



Contents

ISSUE 92 Dec 2008

Editor

Stephen Ross

Graphic Design

Maria Bentley

Web Design

Maria Bentley

© Commonwealth of Australia 2008
SSN 1035-9338

Geoscience Australia

GPO Box 378
Canberra ACT 2601 Australia
cnr Jerrabomberra Avenue &
Hindmarsh Drive
Symonston ACT 2609 Australia
Internet: www.ga.gov.au

Chief Executive Officer

Dr Neil Williams

Subscriptions

Stephen Ross
p: +61 2 6249 9263
f: +61 2 6249 9926
www.ga.gov.au/about/corporate/ausgeo_news.jsp

Sales Centre

p: +61 2 6249 9966
f: +61 2 6249 9960
e: sales@ga.gov.au
GPO Box 378
Canberra ACT 2601 Australia

Editorial enquiries

Len Hatch
p: +61 2 6249 9015
f: +61 2 6249 9926
e: len.hatch@ga.gov.au

CEO comment 2



New Radiometric Map of Australia 3
Improved datasets to identify energy, geothermal and mineral resources



Dynamic land cover mapping from space 6
Baseline information for environmental monitoring



Foundations of South Australia discovered 10
Gawler Craton—half a billion years older than previously thought



Energy Security Programs update 12
Surveys off southwest Western Australia; Rankins Springs-Yathong Troughs Seismic Survey; Gawler-Officer-Musgrave-Amadeus Seismic Survey



The Australian Landslide Database 17
Single point of access to landslide information



Customising the geological timescale 20
Applying the international geological timescale to Australia

In brief

150 years of continuous geomagnetic monitoring in Australia 24

Product News

Australia's mineral resources maintain world status 25

Tracking water flow made easier with new national elevation database 26

New geophysical datasets released 27

Events 28



CEO comment



Neil Williams – CEO Geoscience Australia



Geoscience Australia's scientists have identified rocks from South Australia's Eyre Peninsula which are over 3 billion years old. As our report points out, the significance of this find is that rocks of this age are uncommon and difficult to find and were previously thought to be restricted to areas in the Pilbara and Yilgarn Craton regions of Western Australia. The rocks were collected as part of a collaborative seismic survey by Geoscience Australia and Primary Industries and Resources South Australia.

This issue includes reports on several significant outputs and the current activities of Geoscience Australia's Offshore and Onshore Energy Security Programs which provide pre-competitive information to support mineral and energy resource exploration. The Southwest Margins Project includes a seismic survey and a marine reconnaissance survey which are currently under way along the coast of southwest Western Australia. The survey will acquire new geophysical data as well as geological samples over several frontier areas including the Wallaby Plateau, Zeewyck Sub-basin and Mentelle Basin, as well as poorly explored areas of the southern Carnarvon Basin and northern Perth Basin. These surveys will contribute to an assessment of the petroleum prospectivity, geological setting and environmental significance of these areas.

The new Radiometric Map of Australia is part of a range of digital radiometric products which will directly assist exploration for uranium and thorium as well as heat flow studies and the assessment of geothermal resources. Processed data from the Australia-wide airborne geophysical survey completed in 2007 was used to adjust all the radiometric data held in the National Radiometric Database to a common standard. The levelled database was then used to produce the first Radiometric Map of Australia which will be released early in 2009.

The mapping of thick sedimentary rocks in an under-explored 'frontier' basin is a significant development for onshore petroleum exploration in Australia and data from the Rankins Springs Seismic Survey in western New South Wales is now available. The data acquisition, in March 2008, was funded jointly by the New South Wales Department of Primary Industries and Geoscience Australia.

I am also pleased to report that work has commenced on the surveying and collecting of gravity and seismic reflection data along the Gawler-Officer-Musgrave-Amadeus seismic traverse in South

Australia and the Northern Territory. This survey is jointly funded by Geoscience Australia, Primary Industries and Resources South Australia and AuScope, an initiative established under the National Collaborative Research Infrastructure Strategy.

This issue also reports on the Australian Landslide Database which is a virtual database which will provide a powerful landslide resource for Australia. It brings information across databases together to give users a single point of access to the latest landslide information available from several agencies across Australia.

There is also a report on a pilot project to develop a single calibrated measure of the reflectance of Earth's surface over time to assist dynamic land cover mapping. This development will capture the pattern of change in the landscape and allow the land cover to be mapped, classified and studied as a dynamic system.

Finally, I wish to thank all our readers for your continuing support and extend best wishes for the festive season and the New Year.

New Radiometric Map of Australia

Improved datasets to identify energy, geothermal and mineral resources

Brian Minty, Murray Richardson and John Wilford



Geoscience Australia is about to release a new full-colour Radiometric Map of Australia at a scale of 1:5 million. In a world first, Geoscience Australia commissioned the flying of an Australia-wide airborne geophysical survey (AWAGS). The processed radiometric data from the survey was used to adjust all of the radiometric survey data held in the National Radiometric Database to a common standard, or datum. The levelled database is now being used to produce the first Radiometric Map of Australia, derived from levelled and merged composite potassium (K), uranium (U) and thorium (Th) grids over Australia at 100 metre resolution. These grids are being used to

generate a number of derivative products, including the new full-colour ternary map of the continent. The new radiometric map, and all the digital data that underpin it, will be available early in 2009.

The new Australian radioelement datum

Geoscience Australia and the state and Northern Territory geological surveys have systematically surveyed the Australian continent for over 40 years using airborne radiometric surveys to map potassium, uranium and thorium elemental concentrations at the Earth's surface. The radiometric data in the national database were not all registered to the same datum. This was because the data had been collected and processed using a range of specifications, technologies and procedures over this period. This made it difficult to combine surveys into regional compilations or to make accurate comparisons between radiometric responses over different parts of the continent which limited the value of the database (figure 1).

To solve this problem AWAGS, costing \$2.6 million, was funded

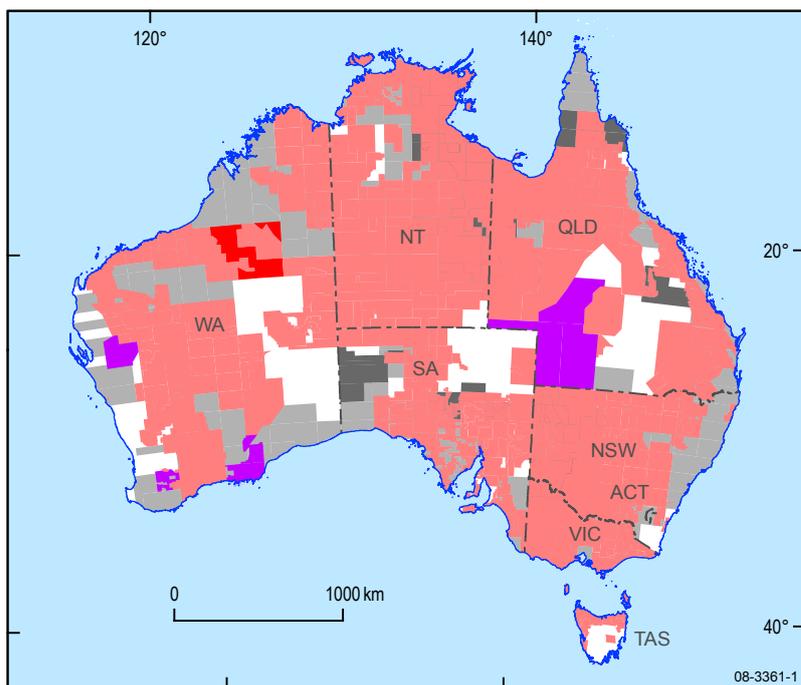


Figure 1. Radiometric data acquisition by Geoscience Australia and state and Northern Territory geological surveys.

under Geoscience Australia's Onshore Energy Security Program. The flying phase of the survey was completed by UTS Geophysics Pty Ltd in December 2007, and the final processed radiometric data was delivered to Geoscience Australia in June 2008. The survey covered the entire continent with north-south flight lines spaced 75 kilometres apart, and east-west tie lines spaced 400 kilometres apart (see *AusGeo News* 84).

Gamma-ray spectrometric data, acquired at an 80 metre height along the flight lines during AWAGS, were processed according to international specifications, and the final estimates of the concentrations of the radioelements (potassium, uranium and thorium) comprise the new Australian radioelement datum. The national radiometric database was levelled by minimising both the differences in radioelement estimates between surveys (where these surveys overlap) and the differences between the surveys and the AWAGS traverses (where these overlap). This effectively levels the surveys to the new national datum (figure 2).

“The improved datasets will lead to an increased understanding of the geology, structure, geochemistry and geomorphology of the continent.”

The Radiometric Map of Australia

The radiometric responses and patterns shown in the ternary image (potassium shown in red, uranium in blue and thorium in green) largely reflect the surface geochemistry and mineralogy of bedrock and regolith materials. In general, actively eroding felsic volcanic and igneous rocks are delineated by high concentrations of the radioelements and appear in white to reddish hues (figure 3). Low radioelement concentrations (black hues) correspond to ultramafic rocks and quartz-rich sandy materials (such as quartzites, sandstones and unconsolidated sands). Water bodies appear black in the ternary image.

Most of the gamma-ray responses relate to the distribution of regolith materials (for example, weathered bedrock, alluvium and colluvium) that reflect the overall antiquity and geomorphic stability of the Australian continent. Many of the relatively high thorium and low potassium responses (green and green/blue hues) relate to ferruginous lags and weathered materials.

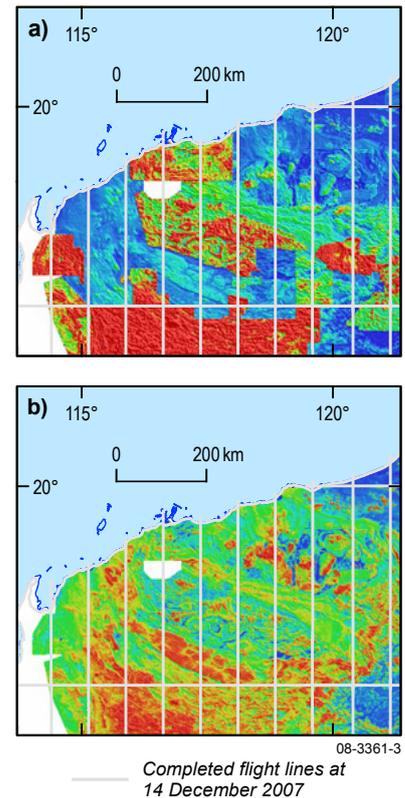


Figure 2. Dataset for the Pilbara region, Western Australia showing thorium data; (a) prior to grid levelling, and (b) after grid levelling.

New applications for improved geophysical datasets

The composite levelled, merged and feathered potassium, uranium and thorium grids of Australia allow explorers to compare the radiometric signatures observed over different parts of Australia, and to better appreciate the significance of broad-scale variations in radioelement concentrations. Consequently, Palaeozoic granites in eastern Australia can now be quantitatively compared and assessed for areas of potential mineralisation and geothermal prospectivity. A consistent

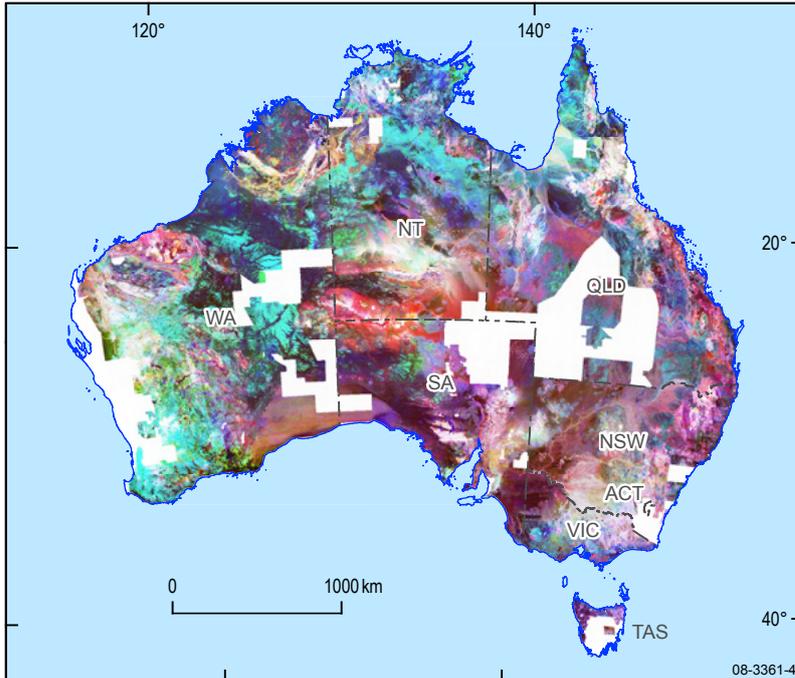


Figure 3. Ternary image (potassium in red, equivalent uranium in blue, and equivalent thorium in green) of Australia derived from the new levelled National Radioelement Database.

radioelement datum also enables the use of quantitative modelling and processing techniques, which enhance and integrate the radiometric imagery with other datasets (such as magnetics, satellite imagery and gravity) to be applied over much larger areas.

