m in diameter) generally occur in fields ranging between 10–100 km², and cover >80% of the southern study area, while smaller pockmarks (<10 m diameter) typically occur in closely spaced clusters within the fields of larger pockmarks. Comparatively fewer pockmarks are present in the northern study area and occur primarily as clusters on the margins of banks and ridges. The geochemical analysis of samples from areas of pockmarks may indicate whether these features are related to the seepage of fluids or gas from the seabed, and the origin of the seepage – from the deep basin or from within surficial sediments.

Infaunal assemblages are dominated by crustaceans and polychaetes, and to a lesser extent echinoderms and molluscs. Once identification of specimens to operational taxonomic units is complete, further analysis will investigate the relationships

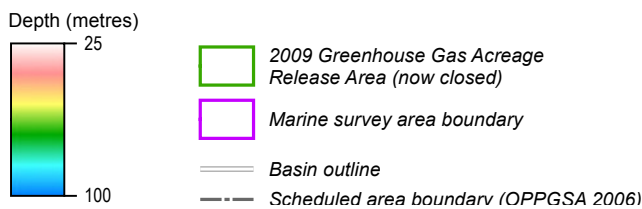
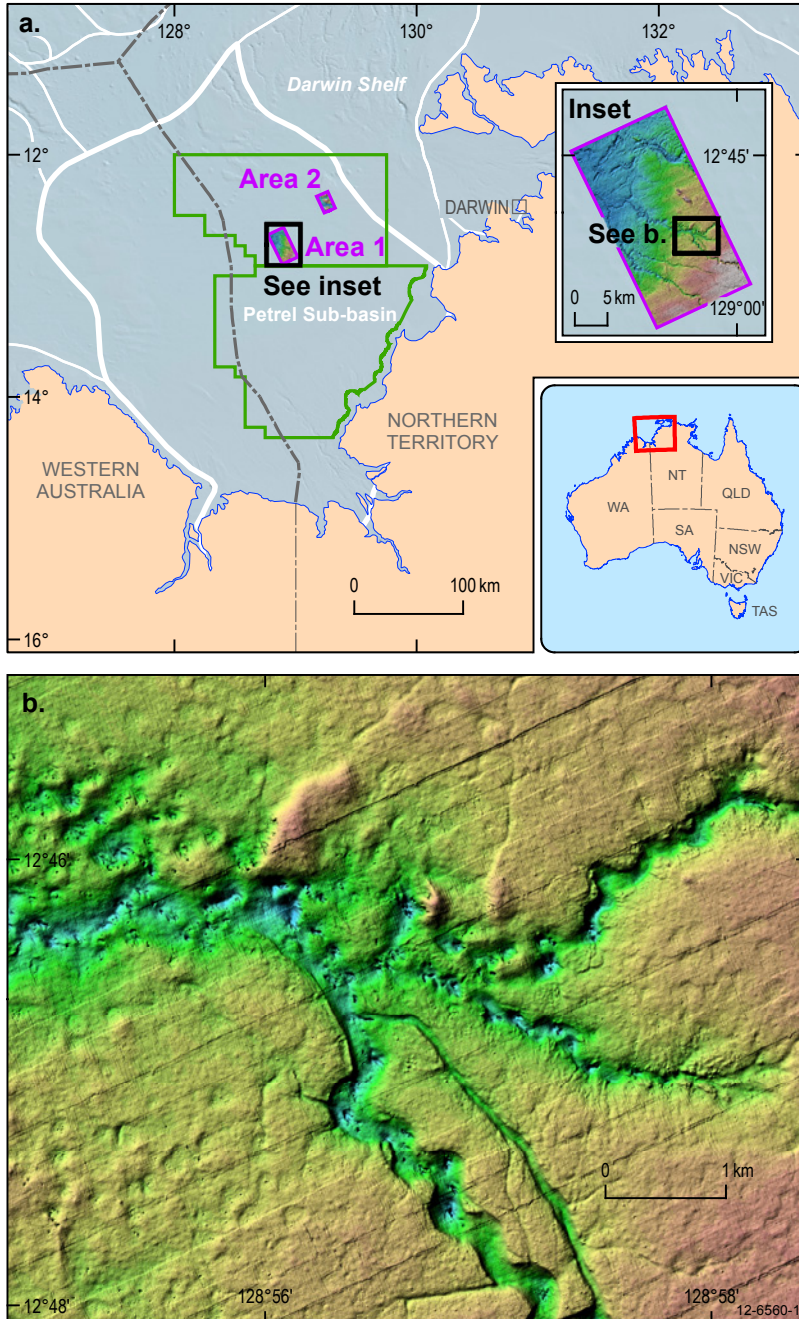


