



Contents

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Editor

Words Worth Writing

Assistant Editors

Stephen Ross

Graphic Design

Maria Bentley, Lindy Gratton

Web Design

Maria Bentley, Lindy Gratton

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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/](http://www.ga.gov.au/about/corporate/ausgeo_news.jsp)

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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

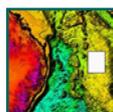
e: len.hatch@ga.gov.au

CEO comment 2



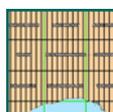
Offshore petroleum exploration set to increase 3

Recent successes have significantly increased known oil and gas reserves



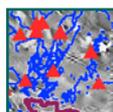
Promising results from Capel and Faust Basins seismic survey 6

New data point to hydrocarbon potential



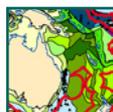
Onshore Energy Security Program takes off 7

Search for new energy sources is underway



Regional geochemical study paves way for national survey 10

Geochemistry of surface regolith points to new resources



High seas and marine protected areas 14

GIS analysis of seafloor geomorphology exposes conservation concerns



Australian mineral exploration growing strongly 17

Strong demand underpins higher spending



Gnangara geomagnetic observatory—50 years young 19

Australian geomagnetic studies go back 167 years.

In brief

Scientist recognised by industry 21

New seabed map 21

Global geology map 23

Product News

Geophysical datasets released 24

New Gazetteer released 25

Events 26



CEO comment



Neil Williams – CEO Geoscience Australia



This issue of AusGeo News features several articles relating to Geoscience Australia's programs to provide pre-competitive information to support industry's search for new offshore and onshore energy resources.

Interest in offshore exploration for oil and gas is rapidly increasing, as shown by the trebling of borrowings from Geoscience Australia of pre-competitive data used in the assessment of exploration opportunities. Details of the areas included in the 2007 Release of offshore petroleum exploration areas are included in this issue. Geoscience Australia has a number of products to assist explorers in reviewing potential acreage and, as part of the Offshore Energy Security Program, has established an Acreage Release Data Room at our Symonston ACT headquarters for visitors interested in the 2007 Release.

There is also a report on the seismic data acquired during the marine survey in the Capel and Faust Basins off eastern Australia completed early this year. At this preliminary stage several basin structures have been seen for the first time and their shape and size look favourable for hydrocarbons.

Geoscience Australia's Onshore Energy Security Program will significantly boost investment in exploration for onshore energy resources. Data acquisition has commenced for three national programs focussed on onshore energy commodities—geothermal, hydrocarbon and uranium. The projects, which include the continent-wide radiometric survey and the National Geochemical Survey of Australia, will be supported by targeted regional projects in specific areas over two or three years.

The Thomson Regional Geochemical Survey was a pilot geochemical survey which provided fundamental datasets for mineral exploration and resource potential evaluation. This survey, and other pilot geochemical surveys, also contributed to the National Geochemical Survey of Australia by refining sampling protocols to ensure their suitability to a range of environments across Australia.

Australia claims the third largest Economic Exclusion Zone (EEZ) in the world (8.1 million square kilometres) which is around 2.2 per cent of the world's ocean area. The article on our new geomorphic province map covering the world's oceans places the distribution of

geomorphic features in our EEZ into a global context.

There is also an update on mineral exploration in Australia which continues to strengthen as expenditure on mineral exploration rose to \$1.46 billion in 2006. This continuing growth is a consequence of current mineral and metal prices, most of which are at or near record highs.

Monitoring of the Earth's geomagnetic field requires consistent recording over extended periods to detect subtle but important changes to provide information for navigation, oil and mineral exploration, and scientific research. The article on the Gngangara Geomagnetic Observatory in Western Australia profiles the second observatory on mainland Australia to have provided geomagnetic data over a 50-year time span.

As usual we always appreciate your feedback and encourage you to use the online rating mechanism with each article.

Offshore petroleum exploration set to increase

Recent successes have significantly increased known oil and gas reserves

Jenny Maher

Each year the Australian Government releases new opportunities for offshore petroleum exploration through the annual release of offshore acreage. Interest in offshore exploration for oil and gas is increasing rapidly with the take-up rate of acreage released rising from just short of 50 per cent in 2002–03 to 90 per cent for the 2005 acreage release. Borrowings of pre-competitive data from Geoscience Australia, used by explorers to define the best drill locations, have trebled between 2004 and 2006.