The new updated database will directly assist:

- uranium and thorium exploration through the ability to make quantitative comparisons between the radiometric signatures in different survey areas
- heat flow studies and assessment of geothermal energy resources
- geological mapping, mineral and petroleum exploration
- geomorphological studies and environmental mapping
- derivation of a radiation risk map of Australia.

The improved datasets will lead to an increased understanding of the geology, structure, geochemistry and geomorphology of the continent.

New digital radiometric products

The newly-levelled national radiometric database has enabled Geoscience Australia to produce a range of new digital radiometric products. The fundamental datasets are the levelled and merged composite potassium, uranium and thorium grids over Australia at 100 metre resolution. These have been used to produce grids at the same resolution showing the terrestrial dose rate, dose due to natural

sources of radiation (that is, terrestrial dose plus cosmic radiation), as well as potassium/uranium ratio, potassium/thorium ratio and uranium/thorium ratio grids.

The gridded datasets will be available free-of-charge in ERMMapper format from the Australian governments Geophysical Archive Data Delivery System (GADDS). Printed copies of the map will also be available from the Geoscience Australia Sales Centre early in 2009.

For more information

phone Brian Minty on
+61 2 6249 9228
email brian.minty@ga.gov.au
phone Murray Richardson on
+61 2 6249 9229
email murray.richardson@ga.gov.au
phone Sales Centre on
+61 2 6249 9966
Freecall 1800 800 173
email sales@ga.gov.au

Related websites/articles

Geophysical Archive Data Delivery System (GADDS)

www.geoscience.gov.au/gadds

Onshore Energy Security Program website

www.ga.gov.au/minerals/research/oesp/

AusGeo News 84: Onshore Energy Security Program underway

www.ga.gov.au/ausgeonews/ausgeonews200612/onshore.jsp

AusGeo News 88: Flight to find new energy resources

www.ga.gov.au/ausgeonews/ausgeonews200712/onshore.jsp

Dynamic land cover mapping from space

Baseline information for environmental monitoring.



Leo Lymburner, Fuqin Li, Peter Tan, Norman Mueller and Shanti Reddy

Geoscience Australia currently uses Earth observation satellites to capture environmental information over the entire Australian continent. The satellites used, including Landsat, the Advanced Land Observing System, and Resourcesat-1, are operated by the United States, Japan and India respectively. Geoscience Australia now holds an archive of satellite observations, over the last 30 years, which supports several nationally significant environmental initiatives. These include the National Carbon Accounting System for the federal Department of Climate Change and the Statewide Landcover and Trees Study (SLATS) by the Queensland Department of Natural Resources and Water.

Traditionally, Geoscience Australia receives raw telemetry data from satellites, archives the raw data on computer tapes and processes selected images on-demand. These images cannot be directly compared over time because the effects of the atmosphere and the sun illumination angle differ between images. Although this mode of operation satisfied expert users of remotely sensed imagery, it is now apparent that the changing needs of government can be more effectively satisfied by further processing of the data. This would require a single calibrated measure of the reflectance of the Earth's surface over the last three decades. Early trials indicate that this would be very useful information for tackling national problems such as water management, environmental responses to climate change, as well as provide data for national environment reporting.

Under this new approach, remote sensing images are firstly converted to measures of surface reflectance. Analysis of the changes in surface reflectance over time yields a number of useful biophysical parameters

(or land cover features such as water and vegetation). These are statistics which capture the patterns of change or biophysical dynamics of the landscape, and ultimately allow the cover of the land to be mapped, classified and studied as a dynamic system.

In early 2008, Geoscience Australia initiated a pilot project to explore this new approach and the initial results from the pilot study are described below. Figure 1 outlines the methodology being developed to produce land cover information.

Surface reflectance

The radiance values recorded by the sensors onboard Earth orbiting satellites are affected by the atmosphere, solar incidence and direction, as well as sensor view angles at the time of the satellite overpass. Therefore it is necessary to correct for atmospheric, radiometric and view angle effects and derive calibrated surface reflectance values which can stand as quantitative, absolute measures of the land-surface. In the past, many empirical, data dependent and also exploratory methods have been adopted to derive normalised surface reflectance values. Simple transformations such as the Normalised

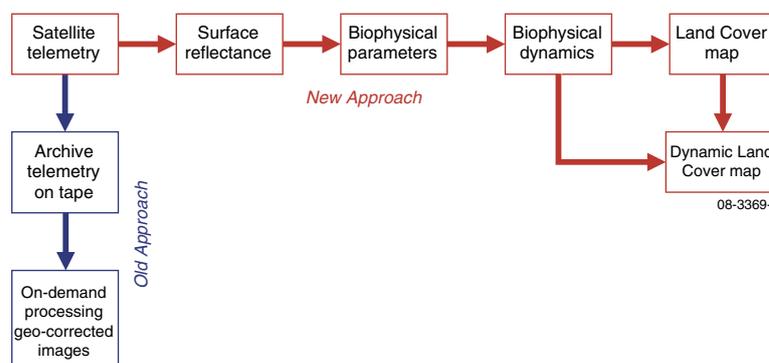


Figure 1. Proposed methodology for dynamic land cover mapping.

Difference Vegetation Index (NDVI) have sometimes proved effective in standardising observations to a point where true underlying changes can be sensed. However, these methods are very hard to validate and are not consistent between different sensor systems and surface environment conditions.

Geoscience Australia has developed a physically-based robust algorithm to derive surface reflectance data using MODTRAN™ radiative transfer model with necessary input data (such as water vapour, aerosols and ozone) to correct atmospheric effects. It also uses observations from the Moderate Resolution Imaging Spectroradiometer (MODIS) on board the TERRA and AQUA satellites to infer the Bidirectional Reflectance Distribution Function (BRDF) which describes illumination and viewing angle effects. Eleven cloud-free Landsat scenes acquired in 2004 over the Gwydir River catchment in northern NSW have been processed to produce reflectance data. Furthermore, data from one 2008 scene has been validated against field measurements (figure 2). Comparison with reflectance estimates from the MODIS sensor also indicate that the method is reliable, robust and produces consistent quality surface reflectance data.

Derivation of biophysical parameters

Use of time-series data, rather than individual images from a single point in time, is a major advance on previous methodologies and is fundamental to a rigorous and repeatable approach to land observation using satellites. For the pilot study, the eleven cloud-free Landsat scenes over the Gwydir River catchment acquired in 2004 were processed to give a short time-series, or 'stack', of reflectance data.

When assessing a stack of Landsat or MODIS surface reflectance data for a particular region it is necessary to be able to extract summary information so that the data can be clustered, regionalised

and classified. Such summary techniques need to be robust because the ultimate goal will be to apply them to any time-series without any prior knowledge or manual input. The temporal resolution and duration of the time-series must therefore be considered. The list below indicates some of the statistics that can be calculated for any stack of satellite scenes which are used to provide the summary statistics:

- maximum value in a band for that pixel from any scene
- minimum value in a band for that pixel from any scene
- mean and variance value of that band for that pixel for all scenes
- ratio (maximum/minimum)
- timing of the maximum (Epoch during which the maximum value of that band occurred)
- rate of change (linearly or exponentially) from the start to the end of a time series
- difference between the start and the end of a time series
- number of observations above or below a threshold.

If the data covers multiple years, then each of the statistics can be calculated for each year and averaged (for example, average annual maximum). These statistics, whilst being quite basic from a mathematical point of view, account for noise commonly found in remote sensing images. Consequently they are valuable as inputs to appropriate machine learning algorithms, and such analyses

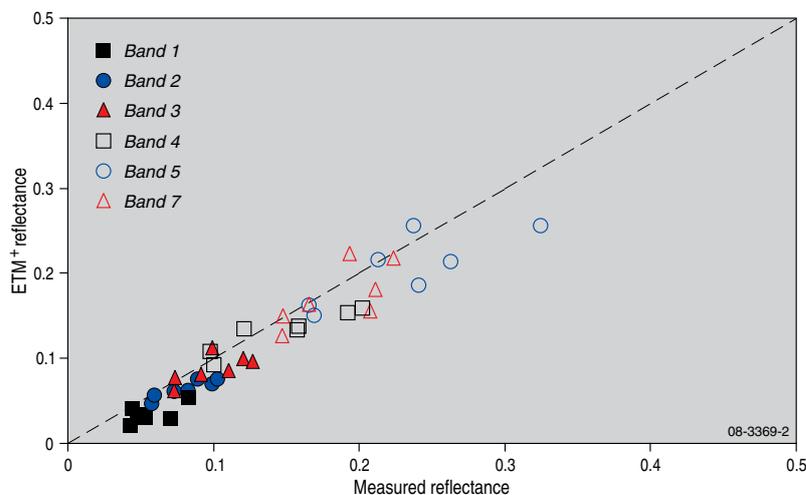


Figure 2. Comparison of Landsat-derived surface reflectance values with field measurements obtained in June 2008, Gwydir River catchment. Reflectance is measured for wavelength band for each pixel.

are capable of providing insight into system behaviour. This point is illustrated in figure 3, which shows a water body map of the Gwydir River catchment generated by aggregating and classifying minimum reflectance values in Landsat Band 5 from the 2004 data stack. Statistics can also be taken on derived land surface measures, for example, on fractional cover or on fractional cover proxies such as vegetation indices and bare soil indices. During the pilot study biophysical parameters at sub-pixel level – that is fractions of soil, vegetation, and non-photosynthetic vegetation (dry grass) – were derived within a 30 metre by 30 metre pixel area using linear spectral unmixing algorithms.

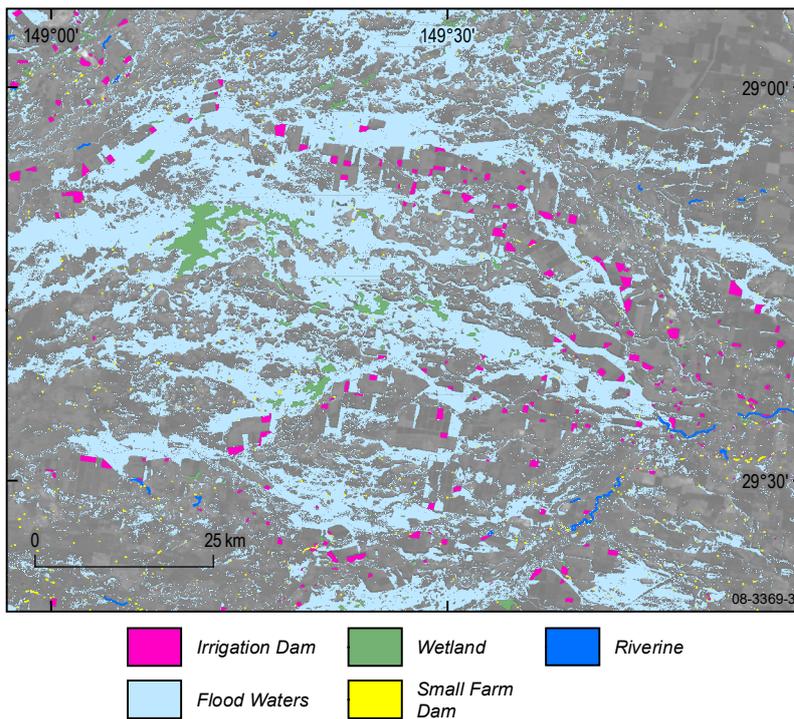


Figure 3. Water body map of Gwydir River catchment generated by aggregating and classifying minimum reflectance values in Band 5 from a stack of cloud-free Landsat images acquired in 2004.

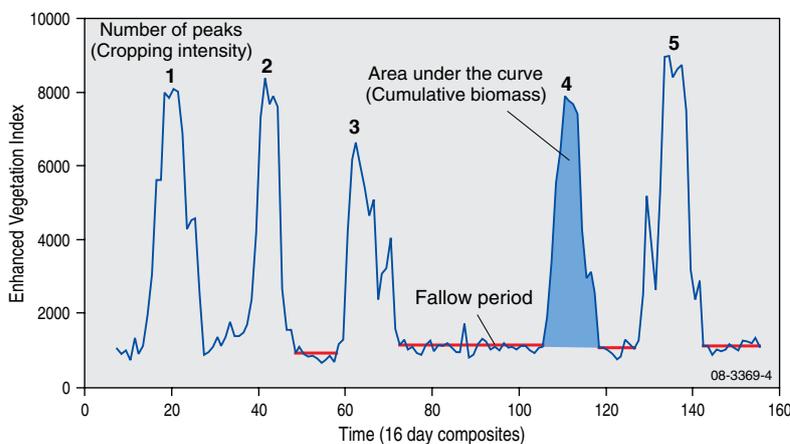


Figure 4. Land use information extracted from tailored time-series analysis of six years of MODIS Enhanced Vegetation Index data.