Figure 1a. Location of survey areas in the Petrel Sub-basin, northern Australia. Former Greenhouse Gas acreage release areas (released in 2009 and now closed) are also shown. **1b.** High-resolution false-colour bathymetry image of the southern acquisition area, showing palaeo-channels (valleys).

amongst environmental factors and infauna, particularly in relation to those indicative of fluid seepage and unique communities. The major analyses of samples and data and their interpretation will be completed by December 2012. These new data will support the regional assessment of CO₂ storage prospectivity in the Petrel Sub-basin and contribute to the nation's knowledge of its environmental assets.

References

Carbon Storage Taskforce 2009, National Carbon Mapping and Infrastructure Plan – Australia: Concise Report, Department of Resources, Energy and Tourism, Canberra.

Related articles/websites

¹National Low Emissions Coal Initiative (NLECI)
www.ret.gov.au/energy/clean/ccs/nleci/Pages/index.aspx

For more information

email ausgeomail@ga.gov.au or
email tanya.whiteway@ga.gov.au

Scientists investigate Victorian earthquake

The most significant earthquake experienced in Victoria in 30 years is to come under examination from seismologists and natural hazard researchers as temporary seismometers are deployed in the area surrounding the epicentre.

The magnitude 5.4 earthquake occurred in the state's southeast at 8:53pm on 19 June 2012, 16 kilometres southwest of the Gippsland township of Moe. There have been more than 170 aftershocks following the Moe event, the largest recorded at magnitude 3.5.

It is the largest earthquake in Victoria since November 1982 when an earthquake also measuring magnitude 5.4 occurred near the town

of Wongungarra, 100 kilometres north of the event near Moe. In 1969 there was a magnitude 5.3 event centred on Boolarra, 15 kilometres southeast of the Moe event.

Using data captured by the temporary seismometers, seismologists will analyse aftershock data to further clarify the location of the main shock, and to help identify the active fault system which produced the earthquake. The data will also help to refine local ground motion models for predicting the amount of shaking produced by earthquakes in Victoria.

Post-analysis information will help to improve future assessments of the likely earthquake hazard in the area around Moe and Traralgon, and more broadly, the likely hazard in Victoria's Gippsland region.

These earthquakes are called intra-plate, and occur due to the release of stress that has built up in the Earth's crust, caused by movement of the tectonic plates. The Australian continent is part of the Indian-Australian plate which is being pushed slowly north-east at approximately 7cm per year.