“Borrowings of pre-competitive data from Geoscience Australia, used by explorers to define the best drill locations, have trebled between 2004 and 2006.”

The 2007 Release of Offshore Petroleum Exploration Areas was announced on 16 April by the Hon. Ian Macfarlane MP, Minister for Industry, Tourism and Resources, at the annual Australian Petroleum Production and Exploration Association (APPEA) conference in Adelaide.

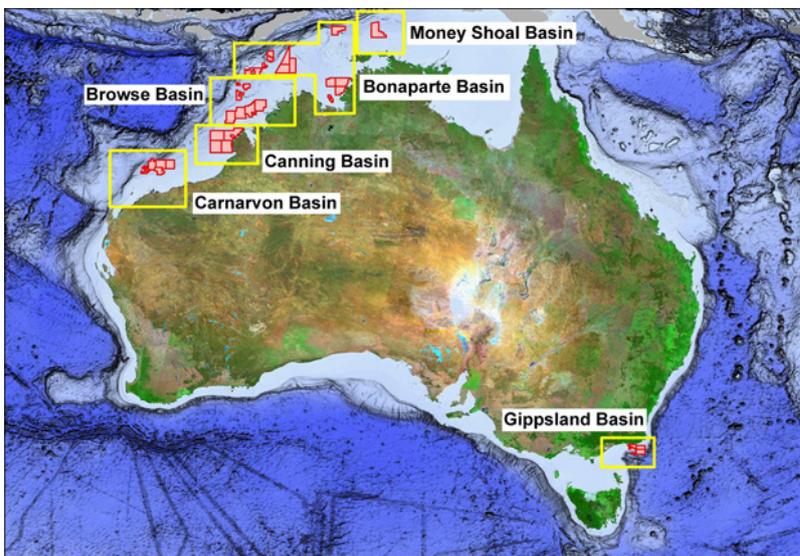


Figure 1. Location of Australia's 2007 Offshore Petroleum Exploration Areas.

Thirty four new exploration areas, located in six of Australia's offshore sedimentary basins, were released (figure 1).

The new areas on offer include:

- Money Shoal Basin—one area adjacent to the 2006 acreage release areas, a region where Geoscience Australia has recently completed a major study (figure 2).
- Bonaparte Basin—thirteen areas of various levels of exploration maturity and in a range of water depths (figure 2).
- Browse Basin—three areas in the Caswell Sub-basin near giant gas fields and four areas on the Yampi-Leveque Shelf (figure 3).
- Offshore Canning Basin—four large shallow water blocks in the offshore extension of the Fitzroy Trough and all are Designated Frontier areas and attract the 150 per cent tax uplift (figure 3).
- Carnarvon Basin—two areas on the northern Exmouth Plateau near one of Australia's major developed resource projects, the North Rankin/Goodwyn gas field, plus four areas in the Beagle Sub-basin (figure 4).

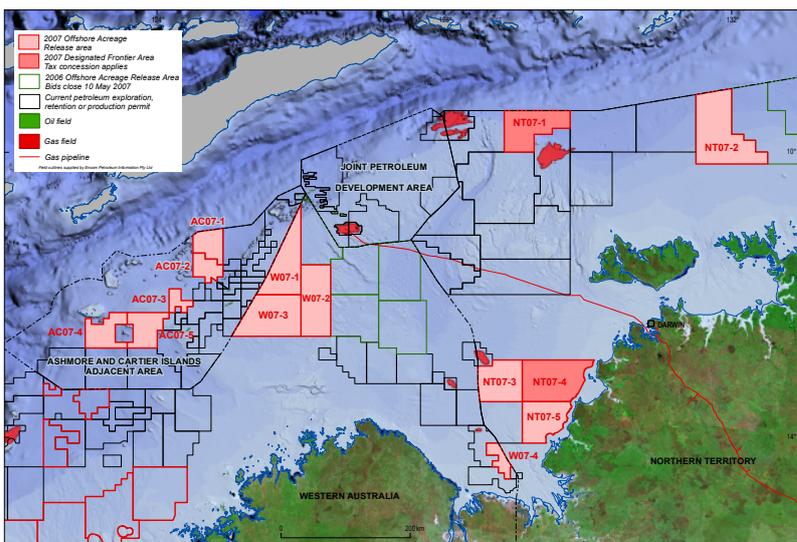


Figure 2. 2007 Offshore Release Areas in Money Shoal and Bonaparte Basins.