Extracting biophysical dynamics

Land cover types have characteristic behaviour over time, and time-series data can therefore be interpreted in very specific and targeted ways to infer system dynamics. The study has identified a generic strategy for analysis of tailored remote sensing time-series imagery:

- a time series can be divided into a sequence of sub-time series with shorter length
- characteristics of a time series can be represented by a set of generic statistics extracted from these sub-time series
- a machine learning algorithm, or a more sophisticated statistical method with these generic statistics as input variables, can be used to target specific problems.

Under this strategy, specific remote sensing problems are addressed in two stages. Firstly, a set of statistics are extracted from several shorter sub-sets of the original time series. These statistics are generic, independent of model assumptions and require no input parameters or prior knowledge. In the second stage, application specialists with expert knowledge use these coefficients as input data for more sophisticated interpretation, ultimately producing higher level information products.

As an example, time-series analysis tools were developed to quantify cropping practices. The phenology (or changes over time) of cropped areas is determined by a combination of human activity and natural rainfall variability.

The green fractional cover rises sharply as the crop matures, remains high for a time, before a sharp drop in green fractional cover after the crop is harvested. An interval of zero green cover which follows corresponds to the fallow period. Time-series analysis of the cropping phenology can identify a range of features (see figure 4) including:

- the number of cropping cycles within a year
- the number and cumulative time of fallow periods
- the timing of crop cycles (whether winter or summer crops)
- crop green biomass (estimated by integrating the area under the curve of a crop cycle)
- inter-annual changes in crop green biomass.

Dynamic land cover mapping

The major aim of the pilot study was to develop a method for consistent, repeatable, monitoring of the land cover and this was achieved by classifying the biophysical parameters and time-series coefficients discussed above. This is done within an object-oriented image processing environment which allows users to define a set of rules, spatial attributes of objects, and ultimately a classification. A land cover map shown in figure 5 has been generated by cluster analysis of the time-series coefficients extracted from six years of MODIS Enhanced Vegetation Index data. For this purpose the International Standards Organization (ISO) land cover classification

scheme was adopted to produce a consistent quality land cover map across jurisdictional boundaries. Geoscience Australia staff are currently finalising methods to produce land cover maps covering the whole country using MODIS time series data on a fortnightly basis. The Geoscience Australia staff have also demonstrated methods to integrate higher spatial resolution Landsat data with MODIS time-series data to produce a detailed scale ISO land cover classification.

The concept of dynamic land cover mapping and the initial results from this pilot project have been well received during presentations to key Australian Government agencies. The methodology is now being extended to other bioregions to ensure it can be repeated in the full range of Australian environments. The proposed approach promises consistent quality and long term baseline information to support new environmental initiatives at the national level.

The surface reflectance measurements based on Landsat imagery are expected to be of great value to a wide range of ecosystem scientists and this research will be continued under funding provided through the National Collaborative Research Infrastructure Strategy - Terrestrial Ecosystem Research Network (NCRIS-TERN).

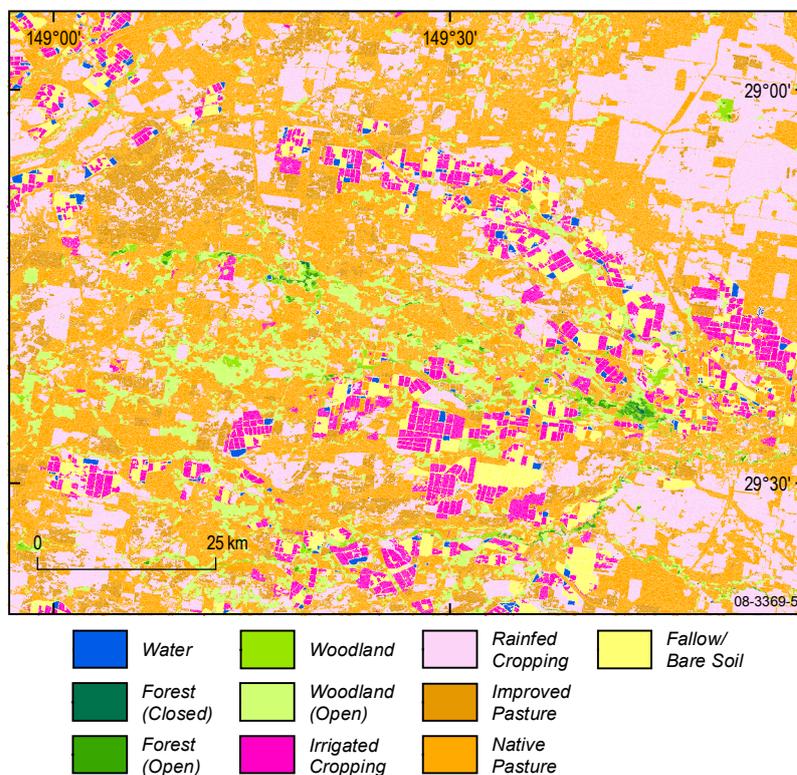


Figure 5. Land cover map of Gwydir River catchment derived from time-series analysis of six years of MODIS Enhanced Vegetation Index data.

For more information

phone Shanti Reddy on
+61 2 6249 9647
email shanti.reddy@ga.gov.au

Foundations of South Australia discovered

Gawler Craton: half a billion years older than previously thought!



Geoff Fraser, Chris Foudoulis, Narelle Neumann, Keith Sircombe (Geoscience Australia)
Stacey McAvaney, Anthony Reid, Michael Szpunar (Primary Industries and Resources South Australia)

Recent geochronology results obtained using Geoscience Australia's Sensitive High Resolution Ion Microprobe (SHRIMP) have identified Mesoarchean rocks (about 3150 million years old) in the eastern Gawler Craton, South Australia. These rocks are approximately half

a billion years older than the oldest previously-dated rock from South Australia, making these the oldest rocks yet discovered in Australia outside the Pilbara and Yilgarn Craton areas of Western Australia.

A series of seismic transects are being collected across selected regions of the Australian continent as part of Geoscience Australia's Onshore Energy Security Program. One of these seismic transects, collected in June 2008, traverses the northern Eyre Peninsula of South Australia (figure 1). When processed, the seismic data will provide an east-west cross-section of the eastern margin of the Gawler Craton. This region hosts significant uranium, geothermal, copper-gold, gold and iron resources. To assist the interpretation of the seismic data and the current geological mapping program of Primary Industries and Resources South Australia, a program of geochronology is underway to determine the ages of major rock units crossed by the seismic line. It was during the course of this project that this exciting and unexpected result was discovered.

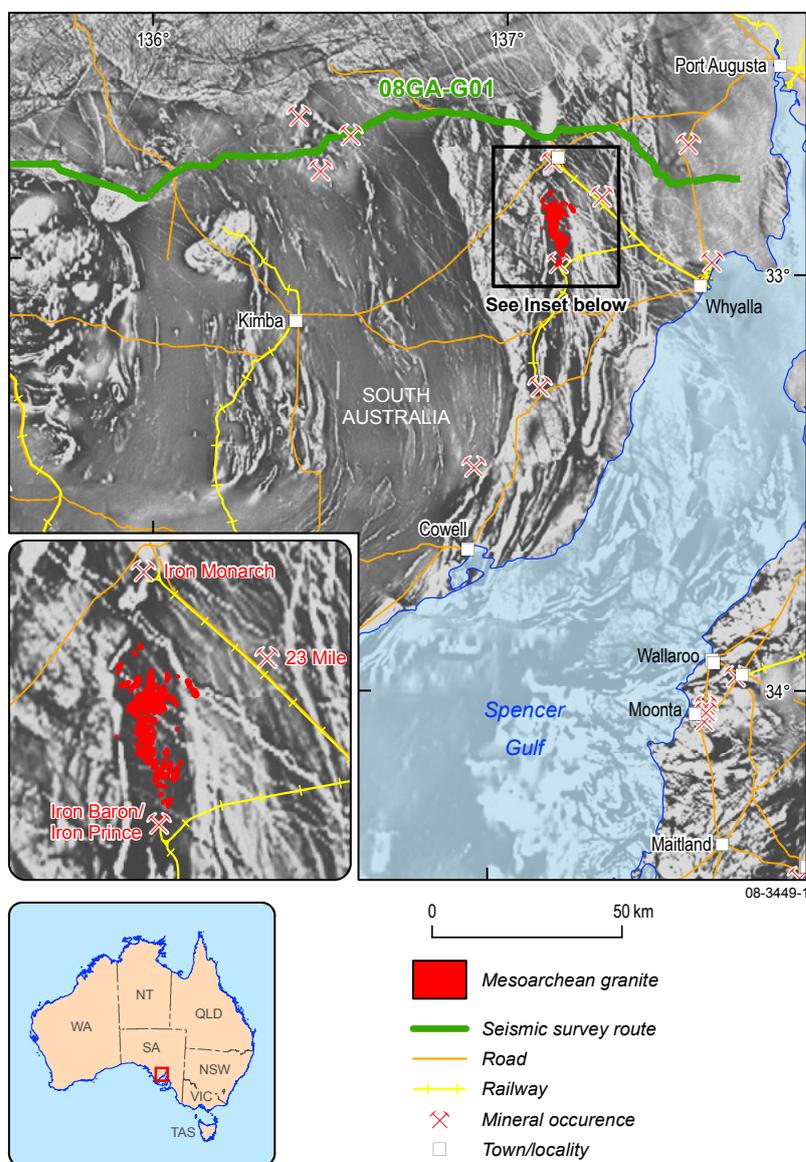


Figure 1. Magnetic image of the northeastern Eyre Peninsula showing the trace of the recently collected seismic line (bold green line), and the location of Mesoarchean granite (highlighted in red) between the Iron Monarch and Iron Baron mines (inset).

Previous work in the Gawler Craton suggested that rocks of the northern Eyre Peninsula are dominantly Paleoproterozoic sediments, volcanics and intrusives (~2000 – 1700 million years old or Ma) deposited on late-Archean to earliest Proterozoic basement gneisses (~2450 Ma and ~2000 Ma). The presence of Mesoarchean inherited zircons as well as extremely evolved neodymium-isotopic ratios in some Proterozoic granites suggested the presence of Mesoarchean crust at depth beneath parts of the Gawler Craton (Creaser and Fanning 1993, Daly and Fanning 1993, Fanning 2008), but no surface rocks of this age have previously been identified. These new results are, therefore, the first direct evidence of the age and location of the foundations of the Gawler Craton.

These new results were obtained from Geoscience Australia's SHRIMP facility, which was commissioned earlier this year. The SHRIMP measures uranium and lead isotopes from tiny portions of zircon crystals and the results are then used to calculate the age of the crystal based on the natural decay rate of uranium to lead.

The newly identified Mesoarchean rock is a grey, gneissic granite, trending north-south between Iron Knob and Iron Baron (figures 1 & 2). The rock was originally mapped as part of the Lincoln Complex, a term for local Paleoproterozoic intrusives, but the new age data indicate that this rock is approximately twice as old as first thought, and forms basement to the iron-rich sediments of the Middleback Ranges which have been mined for iron ore since the late 1800s.



Figure 2. Outcrop of Mesoarchean granite.

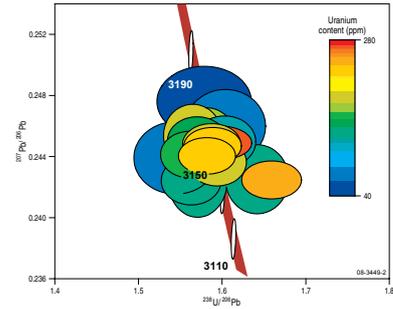


Figure 3. Geochronology results plotted on a uranium-lead concordia diagram showing concordant zircon ages of ~3150 Ma.

The first Mesoarchean results from this rock were such a surprise that additional samples were collected. Analyses of several additional samples have verified the Mesoarchean age of this granite (~3150 Ma: figure 3), and ongoing work is in progress to define the regional extent of rocks of this age.