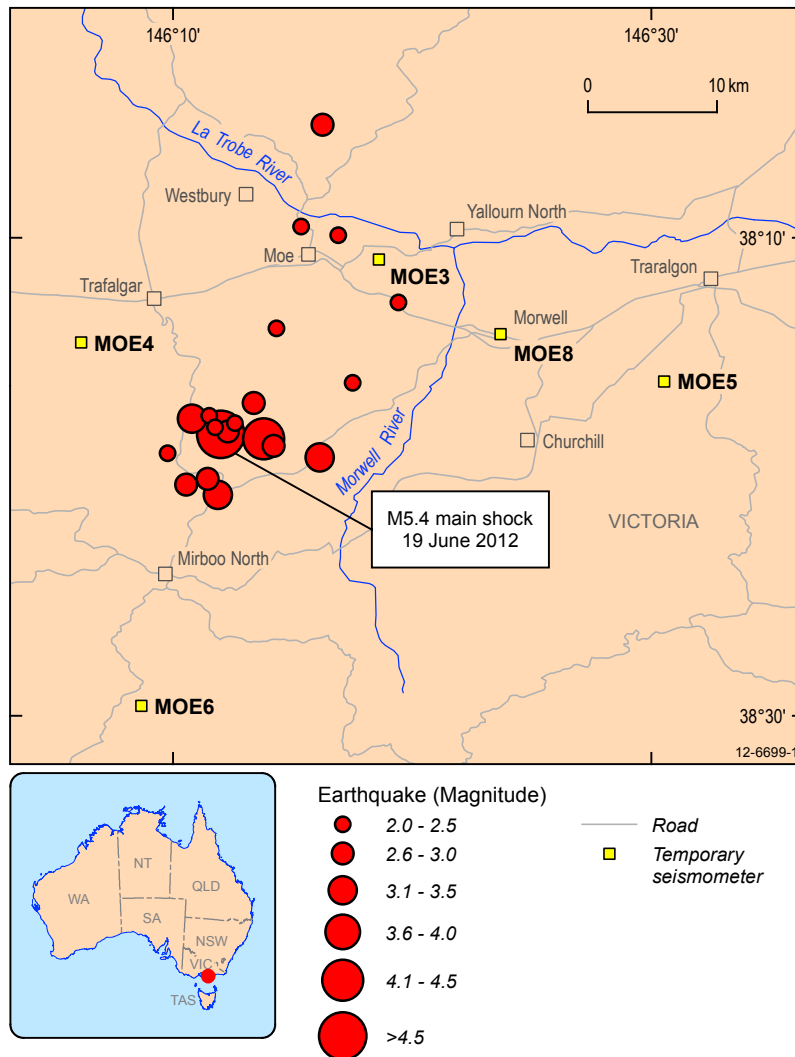


Figure 1. The map shows the magnitude 5.4 main shock that occurred in June 2012 and the aftershocks located through the use of the Australian National Seismograph Network (ANSN) until August 2012. The aftershocks as recorded by the ANSN range in magnitude from 2.0 to 4.4. The map also shows the locations of the temporary seismometers deployed by Geoscience Australia in the days following the main shock (labelled MOE3-MOE8).

Related articles/websites

Earthquakes @ Geoscience Australia
www.ga.gov.au/earthquakes/getQuakeDetails.do?quakeld=3226344&corid=614420&sta=TOO

For more information

email ausgeomail@ga.gov.au



© Commonwealth of Australia 2012.

New National ASTER maps show land surface mineralogy

The ASTER Geoscience Maps of Australia are the first public, web-accessible continental-scale maps of the Earth's land surface mineralogy. The maps have applications for mineral mapping and exploration, soil mapping, as well as environmental and agricultural management. These applications range from local (~1:25 000 scale) to continental scales and include:

- mapping the regolith, especially transported versus in situ materials
- recognising alteration mineral footprints
- locating productive soils, especially those that hold moisture and nutrients
- managing soil loss through dust and water erosion, especially exposed areas of mobile clays characterising water catchments, especially where rainfall will either recharge groundwater aquifers or add to surface run off
- cataloguing natural sources and sinks of carbon, such as carbonates in rocks and soils.

Japan's ASTER (Advanced Spaceborne Thermal Emission and Reflectance Radiometer) is an imaging instrument onboard NASA's Terra satellite which was launched in 1999. This space-platform is the first and to date only, operational satellite-borne

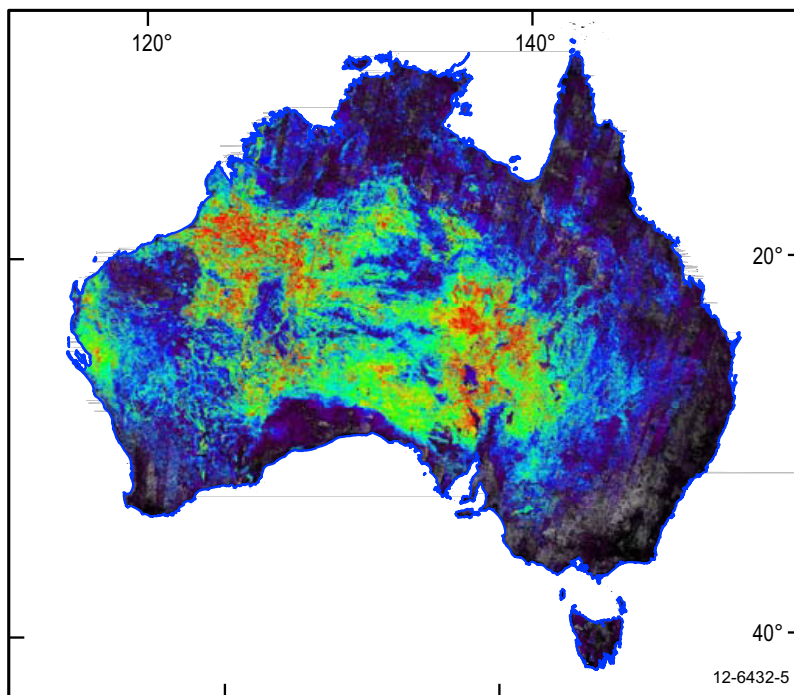


Figure 1. National ASTER map measuring the broad content of silicates. The red areas indicate a high content and the blue areas indicate a low content.