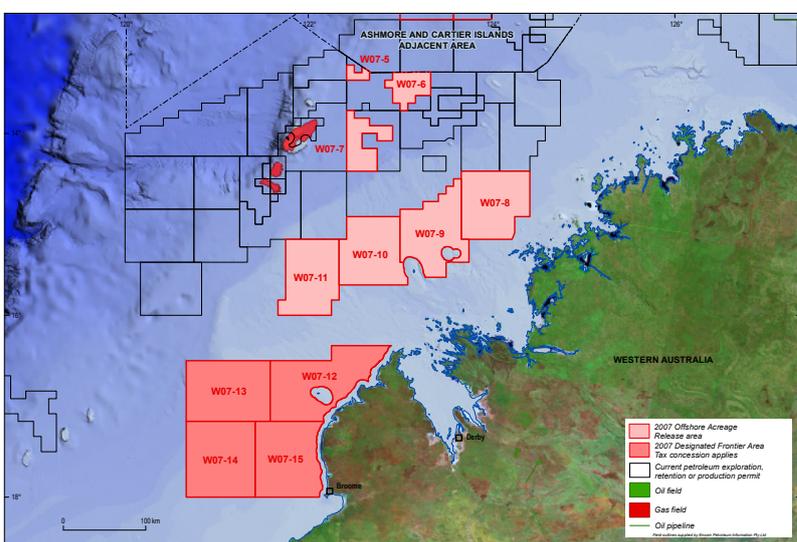


Figure 3. 2007 Offshore Release Areas in Browse and Canning Basins.

- Gippsland basin—three areas in the eastern extension of this major hydrocarbon province (figure 5).

All areas are available for uptake through a work program bidding system. The closing date for those release areas in the first closing round is 18 October 2007 whilst bids for the areas in the second round close 17 April 2008.

Geoscience Australia has a number of products that could assist explorers in reviewing potential acreage. In particular an Acreage Release Data Room has been established at Geoscience Australia's Symonston ACT headquarters and the Data Room is available for visitors interested in the 2007 release areas from mid-June 2007 until

bids for the 2007 release areas have closed.

Alternatively, packages of specific seismic surveys are now available in either Geoframe, Kingdom or Landmark format. These data packages also include digital Well Completion Reports and the 2007 release area shapefiles and can be ordered through the Geophysical Repository at the cost of transfer.

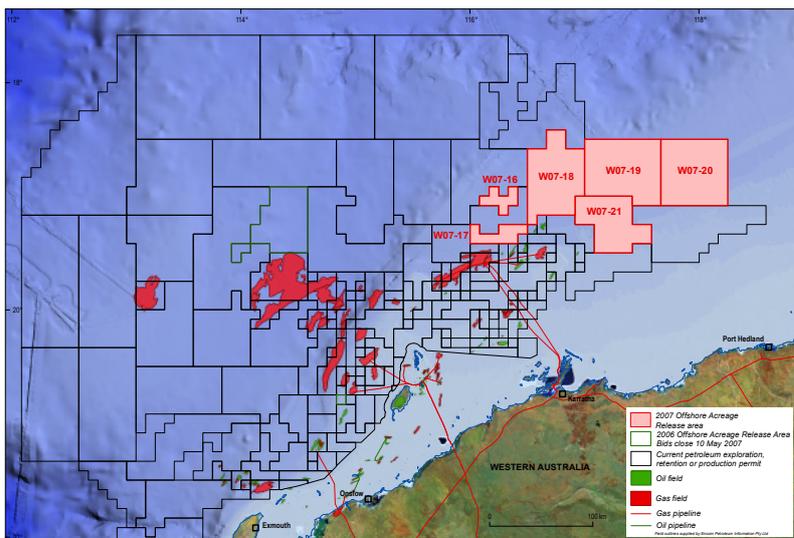


Figure 4. 2007 Offshore Release Areas in the Carnarvon Basin.