For more information

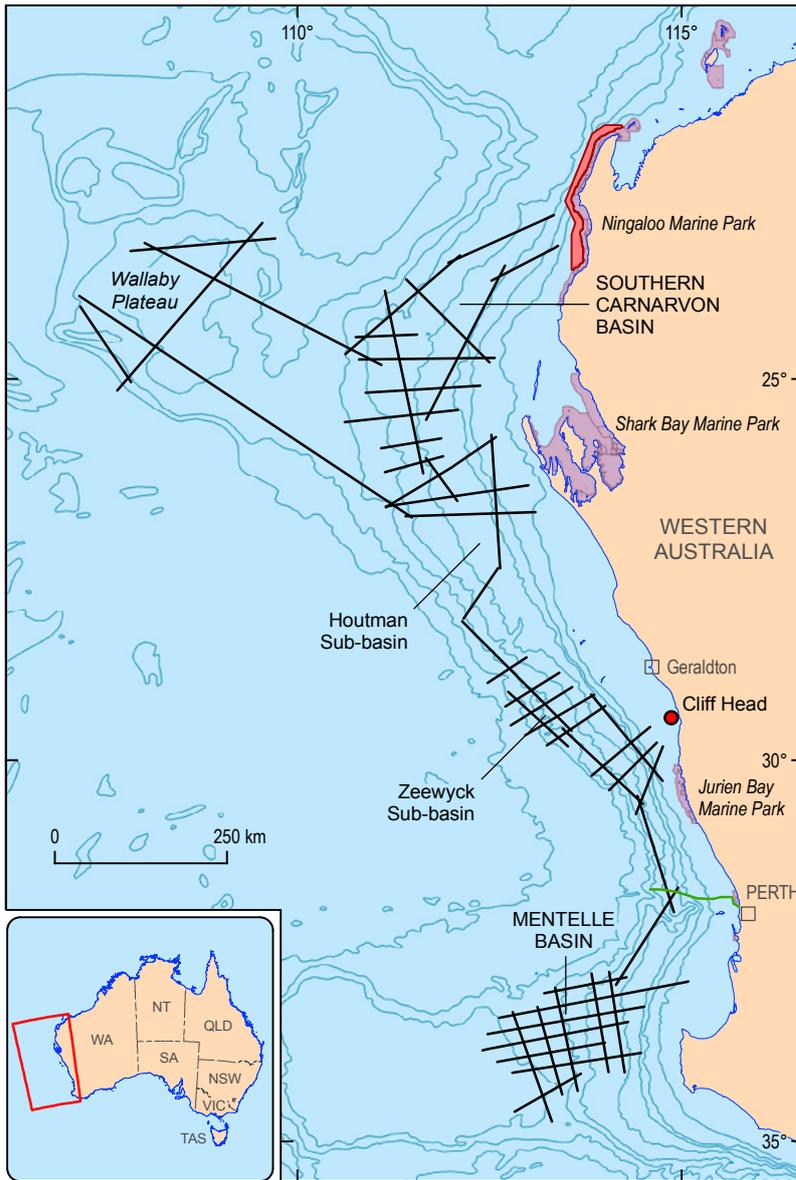
phone Geoff Fraser on
+61 2 6249 9063
email geoff.fraser@ga.gov.au

References

- Creaser RA & Fanning CM. 1993. A U-Pb zircon study of the Mesoproterozoic Charleston Granite, Gawler Craton, South Australia. *Australian Journal of Earth Sciences* 40:519–526.
- Daly SJ & Fanning CM. 1993. Archean, in Drexel JE, Preiss WV & Parker AJ (eds). *The Geology of South Australia: Volume 1 The Precambrian*. South Australia. Geological Survey Bulletin 54:32–49.
- Fanning CM. 2008. Daly's search for the Mesoarchean of the Gawler Craton. *MESA Journal* 42a:12–13.

Surveys off southwest Western Australia

As part of Geoscience Australia's Southwest Margins and Seabed Characterisation Projects, two surveys are currently underway off the coast of southwest Western Australia. The areas being investigated include the frontier Mentelle Basin, Zeewyck Sub-basin and the Wallaby Plateau, as well as poorly explored areas of the Northern Perth and Southern Carnarvon Basins (figure 1).



Southwest Margins 2D Seismic Survey 2008

- | | |
|-----------------------------------|--------------------------------|
| Marine park (Commonwealth waters) | Southwest margins survey lines |
| Marine park (WA state waters) | Bathymetry contours |
| Submarine Cable Protection Zone | Production facility |

Figure 1. Location of the 2D seismic reflection survey, offshore Western Australia.

The Southwest Margins Project aims to maximise opportunities for the discovery of a new hydrocarbon province and underpin promotion of selected areas for petroleum exploration. Results from the survey will also assist with the planning and management of Australia's marine environments.

A 2D seismic reflection survey will run from late November 2008 to late January 2009 whilst a marine reconnaissance survey which commenced in October 2008 will be completed in January 2009. Both surveys are part of Geoscience Australia's offshore frontier basin research (Offshore Energy Security Program) which has funding of \$75 million over five years (2007 to 2011) to provide a stimulus for petroleum exploration activities in Australia and support the vital quest to find a new offshore oil province (see *AusGeo News* 90).

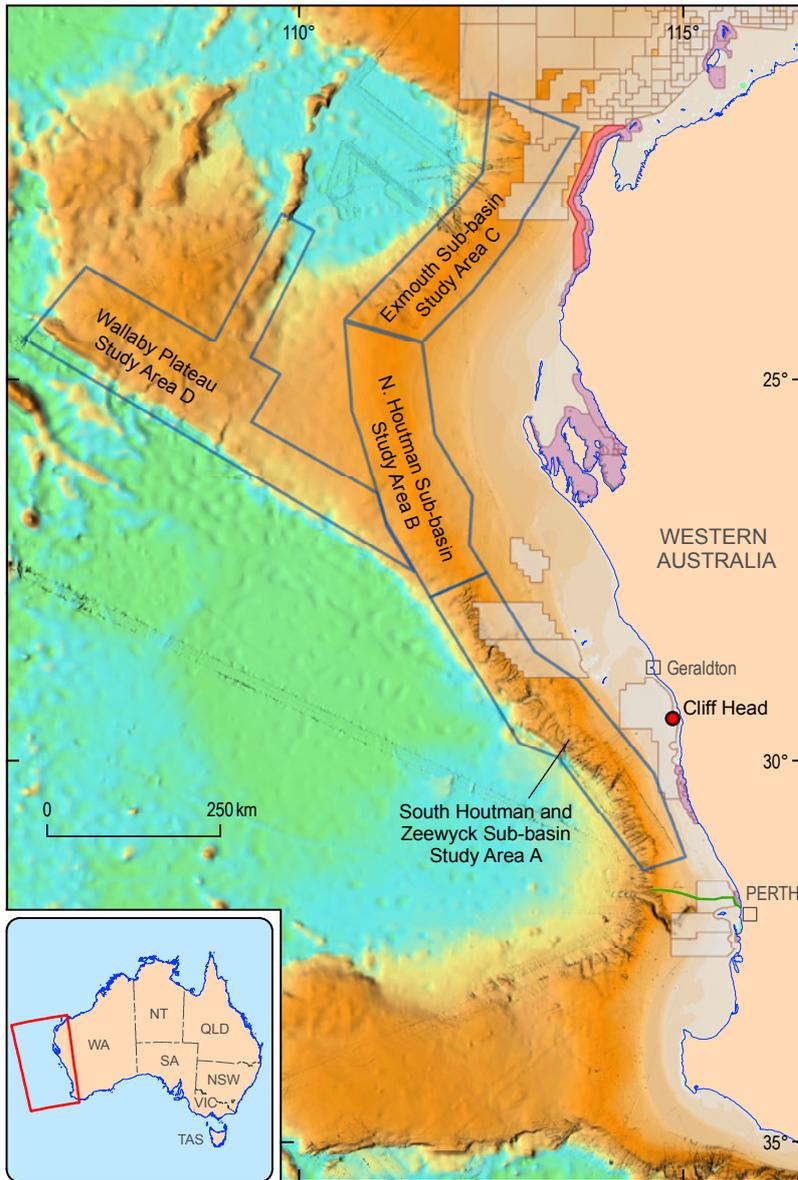
2D seismic reflection survey

This survey will collect up to 8000 kilometres of 2D seismic reflection, magnetic and gravity data along 52 proposed regional lines within the Mentelle, Perth (Zeewyck and Houtman Sub-basins), and Southern Carnarvon Basins and on the Wallaby Plateau (figure 1). Seismic data

provides information on the geological structures and sediment thickness below the seafloor and is carried out using a specialised seismic acquisition vessel. Geoscience Australia has contracted CGG Veritas to undertake the seismic survey and they will be using their commercial seismic vessel, the *Duke*. This vessel operates a 4290 cubic inch airgun array and an 8 kilometre solid streamer. The airguns generate an energy pulse and the returned signal is recorded for 12 seconds.

The objective of the seismic survey is to collect geophysical datasets within and across the identified geological regions to assist in understanding the basin shape, sedimentary fill characteristics and geometry of the controlling geological structures.

The acquired data will assist in understanding the petroleum prospectivity of the region. This data will facilitate more detailed mapping of the regional geology and determination of total sediment thickness, as well as interpretation of the nature and thickness of the crust beneath the major depocentres (or area of major sediment accumulation). It will also support modelling of tectonic evolution and an assessment of the petroleum prospectivity of the frontier basins along the southwest margin.



Southwest Margins Marine Reconnaissance Survey 2008

- Marine Reconnaissance Study Areas
- Current permits
- Marine park (Commonwealth waters)
- Marine park (WA state waters)
- Submarine Cable Protection Zone
- Production facility

Figure 2. Marine reconnaissance survey locations, offshore Western Australia.

Marine reconnaissance survey

This survey of about 100 days duration will be conducted along the southwest margin between October 2008 and January 2009.

The survey will be conducted using the RV *Sonne* in three survey legs (figure 2). The first leg will cover Study Area A (South Houtman and Zeewyck



Sub-basin) followed by the second leg covering Study Areas B and C (North Houtman and Exmouth Sub-basin) and the third leg will cover Study Area D (Wallaby Plateau). The overall scientific aim of the survey is to collect geophysical, geological and biophysical data for the Zeewyck and Houtman Sub-basins (part of the Perth Basin), the Southern Carnarvon Basin, and Wallaby Plateau areas to assist in understanding their petroleum prospectivity, geological setting and environmental significance.

The geophysical component of the marine reconnaissance survey involves collection of regional bathymetry and sub-seafloor data (multi-beam sonar and sub-bottom profiler data) and potential field data. The geological component involves sampling of the seafloor, the water column and the bedrock. The multi-beam swath acquisition images the sea floor bathymetry and characterises the seabed type to assist in a better understanding and management of the marine environment. The magnetic and gravity data reflects variations in the magnetism and density of the bedrock geology. Sampling of scarps in submarine canyons will help to build an understanding of the age and composition of rocks in frontier basins. Samples will be analysed at Geoscience Australia and incorporated into an analysis of the geological history of these basins.

The multibeam sonar mapping will cover around 210 000 square kilometres over the three survey legs, increasing the area of multibeam sonar coverage in Australia's Exclusive Economic Zone by 12 per cent. The survey will therefore be the biggest, in terms of area mapped, ever carried out in Australia's ocean territory.

Data availability

Information and data collected on the surveys will be used to support the work programs of the Department of Resources, Energy and Tourism. The data will be available to the petroleum exploration industry as pre-competitive data sets to support future releases of offshore petroleum exploration areas by the Australian Government. Data will also be provided to relevant Australian Government agencies to assist with marine management of these areas. It will also be used to potentially support the design of a national representative system of marine protected areas.