system designed specifically for geoscience applications, namely the mapping of mineral groups such as clays, iron oxides and quartz. Key materials that can be identified include clays and magnesium/iron/aluminium oxyhydroxides, as well as information on mineral composition, abundance and physicochemistry. ASTER has now acquired over 2.23 million scenes (each covering an area 60 kilometres by 60 kilometres): enough to cover the Earth's land surface more than three times.

Approximately 3500 ASTER scenes across Australia were selected from an archive of over 35 000 scenes to produce the National ASTER mosaic. Seventeen GIS compatible geoscience products were generated from ASTER's 14 spectral bands in the visible, near-infrared, shortwave infrared and thermal infrared wavelength. Both the reflectance mosaics and the derived geoscience products were cross-calibrated and validated using hyperspectral imagery from the Hyperion sensor on NASA's EO-1 (Earth Observation) satellite.

The National ASTER project represents a successful collaborative Australian initiative, led by CSIRO's Western Australian Centre of Excellence for 3D Mineral Mapping and state, territory and Australian Government agencies, including Geoscience Australia, along with international partners in Japan and the United States.

Related articles/websites

View the ASTER maps using World Wind
www.ga.gov.au/aster-viewer

View and download the ASTER maps
<http://portal.auscope.org/portal/gmap.html> or
<http://c3dmm.csiro.au>

Order ASTER maps on external hard drive from the GA Sales Centre
www.ga.gov.au/products-services/how-to-order-products/sales-centre.html

Order ASTER data
http://gds.aster.ersdac.jpacesystems.or.jp/gds_www2002/index_e.html

Learn more about the science behind ASTER
<http://asterweb.jpl.nasa.gov>

Learn more about the Australian ASTER Geoscience Initiative
<http://c3dmm.csiro.au>

For more information

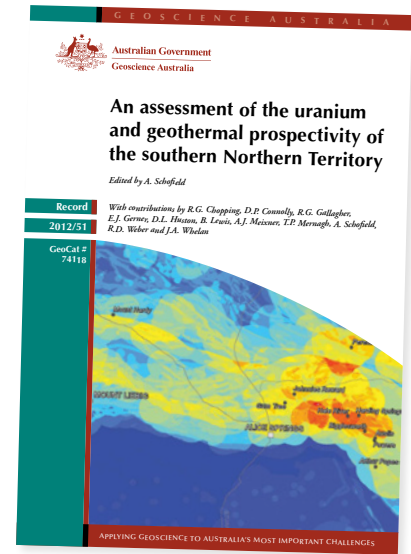
email ausgeomail@ga.gov.au

Northern Territory Energy Assessment

Geoscience Australia has recently released a report, together with associated maps and digital data, examining the uranium and geothermal energy potential of the southern Northern Territory. This report is the third investigation undertaken of its kind, with previous studies completed in northern Queensland and east-central South Australia.

Assessments for four uranium mineral systems were undertaken, including sandstone-hosted deposits and uranium-rich iron oxide-copper-gold mineralisation. This was done using existing data and a mineral systems approach which considered key questions related to mineralisation, such as the sources of metals and fluids, drivers for the flow of metal-bearing fluids and their pathways, and favourable uranium deposition sites. Although locations of known mineralisation were not used to identify prospective areas, the study successfully reproduced the location of recognised deposits and highlighted several areas prospective for previously unrecognised uranium systems, including a number of areas beneath recent sedimentary cover.

The potential for hot rock and hot sedimentary aquifer geothermal energy systems was also examined during the investigation. The analysis for geothermal systems was undertaken in a three-dimensional environment, with temperatures predicted at-depth using a range of geological, geochemical and geophysical inputs. Potential for hot rock geothermal energy systems was overall low to moderate in the study area. Geothermal energy from hot sedimentary aquifers was highest in the southeast of the study area, including moderate to high potential in the Pedirka Basin.