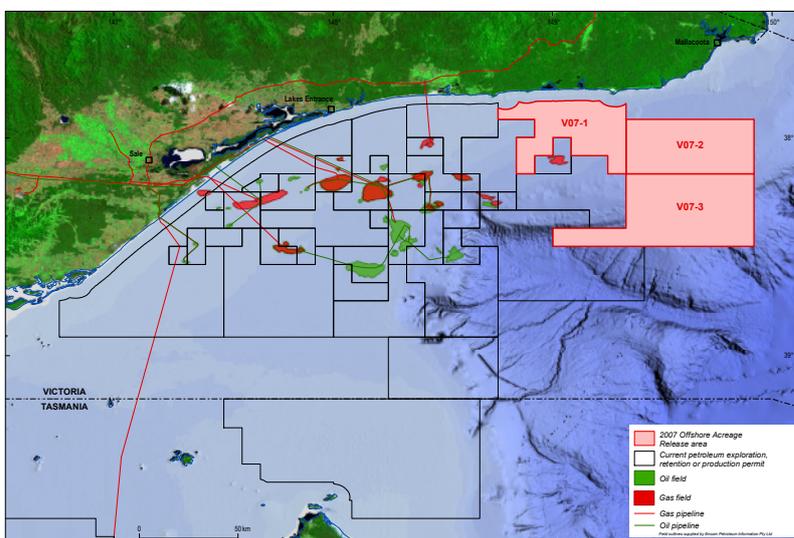


Figure 5. 2007 Offshore Release Areas in the Gippsland Basin.

For more information

For more information on the 2007 Offshore Acreage Release or to book into the 2007 Acreage Release Data Room

phone Jenny Maher on +61 2 6249 9111

email jenny.maher@ga.gov.au

visit www.ga.gov.au

Information on the 2007 Release of Offshore Petroleum Exploration Areas can also be obtained from the Department of Industry, Tourism and Resources website.

Related websites

2007 Offshore Acreage Release
(Department of Industry, Tourism and Resources)

www.industry.gov.au/petexp

Data supporting the 2007 release areas (Geoscience Australia)

www.ga.gov.au/oceans/ss_Acreage.jsp

Geophysical Repository

ausgeodata@ga.gov.au

Promising results from Capel and Faust Basins seismic survey

New data point to hydrocarbon potential

Fred Kroh

Geoscience Australia has recently completed a seismic survey in the Capel and Faust Basins as an initial appraisal of their hydrocarbon potential. The Capel and Faust Basins are two remote deepwater basins 800 kilometres due east of Brisbane that were identified in consultation with the petroleum industry as worthy of reconnaissance.

This survey represents the final stage of seismic data acquisition as part of the Australian Government's New Petroleum Program (Big New Oil initiative, 2003 to 2007) to provide pre-competitive data to support acreage release and open up offshore frontier areas for exploration.

The survey was conducted between 19 November 2006 and 7 January 2007, collecting high-quality, industry-standard seismic data, as well as magnetic, gravity, and long-offset refraction and reflection data. The vessel used an 8-kilometre solid seismic streamer, and collected 12 seconds of data with a 12.5 metre group interval and 37.5 metre shotpoint interval, producing a 106-fold common mid-point (CMP).

“The shape and size of these structures look favourable for hydrocarbons.”

Favourable weather conditions during the survey resulted in the collection of 5920 kilometres of two-dimensional (2D) seismic data, with a line spacing of approximately 30 kilometres, which was approximately 50 per cent more 2D seismic data than originally proposed (figure 1).