For more information

petroleum survey

phone Irina Borissova on
+61 2 6249 9658

email irina.borissova@ga.gov.au

marine survey

phone Andrew Heap on
+61 2 6249 9790

email andrew.heap@ga.gov.au

geophysical survey

phone Bruce Goleby on
+61 2 6249 9404

email bruce.goleby@ga.gov.au

Related articles/websites

AusGeo News 90: Offshore energy program underway
www.ga.gov.au/ausgeonews/ausgeonews200806/offshore.jsp

Rankins Springs-Yathong Troughs Seismic Survey

The Rankins Springs-Yathong Troughs Seismic Survey was the first survey of an under-explored onshore petroleum basin undertaken as part of Geoscience Australia's Onshore Energy Security Program. The deep seismic survey comprised two east-west traverse lines, one each across the Rankins Springs and Yathong Troughs in the southeastern Darling Basin in western New South Wales (figure 3). The survey acquired a total of 234 kilometres of seismic data in March 2008 and a 40

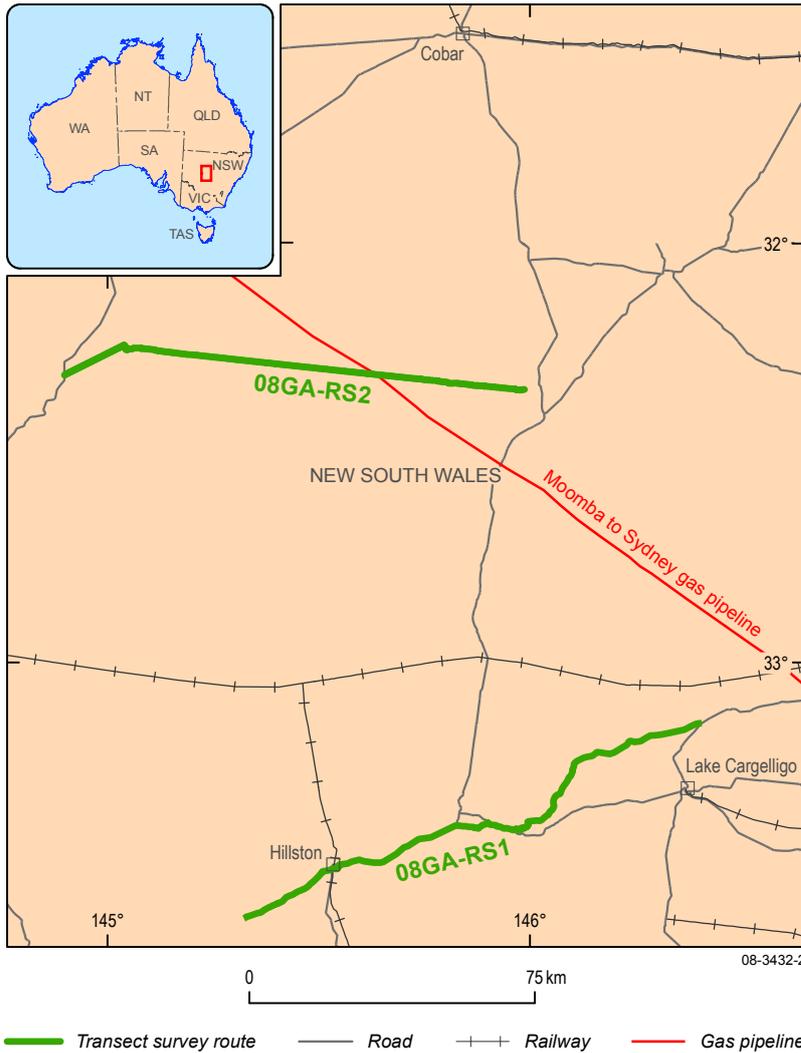


Figure 3. Traverse lines for Rankins Springs and Yathong Troughs deep seismic survey, New South Wales.

kilometre extension to the Yathong Trough traverse is planned for early 2009.

Preliminary analysis of the seismic sections indicates the presence of well-stratified basin sediments, possibly of Devonian age, overlying a thick section of unknown age and lithology, which in turn overlies crystalline basement. The mapping of thick sedimentary rocks in an under-explored 'frontier' basin is a significant development for onshore petroleum exploration in Australia. If petroleum source rocks can be identified, either from seismic interpretation or by drilling exploration wells, then the prospectivity of the Darling Basin may be re-assessed by petroleum companies and lead to further exploration.

The survey was jointly funded by the New South Wales Department of Primary Industries and Geoscience Australia through the Onshore Energy Security Program. The raw seismic data and

un-interpreted processed seismic sections from the survey are now available to the petroleum industry.

Gawler-Officer-Musgrave-Amadeus Seismic Survey

Geoscience Australia is currently conducting a seismic survey in Central Australia.

The survey consists of one continuous traverse crossing from the Gawler Province, over the Officer Basin to the Musgrave Block and then into the Amadeus Basin in the Northern Territory (figure 4). This traverse is planned to be approximately 634 kilometres long.

Acquisition commenced at the northern end of the traverse approximately 25 kilometres southeast of Eralunda in the Northern Territory on November 1. This traverse follows the Adelaide to Alice Springs railway line utilising the railway access road and is planned to conclude in late December near Tarcoola in South Australia.

This survey aims to provide new insights into the crustal architecture of the two Neoproterozoic sedimentary basins in Central Australia and their tectonic relationship to older (Mesoproterozoic) basement terrains. Of particular interest is the identification

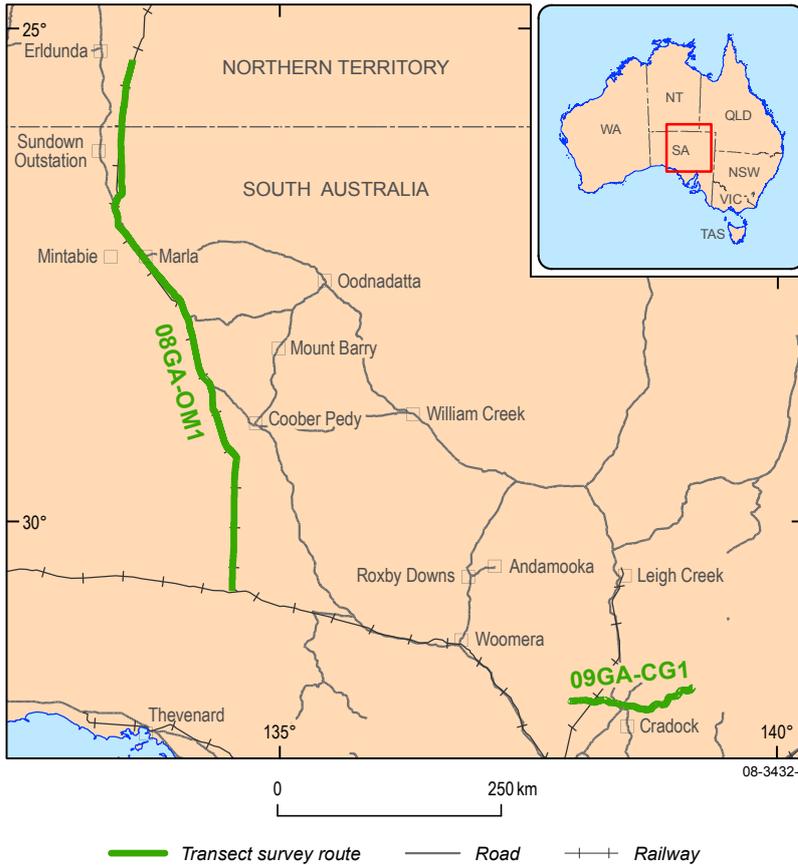


Figure 4. Traverse line for Gawler-Officer-Musgrave-Amadeus seismic survey, South Australia and Northern Territory.

of structural elements in the basal sections which may host hydrocarbons that were generated prior to the Alice Springs Orogeny.

This survey is jointly funded by Geoscience Australia through the Onshore Energy Security Program, Primary Industries and Resources South Australia and AuScope. AuScope is an initiative established under the National Collaborative Research Infrastructure Strategy to characterise the structure and evolution of the Australian continent.

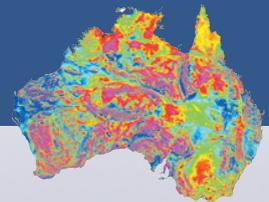
For more information

phone Jenny Maher on
+61 2 6249 9896

email jenny.maher@ga.gov.au

AusGeoRef

Australian Geoscience References



Find

Information about:

- Australian geoscience
- Papers from Australian geoscience conferences and journals
- The latest research in your particular field
- An Australian geographic location or a geological feature

Create

- A search on your special topic
- A customised bibliography
- An Alert profile for your particular field
- A document request

Annual subscription costs start from \$US95.00.

Try the 30 day free trial (www.ausgeoref.org)

For more information phone + 61 2 6249 9567
or email Geoscience Australia's Library.
(Reference.Library@ga.gov.au)



Australian Government
Geoscience Australia

in
collaboration
with



The Australian Landslide Database

*Single point of access
to landslide information*

Monica Osuchowski

Geoscience Australia recently tested an information management technique to allow its landslide data to be presented simultaneously with landslide information available from several other agencies in Australia. The result is the Australian Landslide Database (ALD), a 'virtual' database which brings information across databases together and gives users the latest landslide data. The database is a spatial index of the available information about landslide events in Australia and provides a range of information related to an event, including its causes and consequences.

A comprehensive approach

The project stemmed from a recommendation made by the Council of Australian Governments to establish a nationally consistent system of data collection as part of a more comprehensive approach to natural disaster management in Australia (COAG 2004). Such a reform in data collection requires new, innovative approaches in both the governance and the science of natural disaster management. The evolution of the ALD demonstrated an option for the future management of natural hazard datasets. The vision for a new national landslide database was based on the concept of collecting data once, maintaining it at the most effective level, and sharing this information across all levels and between different users and applications. This approach assumes that responsibility for collecting information does not fall to a single organisation, but is a shared responsibility, and these joint efforts are combined to produce comprehensive data.

Data sharing

The new database overcame several obstacles which have previously hampered efforts to facilitate the exchange of data, such as variations in data format and levels of detail, as well as the collection and classification of a large volume of information from different sources. In overcoming these obstacles, the database designers demonstrated how information management techniques could be applied to facilitate the sharing of data. The methodology adopted, known as



'networked service-oriented interoperability', required the completion of four distinct components: a landslide application schema, a landslide domain model, web service implementations and a user interface. These components are not described here, but are outlined in Osuchowski & Atkinson (2008).

The methodology was successfully implemented by connecting three physically separate and unique landslide

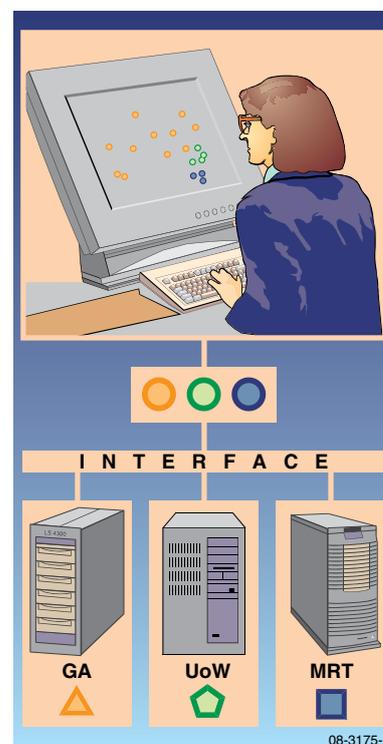


Figure 1. Concept underlying the common interface into one 'virtual' database.

event databases via the web. These databases included a national database managed by Geoscience Australia, a regional (state-wide) database managed by Mineral Resources Tasmania and a local database managed by the University of Wollongong. The new database provided a resource which synthesised the capabilities of each of the single-purpose inventories and allowed landslide data which had been described uniquely in the different host databases to be translated into a consistent format. This process allows the user to view and query information from different databases at the same time, while the original data remains unaltered (figure 1).

“The system collates and characterises a large volume of information from different sources in real time.”

Such an approach, in combination with a willingness to share data, provides a powerful and extensible coordinated landslide resource for Australia, as well as an appropriate foundation for further investment in data collection and analysis.

New database tools and functionality

Users of the database can select the number of databases to be included in their landslide query and have the option of executing a basic or advanced level search. The user can define the spatial extent of their search in several ways by: searching the map extent, drawing

a boundary box or selecting a defined region (figure 2).

Queries also can be filtered to refine the coverage of landslides. In addition to landslide identification and the date of the landslide, filters currently include information related to landslide type (movement type and material class), cause (both human and natural contributing factors as well as trigger factors) and damage (such as number of buildings damaged or destroyed, fatalities, injuries, and type of damage). This means a search could be refined to locate all debris slides or flows which had wave erosion as a contributing factor within a certain timeframe.

The reporting functionality includes tabular and cross-tabular reports which can be downloaded in a range of data formats. For numerical fields, a count is also displayed.



Figure 2. User interface for the virtual Australian Landslides Database displaying a spatial index of data accessed from host databases.

Major benefits

The main advantage of the interoperable approach is the increased volume of information it enables. A range of additional benefits (described in Osuchowski & Atkinson 2008) include the following:

- The system collates and characterises a large volume of information from different sources in real time. This provides an automatically updated single point of access to landslide information with new information available online immediately.



- Users are able to simultaneously search and query remote landslide inventories regardless of where they are hosted or differences in format.
- Data is presented consistently to enable the comparison of data across databases, landslide characteristics or locations. This allows data to be compared and contrasted within a landslide domain.
- Detailed information can be accessed for either detailed analysis (such as a single landslide event) or generic information can be accessed and aggregated for strategic purposes (such as aggregating details for a number of landslide events). Data is provided at basic, intermediate and sophisticated levels from an information-rich foundation source.
- Drill-down functionality means that different users can access the level of information they require from the same source data. This removes the need to locate, access and interrogate isolated landslide databases or to separately identify and contact a number of individuals.
- Results can be displayed as reports, tables, maps and potentially as graphs and tables of statistics. Users can also access multi-media such as photographs, videos, published papers, landslide risk management reports, studies etc.
- There is no limit to the number of landslide databases that can be linked into the virtual database since the interface neither stores nor records data.