Related websites

An assessment of the uranium and geothermal prospectivity the southern Northern Territory
https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=74118

An assessment of the uranium and geothermal potential of north Queensland
https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=69711

An assessment of the uranium and geothermal prospectivity of east-central South Australia
www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=72666

For more information

email ausgeomail@ga.gov.au

New and updated Basin Lithostratigraphy charts for 2012

Geoscience Australia has just published four new and updated lithostratigraphic charts for Australian Basins.

These charts are available for free download from the

Geoscience Australia website. These charts use the International Geological Time Scale and include updated local biozonation schemes, summaries of hydrocarbon shows, and comprehensive lithostratigraphic schemes developed by Geoscience Australia basin research projects, and local experts.

The new charts cover the Gippsland Basin, Perth Basin, offshore North Perth Basin and a revision of the 2009 Bight Basin lithostratigraphic chart. These charts add to the series published in 2010, and between them, cover most of the prospective basins in offshore Australia. Future work will include updating older charts to the 2012 International Geologic Time Scale standard, and extending coverage to include prospective onshore basins.

Related articles/websites

Basin Biozonation and Stratigraphy Charts 2012

www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=73734

Basin Biozonation and Stratigraphy Charts 2010

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=70371

Geoscience Australia Biostratigraphy

www.ga.gov.au/energy/disciplines-techniques/biostratigraphy.html

For more information

email ausgeomail@ga.gov.au

New geophysical datasets released

Datasets from six new geophysical surveys have been released since June 2012.

Airborne Magnetic – Radiometric - Elevation Surveys

Survey	Date	1:250 000 Map Sheets	Line Spacing (m), terrain clearance (m), orientation	Line Km	Contractor
Murchison 2 (Perenjori)	October 2011 – April 2012	Yalgoo (pt), Perenjori (pt), Geraldton (pt), Dongara (pt).	200 m 50 m east – west	121 383	GPX Surveys Pty Ltd
South Officer 2 (Waigen – Mason)	June 2010 – November 2011	Lennis (pt), Waigen (pt), Wanna (pt), Mason (pt).	400 m 60 m north – south	113 000	Thomson Aviation Pty Ltd.
South West 2 (Corrigin)	January 2012 – June 2012	Pinjarra (pt), Corrigin (pt).	200 m 50 m east – west	113 956	GPX Surveys Pty Ltd
Perth Basin 1 (Perth Basin North)	June 2011 – July 2012	Ajana (pt), Geraldton (pt), Dongara (pt).	400 m 60 m east – west	95 161	Fugro Airborne Surveys Pty Ltd
South West 1 (Moora)	June 2011 – February 2012	Moora (pt), Perth (pt), Bencubbin (pt), Kellerberrin (pt).	200 m 50 m east – west	138 874	UTS Geophysics Pty Ltd
South West 3 (Collie)	March 2011 – January 2012	Collie (pt), Pemberton (pt).	200 m 50 m east – west	108 898	Fugro Airborne Surveys Pty Ltd

Related articles/websites

Geophysical Archive Data Delivery System (GADDS)

www.geoscience.gov.au/gadds.

For more information

email ausgeomail@ga.gov.au

Shaping a Nation: A Geology of Australia

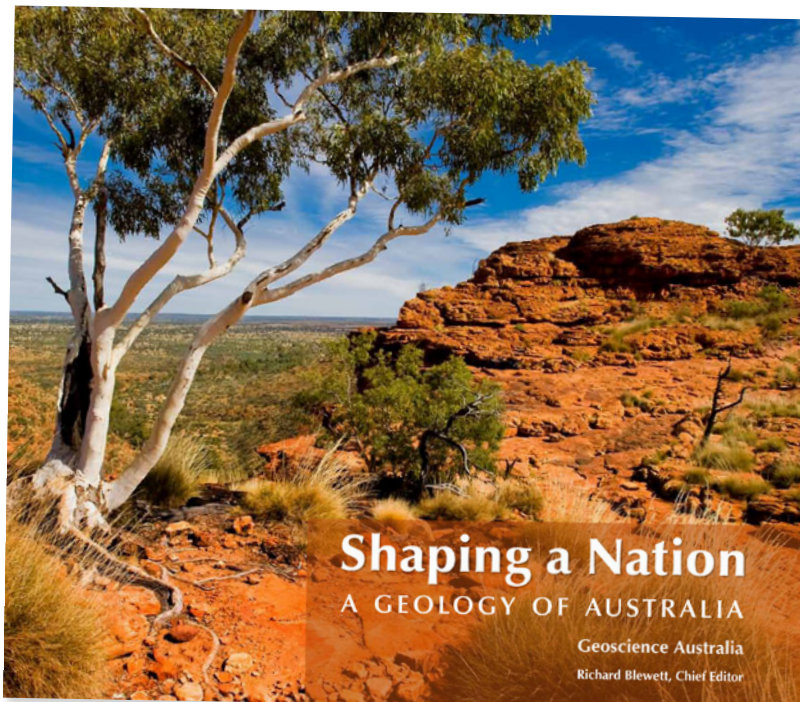
Shaping a Nation: A Geology of Australia is the story of a continent's geological evolution as seen through the lens of human impacts. Exploring the geology, resources and landscapes of Australia, the book reveals how these have helped to shape this nation's society, environment and wealth. Presented in a refreshingly non-linear format, the book summarises much of what we know about this country's geological history, discussing the fossil record and evolution of life across the continent, describing its mineral and energy reserves, and revealing the significance of its coastal and groundwater systems.