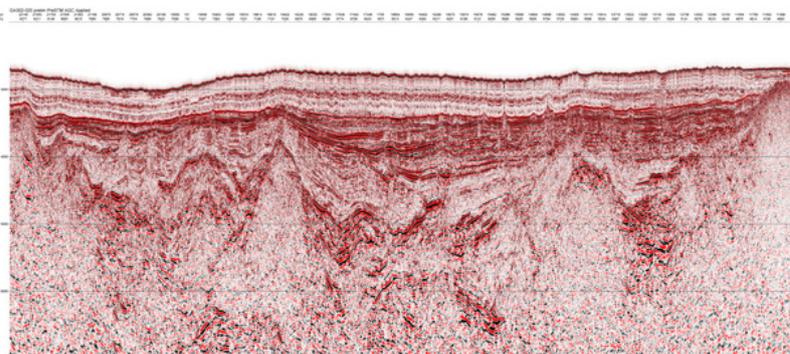


Figure 1. A section of the new seismic data collected in the Capel and Faust surveys highlighting the thick sedimentary section (up to eight kilometres thick) and large prospective structures.

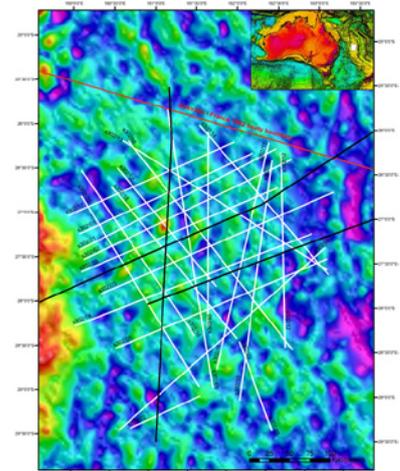
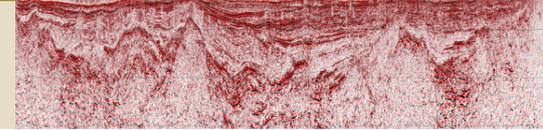


Figure 2. The map shows the position of the seismic lines collected, overlaid on satellite gravity data. Lines marked in white are from the new survey; those in black are from previous Australian Geological Survey Organisation surveys in 1996 and 1998 as part of the Law of the Sea program to establish Australia's extended continental shelf.

Geoscience Australia is processing and analysing the new data; at this preliminary stage, several basin structures have been seen for the first time (figure 2). The shape and size of these structures look favourable for hydrocarbons. After processing, the data will be available to industry at the cost of transfer from Geoscience Australia.

Processed datasets and data will be on display at the 19th International Geophysical Conference and Exhibition, to be held in Perth in November 2007.

For more information

phone Fred Kroh on
+61 2 6249 9183

email fred.kroh@ga.gov.au



Onshore Energy Security Program takes off

Search for new energy sources is underway

James Johnson

The Australian Government's Onshore Energy Security Program (OESP) was announced by the Prime Minister in August last year (see *AusGeo News* 84) as part of a broader package of energy exploration initiatives. The \$59 million, five-year program will deliver pre-competitive data packages and fresh, scientifically based assessments of the potential for onshore energy resources such as oil, gas, uranium, thorium and geothermal energy.

An OESP working plan has been developed in consultation with state and Northern Territory geological surveys and peak minerals and petroleum industry bodies, including the Australian Petroleum Production and Exploration Association and the Association of Mining and Exploration Companies. The proposed program has also been presented at several industry conferences to obtain feedback directly from industry.

As the major program to be undertaken by Geoscience Australia's Onshore Energy and Minerals Division over the next five years, the OESP is expected to significantly boost investment in exploration for onshore energy resources. It will complement Geoscience Australia's

major energy program to encourage offshore exploration for hydrocarbons in frontier regions, also funded under the Energy Security Program.

New national and regional projects

Three new national onshore projects focused on energy commodities have begun—geothermal, hydrocarbon and uranium. Data acquisition for these projects is underway, including a continent-wide radiometric survey that commenced in March (see *AusGeo News* 84) and the National Geochemical Survey of Australia (see below).