The new database increases the availability, accessibility and discoverability of data and is now a joint initiative across local, state and national levels of government with all levels contributing to a national system. Since implementation, this approach has resulted in an immediate 70 per cent increase in the total number of landslide events reported nationally. The database now has more than 3000 entries detailing landslides and sets of landslides since 1842 throughout Australia, Lord Howe Island, Norfolk Island and Macquarie Island.

Acknowledgments

The author would like to acknowledge the participation and contributions of staff from Mineral Resources Tasmania and the University of Wollongong in this initiative.

References

- COAG (Council of Australian Governments). 2004. Natural Disasters in Australia: Reforming mitigation, relief and recovery arrangements. A report to the Council of Australian Governments by a high-level officials group, August 2002. Department of Transport and Regional Services. Canberra
- Osuchowski M & Atkinson R. 2008. Connecting diverse landslide inventories for improved information in Australia. Proceedings of the 1st World Landslide Forum, Tokyo, Japan, 18–21 November 2008.

For more information

phone Monica Osuchowski on
+61 2 6249 9717

email Monica.Osuchowski@ga.gov.au

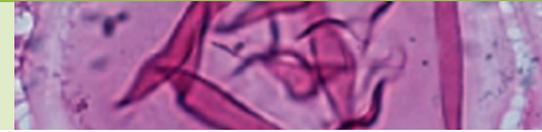
Related websites/articles

- AusGeo News 84*: Landslide Database Interoperability Project
www.ga.gov.au/ausgeonews/ausgeonews200612/inbrief.jsp#inbrief2
- Natural Hazards Program/Landslides
www.ga.gov.au/hazards/landslide.

Customising the geological timescale

Applying the international geological timescale to Australia

John Laurie, Daniel Mantle and Robert S Nicoll



A standardised and precise timescale is invaluable to geological research and crucial to meaningful correlation at local, regional and global scales for both researchers and industry. Modelling of petroleum system plays and ore-body generation, for example, both depend on accurate timescales to be usefully interpreted.

The geological timescale is one of the major achievements of geoscience. It has been developed by geologists over the past two centuries to describe and understand the history of the earth.

Chronostratigraphic (relative-time) units, such as rock formations, biozones (or all the rocks characterised by a particular fossil), and magnetostratigraphy, are calibrated against a chronometric scale (an absolute age in years) to build the timescale. Absolute ages (years before present) are usually measured using radiometric dating techniques and in the Cenozoic and Mesozoic can be calibrated against high resolution orbital forcing events (that is, astronomical cycles). Modern techniques and instruments are delivering increasingly accurate ages (with precision down to ± 0.1 per cent), whilst biozonation schemes are continually refined and standardised on a global basis. As such, constant updating of the geological timescale is required and it will always remain a flexible, on-going project (see figure 1).

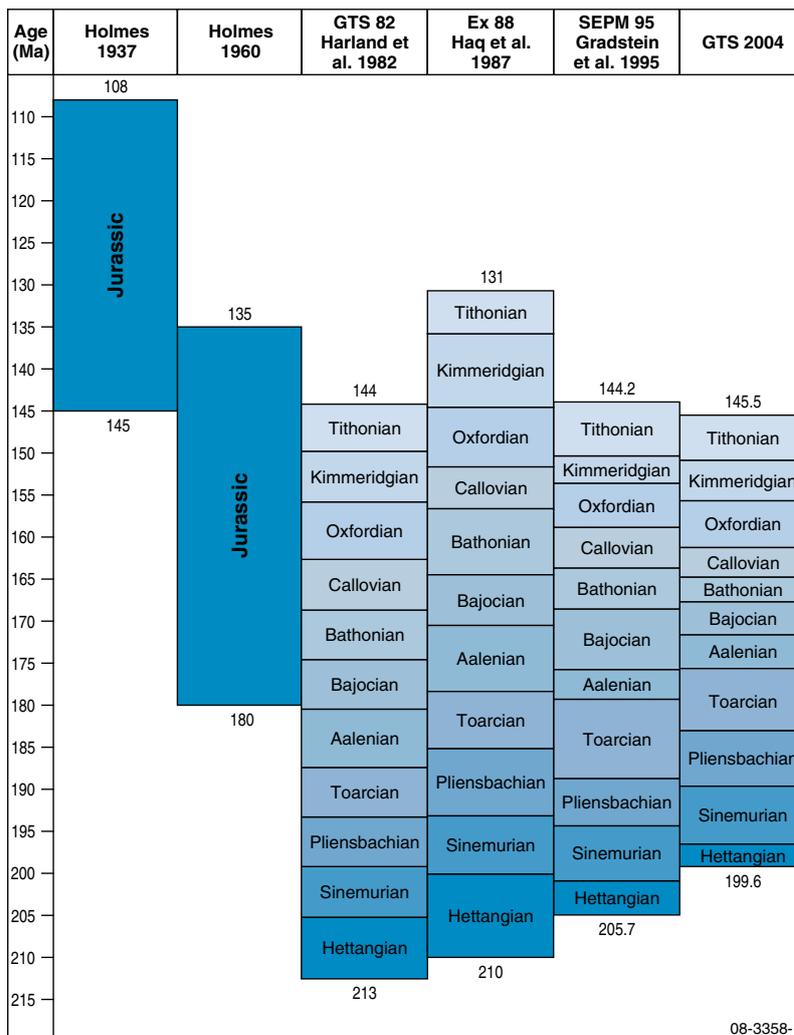


Figure 1. Illustration of the dramatic changes that have taken place with successive revisions of the geological timescale (based on Fig 1.6b in Gradstein et al 2005).

Towards an Australian timescale

Prior to the 1990s there were numerous attempts to develop a standard global timescale, but none were completely satisfactory for application within Australia. As a consequence, during the 1990s the Australian Geological Survey Organisation

(Geoscience Australia’s predecessor) developed its own ‘AGSO 1996’ standard timescale (Young & Laurie 1996) which contained all current Australian biozonal schemes. This has now been superseded by the most recent international standardised timescale – the Geological Time Scale 2004 (GTS 2004, Gradstein et al 2005). This Precambrian to Quaternary numerical and stadial scale (summarised in figure 2) has been collated during 25 years of work by the International Commission on Stratigraphy and its 14 Subcommissions. This timescale is due to be superseded by a further revision in 2010 (GTS 2010).

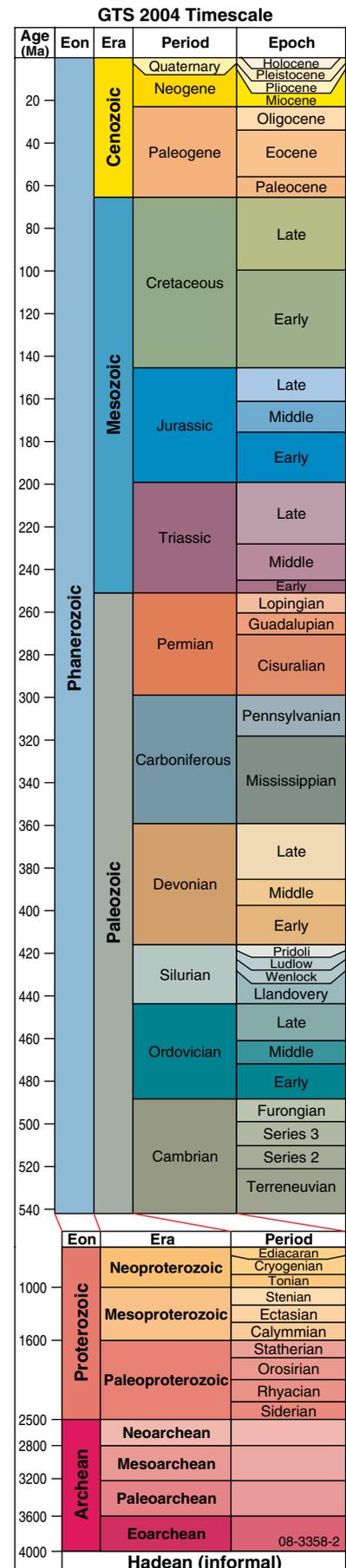
The 2004 version of the Geological Time Scale is mainly built around northern hemisphere datasets and, consequently, many of the biozones used in Australia were not included. These Australian biozones had been compiled and calibrated to the AGSO 1996 timescale, but the adoption of the GTS 2004 timescale meant each biozone needed to be recalibrated. Therefore, implementation of this timescale in Geoscience Australia has been a rather complex exercise. The main difficulty lay in the fact that there was no record of the reasoning or the data to explain how the biozones were tied to the stages, let alone the absolute ages. Furthermore, several of the local biozonal schemes have been revised during the intervening period and need to be updated in Geoscience Australia’s databases.

Calibrating biozones

A biozone (or biostratigraphic zone) is an interval of rock strata that is defined on the basis of its included characteristic fossil species. As species survive for a relatively short period before becoming extinct, if the same fossil is found in widely scattered rock units, it is most likely that those rock units were all laid down at about the same time. In the petroleum exploration industry, biozones provide the primary time framework used in basin modelling, exploration and production.

Most biozonation schemes are based on the first and last appearance datums (essentially speciation and extinction events) or occasionally acme (abundance) events of fossil species. The first appearance datums are generally the most consistent and useful markers of a single point in time, as last appearances and acme events are more likely to vary with environmental influences. A segment of the recently revised and widely utilised HMP biozonal scheme (Helby, Morgan & Partridge 2004) is shown in figure 3. The zonation, based on the stratigraphic ranges of dinocysts (microplankton), is illustrated alongside the main bioevents (or datums) that define each zone. The aim is to capture the relationship of these bioevents to the timescale as a percentage of the time from base to top of a stage. For example, the base of the *Voodooia tabulata* Dinocyst Zone is set as the first appearance of the eponymous species, which is estimated to

Figure 2. Geological Time Scale 2004 (Gradstein et al 2005)



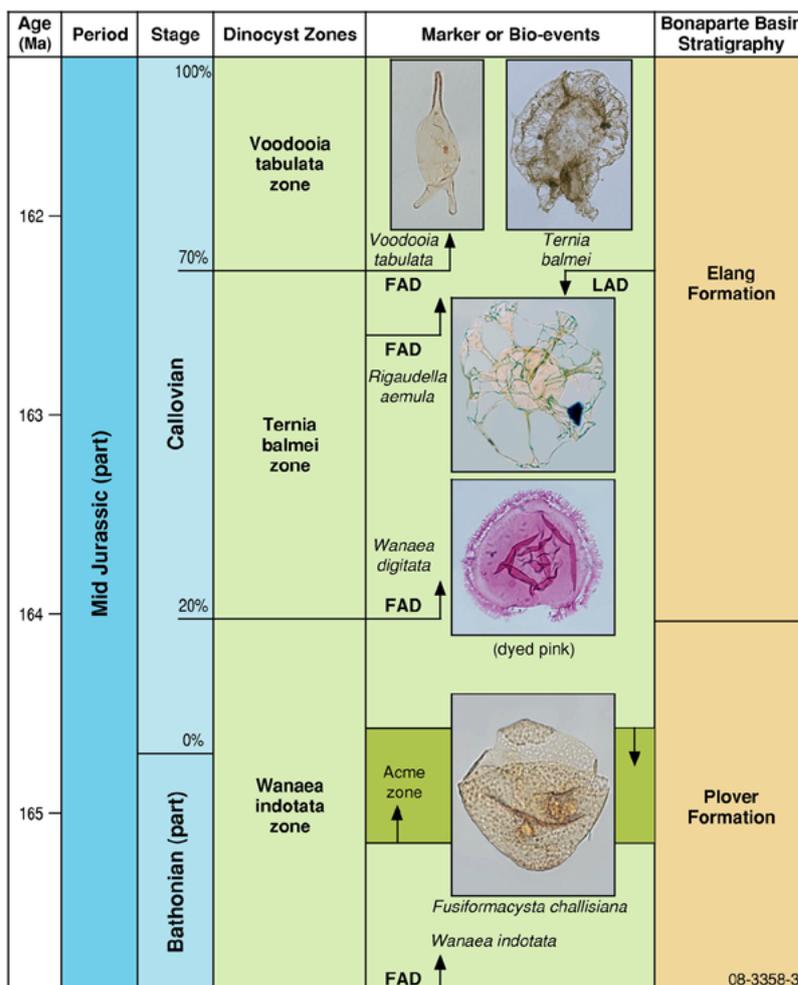
occur at 70 per cent from the base to the top of the Callovian. All the Australian biozones will be stored as such in the Geoscience Australia Timescales Database. Thus, if the base age of Callovian is updated in GTS 2010, the *Voodooia tabulata* Dinocyst Zone would automatically update to a new numerical age as it is stored as a percentile of the Callovian stage.