The book also explores some of the challenges and opportunities presented by Australia's rich geological heritage, and outlines the issues they present in Australian society today. Based on much of the latest science, the book reveals Australia's expertise in the geosciences and reinforces the vital role they play in informing its present and future development.

In presenting the latest geoscientific knowledge, *Shaping a Nation* is vividly illustrated by technical drawings and figures and accompanied by stunning photography that reveals the extraordinary beauty of Australia's geology and landscapes.

For the avid reader, an accompanying DVD hosts extensive appendices, including supplementary reading and reference material, maps, movies and an interactive 3D model showcasing many geoscience datasets.

Shaping a Nation: A Geology of Australia is published by the Commonwealth of Australia (Geoscience Australia) and ANU E Press. A free PDF version is available on the ANU E Press website.



Printed copies are available for \$70.00 AUD incl GST (plus shipping), from the Geoscience Australia Sales Centre.

Related articles/websites

Shaping a Nation: A Geology of Australia

www.ga.gov.au/products-services/publications/shaping-a-nation.html

Geoscience Australia Sales Centre

www.ga.gov.au/products-services/how-to-order-products/sales-centre.html

ANU E Press

<http://epress.anu.edu.au/titles/shaping-a-nation>

For more information

email ausgeomail@ga.gov.au

The geology of Uluru and Kata Tjuta uncovered

The spectacular shapes of Uluru and Kata Tjuta dominate the surrounding desert and are the product of geological events stretching over millions of years. These amazing geological features are the subject of *Uluru and Kata Tjuta: a geological guide* which was recently released by Geoscience Australia.

The book includes an authoritative account of the geological history of this World Heritage listed landscape as well as a guide for visitors seeking to explore and appreciate the scenic beauty and geological features of Uluru and Kata Tjuta.

The Anangu people, the traditional owners of Uluru-Kata Tjuta National Park who have occupied the area for thousands

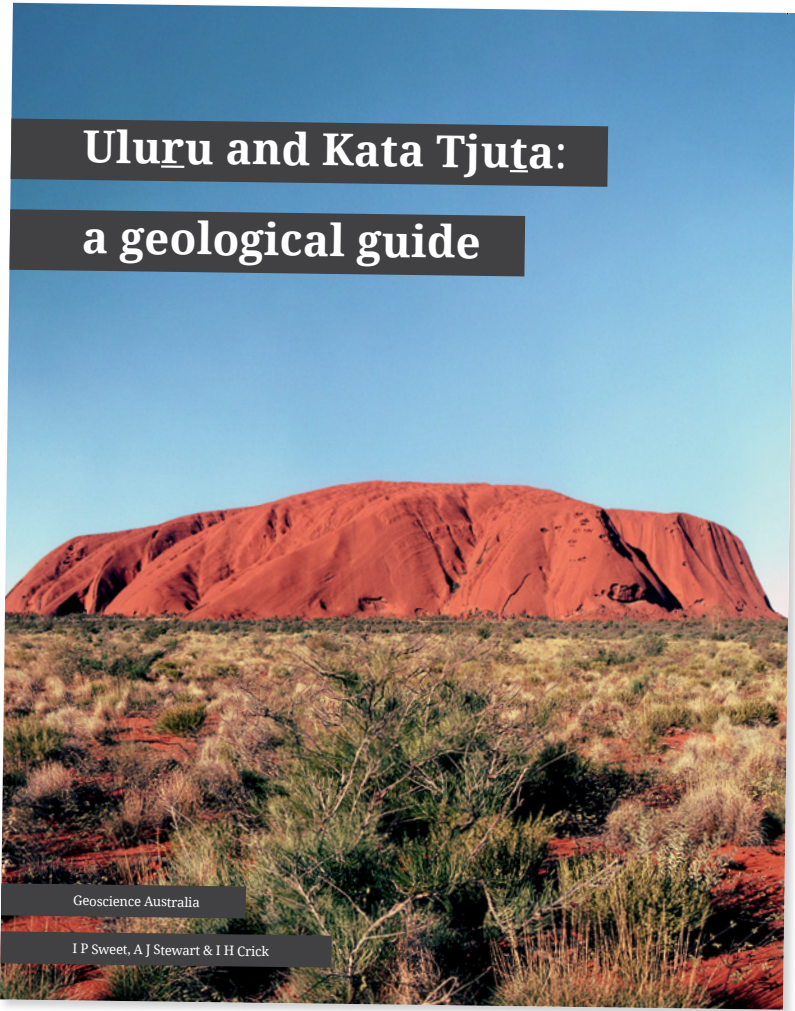
of years, have complex explanations for the landscape features which complement those provided by modern geological studies.