There are currently over 2500 biozones published in Australian biozonal schemes and capturing the relationships of these biozones to the stages will require extensive literature searches and targeted revisions of some biozonations to achieve the required recalibration. This information will then be saved in the Timescales Database, which is a core lookup table for numerous databases across the organisation. As noted above, GTS 2004 will be updated in 2010 and a further recalibration will be necessary. By then the Timescales Database will have been redeveloped to store the appropriate relationships of zones to stages thus obviating the need to repeat such a protracted 'manual' recalibration.

Creating timescales

Time Scale Creator is a software package developed by Adam Lugowski and Jim Ogg (Purdue University) that acts as a visualisation tool for the timescale data included in GTS 2004. There are two versions of this software, one freely available and one commercial. The free version, currently Time Scale Creator 3.7 (released in June 2008) contains a 'datapack' comprising the divisions of the GTS 2004, magnetic polarity zones, biozones, oxygen- and carbon-isotope curves, sequences, and sea-level curves, totalling over 10 000 event-age entries and upwards of 200 stratigraphic columns. Any permutation of these biozonal and other schemes can be chosen and displayed against the selected portion of the timescale. It is an easy-to-use software package and primarily useful for quickly generating graphic displays of chronostratigraphic schemes against GTS 2004.

The commercially available version (Time Scale Creator PRO) allows the user to generate their own datapack and either to add this to the standard version, or to replace the standard datapack. In association with Professor Jim Ogg, Geoscience Australia has been able to develop an up-to-date datapack containing all current Australian biozonations so that timescales containing Australian data can be generated separately or in association with the assorted international schemes. This is a very useful development as



FAD - First appearance datum (species inception)
LAD - Last appearance datum (species extinction)

Figure 3. Middle Jurassic portion of the Helby, Morgan and Partridge (2004) dinocyst biozonal scheme illustrated with formal marker events.

much of the original data included in the free version is based on the predominantly northern hemisphere datasets underpinning GTS 2004. This Australian datapack will be freely distributed at the 2009 APPEA Conference and Exhibition in Darwin (between 31 May and 3 June) and will also be available from the Geoscience Australia Timescales webpage from that date.

Stratigraphic data can also be inserted into Time Scale Creator PRO to allow it to generate stratigraphic columns calibrated against any biozonal scheme or schemes the user chooses. An example image generated by Time Scale Creator showing the lithostratigraphy, supersequences, basin phases, sea-level curve and relevant biozones for an Early–Late Cretaceous segment of the Great Australian Bight Basin is shown in figure 4. In collaboration with staff from some of the state geological survey organisations, Geoscience Australia has also been using Time Scale Creator PRO to generate up-to-date Basin Biozonation and Stratigraphy charts. These are replacing charts drafted about a decade ago using the now outdated AGSO 1996 timescale. Currently, Geoscience Australia has compiled, or is compiling, stratigraphic charts for the Bonaparte, Browse, Canning, Carnarvon, Great Australian Bight, Otway and Perth basins as well as the Dampier Sub-basin. These charts provide a relatively detailed stratigraphic overview of each of the basins concerned. Furthermore, when GTS 2010 replaces GTS 2004, updating these charts should be fairly straightforward as the re-developed Timescales Database will store the zonal markers and their relationships to the timescale rather than independent numerical ages.

References

- Gradstein FM, Ogg JG & Smith AG. 2005. A Geologic Time Scale 2004. Cambridge University Press
 Helby R, Morgan R & Partridge AD. 2004. Updated Jurassic–Early Cretaceous dinocyst zonation NWS Australia. Geoscience Australia.
 Young GC & Laurie JR. 1996. An Australian Phanerozoic Timescale. Oxford University Press.

For more information

phone John Laurie on
+61 2 6249 9412
email john.laurie@ga.gov.au

Related websites

- Timescales Webpage – Geoscience Australia
www.ga.gov.au/oceans/og_lfes_Tscales.jsp
 International Commission on Stratigraphy
www.stratigraphy.org/
 Geological Time Scale 2004
www.stratigraphy.org/gts.htm
 Time Scale Creator software
www.tscreator.com/download.php

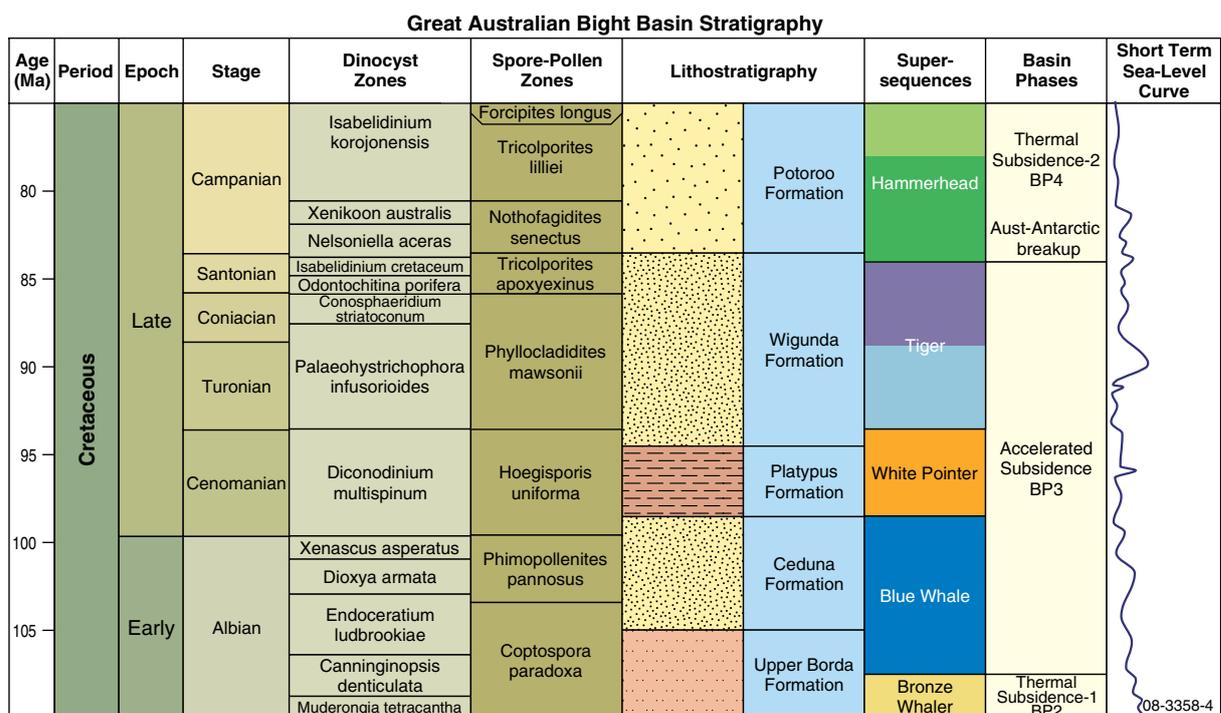


Figure 4. Sample output from Time Scale Creator software showing elements of the Great Australian Bight Basin stratigraphy against the relevant biozonal schemes and GTS 2004.

150 years of continuous geomagnetic monitoring in Australia

Today, Flagstaff Gardens is a short walk from Melbourne's Central Business District. Surrounded by busy streets, it is a tiny green oasis in the midst of a big city – a far cry from its quieter scientific past. In May 1858, an observatory measuring changes to Earth's magnetic field began operation on Flagstaff Hill. A similar observatory had operated in Hobart from 1840 to 1854 until a lack of resources in the young colony forced its closure.

The Flagstaff Hill observatory was established by Georg von Neumayer, a young German scientist, who obtained the necessary funds and equipment from the Duke of Bavaria. His enthusiasm for geomagnetism also extended to arduous field campaigns by horse and cart throughout Victoria and into New South Wales and South Australia in the 1860s. During an expedition in 1862, von Neumayer was memorably recorded in the iconic painting of Mount Kosciusko by Eugene von Guérard.

Melbourne's rapid expansion, with the associated construction and increasing traffic, began to disturb the quiet conditions at Flagstaff Hill necessary to measure subtle magnetic-field changes. In September 1862, observatory operations moved to a new site at the Royal Botanic Gardens (figure 1). The magnetic environment remained suitably quiet there until the 1900s when the introduction of electric trams in Melbourne changed conditions dramatically and forced another move, this time to the country.

In 1919 a new observatory was established at Toolangi, about 50 kilometres northeast of Melbourne. Magnetic-field monitoring continued at this site until the transfer of operations to a new observatory near Canberra in 1979 except for a 12 month break after a devastating bushfire in January 1939. Toolangi's subsequent closure in the mid-1980s ended an impressive span of more than 60 years of operation at a single site. Operations continue at the Canberra observatory today.

This sequence of geomagnetic observatories, beginning in Hobart, provides a significant history of magnetic-field measurement in southeast Australia. Figure 2 shows how the direction of the magnetic field in southeast Australia has changed over that time.

Geomagnetic observatories monitor the constant changes in Earth's geomagnetic field whether caused by solar activity, or the motion of molten fluids in Earth's outer core. Today Geoscience Australia operates six geomagnetic observatories in Australia and three in Antarctica. They provide a wealth of information for a variety of purposes, ranging from natural resource exploration to space weather forecasting.

For more information

phone Adrian Hitchman on +61 2 6249 9800
email adrian.hitchman@ga.gov.au.



Figure 1. The Old Melbourne Observatory 'Magnet Hut' (left), near the Shrine of Remembrance (background) and tramlines along St Kilda Road.

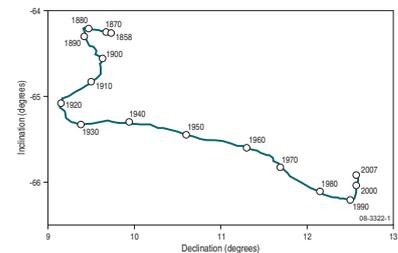


Figure 2. The magnetic field direction at Canberra, Australian Capital Territory, 1858 – 2007. Historic values have been adjusted to the Canberra site. 'Declination' is the angle in the horizontal plane between true north and magnetic north. In southeast Australia magnetic north is to the east of true north, represented by the positive declination values in the graph. 'Inclination' is the angle the magnetic field makes with the horizontal plane. In the southern hemisphere the magnetic field is directed out of the Earth, represented by the negative values of inclination in the graph.

Related websites/articles

Real-time magnetic-field data from Geoscience Australia
www.ga.gov.au/geomag

North-east view from the northern top of Mount Kosciusko by Eugene von Guérard
(National Gallery of Australia)
artsearch.nga.gov.au

AusGeo News 86: Gngangara geomagnetic observatory—50 years young
www.ga.gov.au/ausgeonews/ausgeonews200706/observatory.jsp

Australia's mineral resources maintain world status

A new publication, *Australia's Identified Mineral Resources 2008*, reveals that Australia's minerals reserves continue to ensure that the mining industry is the most important export earning sector of the Australian economy.

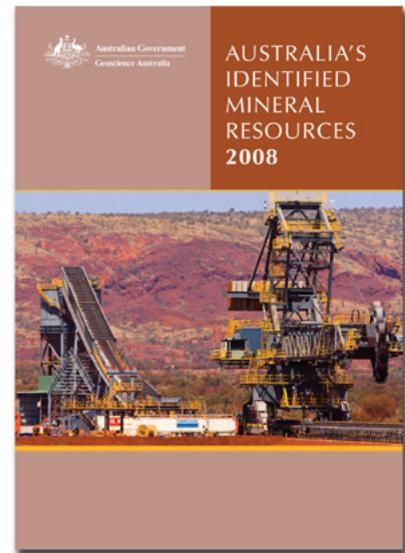
The report, compiled by Geoscience Australia, shows that at December 2007, Australia had the world's largest economic demonstrated resources of mineral sands (rutile and zircon), nickel, uranium, zinc, lead and brown coal. The country also ranks among the top six worldwide for resources of bauxite, black coal, copper, gold, iron ore, industrial diamond, ilmenite, lithium, manganese ore, niobium, silver, tantalum and antimony.

Australia's Identified Mineral Resources 2008 also reveals that during 2007, Australia's economic demonstrated resources increased as a result of ongoing drilling and reassessment of known deposits and the discovery of new deposits.

Over the year, Australian mineral exploration spending increased by 41 per cent to more than \$2061 million. This increase reflected strong growth in prices for many commodities on the back of anticipated strong and growing demand, particularly from China, as well as major increases in the cost of exploration. There were significant numbers of intersections in extensions of known deposits and several new discoveries in Western Australia, South Australia and New South Wales.

Australia's Identified Mineral Resources 2008 provides government, industry, the investment sector and the general community with an informed understanding of Australia's known mineral endowment and the level of exploration activity. The assessment includes data on mining company estimates of ore reserves as well as evaluations of long-term trends in mineral resources, international rankings, summaries of significant exploration results, mining industry developments and an analysis of mineral exploration expenditure.

A free download of *Australia's Identified Mineral Resources 2008* is available through the Geoscience Australia website and other fundamental data on the minerals sector can be accessed through the *Atlas of Australia's Mineral Resources, Mines and Processing Centres*.



For more information

phone Aden McKay on
+61 2 6249 9230

email aden.mckay@ga.gov.au

Related websites/articles

Australia's Identified Mineral Resources 2008

www.ga.gov.au/image_cache/GA12116.pdf

Atlas of Australia's Mineral Resources, Mines and Processing Centres.

www.australianminesatlas.gov.au

Tracking water flow made easier with new national elevation database

Understanding how Australia's precious water drains across the surface of the continent will be dramatically improved thanks to a new national Digital Elevation Model (DEM). The new data will contribute significantly to water accounting, catchment management, modelling the impacts of climate change projections and a broad range of other applications.

Researchers from the Australian National University (ANU) and Geoscience Australia have recently released this new version of their GEODATA 9 Second Digital Elevation Model (DEM-9S). Version 3 marks the culmination of more than a decade of work, providing a grid of ground-level elevation points covering the whole of Australia, with a grid spacing of nine seconds in longitude and latitude, or roughly every 250 metres.

The core data underpinning the new database include:

- revised versions of elevation points, streamlines, cliff lines, and water-bodies
- trigonometric points from the National Geodetic Database
- additional elevation, streamline and sink point data digitised from source material.

The work also incorporated major upgrades to the ANUDEM modelling software to improve the representation of streamlines, lakes, cliff lines and the coastline. According to Professor Michael Hutchinson from ANU 'while there are many locations where higher accuracy data are available, this product provides the only nationally consistent data for modelling across the entire continent'.

Accompanying the elevation data is a corresponding Flow Direction Grid (D8-9S) which describes the principal directions of surface drainage across the whole of Australia. It can be used to delineate streamlines and associated catchment boundaries. This is particularly useful in low-relief areas where drainage structure is not reliably defined by elevations alone. The new data shows that only around 50 per cent of Australia's drainage basins actually flow to the sea.

This work will underpin the Australian Government's Water for the Future program and the Australian Water Resources Information System being developed by the Bureau of Meteorology. Work has



begun already on the next generation of a national DEM which will improve the resolution from 250 metres to less than 90 metres.

Both datasets can be downloaded free-of-charge from the Australian governments' Geophysical Archive Data Delivery System (GADDS). The dataset is also available on CD ROM from Geoscience Australia's Sales Centre for \$99.00.

For more information

To order copies of the CDs

phone Freecall 1800 800 173
(in Australia) or
+61 2 6249 9966

email sales@ga.gov.au

phone Phil Tickle on
+61 2 6249 9769

email phil.tickle@ga.gov.au

Related websites

GEODATA 9 Second DEM and D8: Version 3 and Flow Direction Grid 2008

www.ga.gov.au/nmd/products/digdat/dem_9s.jsp

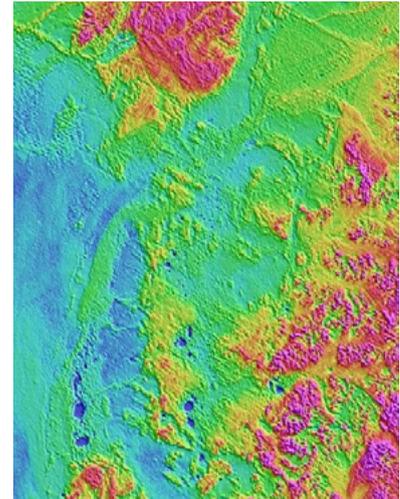
New geophysical datasets released

Datasets from two new airborne magnetic and radiometric surveys, covering the Lower Balonne in southern Queensland and the Byro region in Western Australia, have been released since September 2008.

The Lower Balonne airborne magnetic and radiometric survey was managed by Geoscience Australia under the auspices of the National Action Plan for Salinity and Water Quality. This project was undertaken by the Queensland Department of Natural Resources and Mines, the Cooperative Research Centre for Landscape, Environments and Mineral Exploration and the Australian Government's Bureau of Rural Sciences.

The Byro airborne magnetic and radiometric survey was managed by Geoscience Australia on behalf of the Geological Survey of Western Australia. The survey provides basic geophysical data which can be interpreted to reveal the sub-surface geology where the Gascoyne Province meets the Yilgarn Craton and importantly to stimulate mineral exploration.

The data have been incorporated into the national geophysical databases and will be a valuable tool in assessing the mineral potential of the respective survey areas. The point-located and gridded data for the surveys can be obtained free online using the Australian government's Geophysical Archive Data Delivery System (GADDS).



For more information

phone Murray Richardson
on +61 2 6249 9229
email murray.richardson@
ga.gov.au

Related websites

Geological Survey of Qld
www.dme.qld.gov.au/mines/about_us.cfm

Geological Survey of WA
www.doir.wa.gov.au

Table 1. Details of the airborne surveys.

| Survey | Survey type | Date | 1:250 000 map sheets | Line spacing/ terrain clearance/ orientation | Line km | Contractor |
|---------------------|----------------------------------|---------------------|---|--|---------|---------------------------|
| Lower Balonne (Qld) | Magnetic, Radiometric, Elevation | April – August 2001 | Dirranbandi (pt), St George (pt), Homeboin (pt), Surat (pt) | 100 m, 400 m 60 m 137° | 60 605 | Tesla Airborne Geoscience |
| Byro (WA) | Magnetic, Radiometric, Elevation | April - July 2008 | Wooramel (pt), Glenburgh (pt), Yaringa (pt), Byro (pt) | 400 m 60 m east - west | 83 855 | GPX Surveys Pty Ltd |

AUSTRALIA 2012 – 34th International Geological Congress

‘Unearthing our Past and Future’ will be the theme for the 34th International Geological Congress (IGC), AUSTRALIA 2012, to be held at the Brisbane Convention and Exhibition Centre between 2 and 10 August 2012. Brisbane will host at least five thousand delegates and the accompanying Geo Expo exhibition will include around 200 display booths for industry and government agencies from around the world. The Congress will include a diverse field excursion program to complement the Conference theme and showcase some of the best geological and natural attractions that Queensland and the Oceania region have to offer.

Four years may seem some time off, however, the Organising Committee for AUSTRALIA 2012 has begun preparations to

ensure that the Congress is a success. A major promotional effort was made during the 33rd IGC held in Oslo between 6 and 14 August 2008, led by the AUSTRALIA 2012 Organising Committee President, Dr Neil Williams, the Chief Executive Officer of Geoscience Australia.

An Oceania Symposium held on Wednesday 13 August, featured an outstanding line up of 21 presenters from Australia and New Zealand. Promotion of AUSTRALIA 2012 was maximised through the use of promotional banners and consistent attire for presenters. The closing ceremony the following day also included the promotional banners and a video presentation featuring a welcoming message from Australian Prime Minister The Hon. Kevin Rudd MP.



Figure 1. Dr Neil Williams, President of the AUSTRALIA 2012 Organising Committee, invites delegates to Brisbane at the closing ceremony of the 33rd IGC.



Figure 2. The AUSTRALIA 2012 promotion during the 33rd IGC generated high levels of interest.

For more information

phone Ian Lambert on
+61 2 6249 9556
email ian.lambert@ga.gov.au

Related websites

AUSTRALIA 2012, the 34th International Geological Congress
www.34igc.org

International Year of Planet Earth update

The United Nations General Assembly proclaimed 2008 as the International Year of Planet Earth (IYPE). The aim of the IYPE was to demonstrate how earth sciences can assist in meeting the challenges involved in ensuring a safer, healthier and more prosperous world. Outreach and science programs were the main lines of activity for raising awareness of the role and contribution of the earth sciences to society.

Throughout 2008, IYPE has been a dominant theme for a number of geoscience conferences and outreach activities across Australia. The national Earth Science Week celebrations held during October were a significant contribution to Australia's outreach program. Over 200 students took part in the *Geologi08* short film competition, submitting short earth science films based on the major IYPE themes of natural hazards, Earth's resources and deep Earth.

Earth science workshops were held during Australia's National Science Week in August and the Australian Science Teachers Association (ASTA) also released their teacher resource book themed 'Planet of Earth – Planet of Change'. Other significant activities held during the year have included a national photography competition held at the Australian Fossil and Mineral Museum in Bathurst, and the release of the Australian Bureau of Statistics 2008 Year Book, themed 'Earth Science'.

In February 2008, Lachlan O'Brien was selected as Australia's winner of the IYPE student contest for his musical piece, *Rondo Symbiosis - The rhythm of life*. Lachlan attended the official international launch of IYPE in Paris, along with leading scientists and government representatives from 191 United Nations member countries.

In addition to the extensive outreach program, Australia contributed significantly to a number of ongoing IYPE science programs. OneGeology, a flagship science program for the IYPE, was launched in Oslo at the 33rd International Geological Congress in August. This initiative will enable each member organisation to dynamically share the latest versions of their digital geological data with each other via standardised interfaces. OneGeology is underpinned by the International GeoSciML data-exchange standard, which Australia has played a key role in developing, and will accelerate the accessibility of geoscience data via web services.

Because of the on-going nature of OneGeology and other science programs, 2009 was proclaimed an IYPE wrap-up year. Geoscience Australia is planning to sponsor participation in the Italian Geological Society Youth Earth Sciences Congress (YES) to be held during the northern autumn in 2009, to ensure that Australia's young earth scientists have an opportunity to take part.

For more information

phone Fiona Slater on +61 2 6249 9859

email fiona.slater@ga.gov.au



Related articles/websites

International Year of Planet Earth
yearofplanetearth.org/index.html

Australia's International Year of Planet Earth

www.ga.gov.au/education/events/planet-earth/

Earth Science Week

www.ga.gov.au/education/events/science-week/index.jsp



| | |
|--|---|
| NAPE Expo 2009 American Association of Professional Landmen | 5 & 6 February |
| Houston, Texas, USA Contact: NAPE, 4100 Fossil Creek Boulevard Fort Worth, Texas 76137 USA | p +1 817 847 7700 f +1 817 847 7703 e info@napeexpo.com www.napeonline.com |
| ASEG 09–20th International Geophysical Conference & Exhibition | 22 to 25 February |
| Adelaide Convention Centre Contact: SAPRO Conference Management, PO Box 187, Torrensville, SA 5031 | p +61 8 8352 7099 f +61 8 8352 7088 e aseg09@sapro.com.au www.aseg.org.au |
| PDAC 2009 International Convention & Trade Show Prospectors and Developers Association of Canada | 1 to 4 March |
| Metro Toronto Convention Centre, Toronto, Canada Contact: PDAC, 34 King Street East, Suite 900, Toronto, Ontario M5C 2X8 | p +1 416 362 1969 f +1 416 362 0101 e info@pdac.ca www.pdac.ca/ |
| AMEC National Mining Congress 2009 Association of Mining and Exploration Companies | 21 & 22 May |
| Perth Convention Exhibition Centre Contact: AMEC, PO Box 6337, East Perth, WA 6892 | p 1300 738 184 (Within Australia) f 1300 738 185 (Within Australia) e events@amec.org.au www.amec.org.au |
| 2009 APPEA Conference and Exhibition–Australian Petroleum Production and Exploration Association | 31 May to 3 June |
| Darwin Convention Centre Contact: Julie Hood, APPEA Limited GPO Box 2201, Canberra ACT 2601 | p +61 7 3802 2208 e jhood@appea.com.au www.appea.com.au |
| 7th International Conference on Geomorphology Australian and New Zealand Geomorphology Group (Inc.) | 6 to 11 July |
| Melbourne Exhibition and Convention Centre Contact: Tour Hosts Conference & Exhibition Organisers, GPO Box 128, Sydney, NSW 2001 | p +61 2 9265 0700 f +61 2 9267 5443 e geomorphology2009@tourhosts.com.au www.geomorphology2009.com |
| Spatial Sciences Conference 2009 Spatial Sciences Institute | 28 September to 2 October |
| Adelaide Convention Centre Contact: ICMS Pty Ltd, 84 Queensbridge Street, Southbank, Victoria 3006 | p +61 3 9682 0288 f +61 3 9682 0244 e ssc2009@icms.com.au www.ssc2009.com |