Uluru and Kata Tjuta are also amongst some of the oldest landforms on Earth. The rocks making up Uluru and Kata Tjuta have been dated at around 540 to 550 million years old. The stark outcrops we now see began to stand out as features in the landscape about 100

million years ago.

Geologically speaking, Uluru is just the exposed tip of a huge vertical body of rock otherwise known as an inselberg which is literally 'island mountain' or monolith. This rock extends far below the surrounding plain for between three and five kilometres.

The book includes many photographs highlighting the features that can be seen during a walking tour around Uluru and Kata Tjuta as well as a glossary of geological terms. It is available from the Geoscience Australia Sales Centre for \$16.50 AUD incl GST (plus shipping).



Uluru and Kata Tjuta: a geological guide

Geoscience Australia

I P Sweet, A J Stewart & I H Crick

Related articles/websites

Uluru and Kata Tjuta: a geological guide

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=73105

Geoscience Australia Sales Centre
www.ga.gov.au/products-services/how-to-order-products/sales-centre.html

For more information

email ausgeomail@ga.gov.au



© Commonwealth of Australia 2012.



EABS IV – Eastern Australian Basins Symposium and Exhibition	12 to 14 September 2012
Brisbane Convention and Exhibition Centre, Brisbane Queensland Contact: Conference Action Pty Ltd, PO Box 576, Crows Nest NSW 1585	P +61 2 9431 8699 f +61 2 9431 8677 e EABS2012@conferenceaction.com.au
Earth Science Week	14 to 20 October 2012
American Geological Institute Contact: Australian Earth Science Week celebrations	e education@ga.gov.au www.ga.gov.au/education/public-events/earth-science-week.html
Mining 2012 Resources Convention	31 October to 2 November 2012
Brisbane Convention and Exhibition Centre, Brisbane Queensland Contact: Vertical Events, PO Box 1153, Subiaco WA 6904	P +61 8 9388 2222 f +61 8 9381 9222 e info@verticalevents.com.au www.verticalevents.com.au/mining2012/
China Mining	3 to 6 November 2012
Tianjin Meijang International Convention and Exhibition Center Contact: Vertical Events, PO Box 1153, Subiaco WA 6904	P +61 8 9388 2222 f +61 8 9381 9222 e info@verticalevents.com.au www.verticalevents.com.au/chinamining2012/
Australian Geothermal Energy Conference 2012	14 to 16 November
Australian Geothermal Energy Association and Australian Geothermal Energy Group Crowne Plaza, Coogee Beach, NSW Contact: Australian Geothermal Energy Association	P +61 8 8270 7227 e info@agea.org.au www.agea.org.au/events/agec-conference-2012/
spatial@gov Conference and Exhibition	20 to 22 November
National Convention Centre Canberra Contact: Hannover Fairs Australia	P +61 2 9280 3400 e sales@hannoverfairs.com.au http://spatial.cebit.com.au/

For more information on Geoscience Australia's involvement in the above events email ausgeomail@ga.gov.au