National-scale projects will be supported by targeted regional projects over two or three years to assess the potential for energy resources in specific regions. The projects will involve seismic, airborne electromagnetic (AEM), magnetotelluric and other geophysical surveys, as well as multidisciplinary research through the acquisition of new geochronological, geological and geochemical data. Important early phases of these projects (to be undertaken in collaboration with state and Northern

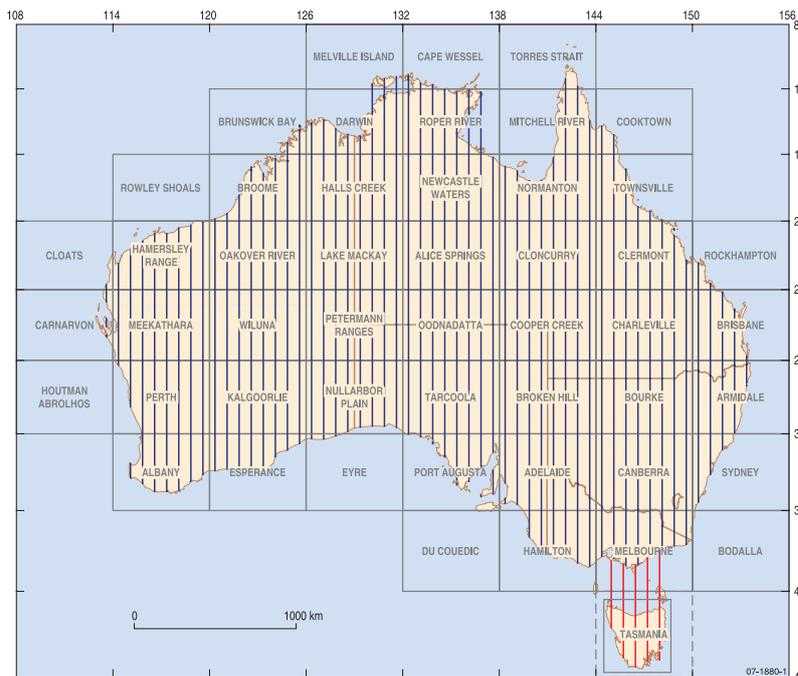


Figure 1. Proposed flight-line pattern for the AWAGS 2 magnetics and radiometrics survey to back-calibrate the National Radiometric Database.

Territory geological surveys) will include the compilation of available information and the definition of specific scientific problems to guide new data acquisition, interpretation, synthesis and delivery phases.

So far, four main regional projects have been identified:

- Mt Isa–Georgetown–Charters Towers region of Queensland
- Gawler–Curnamona–Mt Painter region of South Australia
- Pine Creek–Tanami–McArthur–Arunta–Amadeus region of the Northern Territory
- northern Western Australia.

Some of these projects are further advanced than others, with some geophysical surveys either already begun or about to begin. As these regional projects are completed, new projects will be developed.

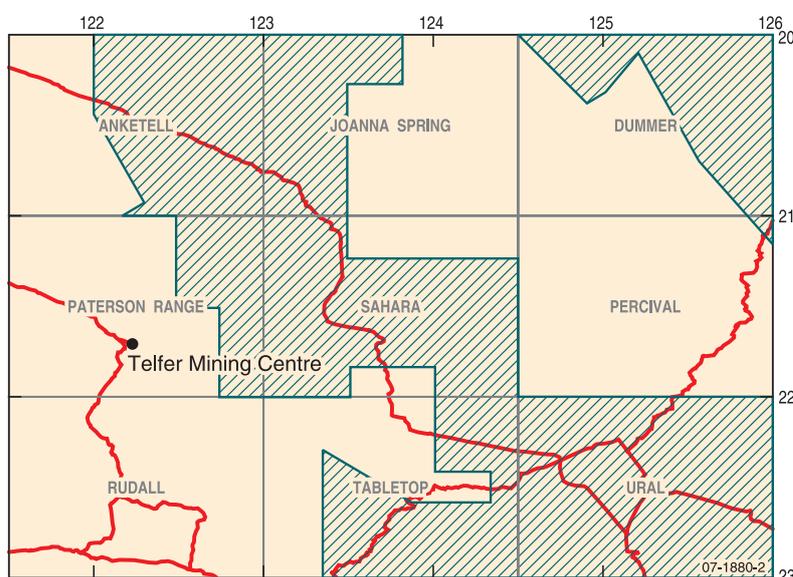


Figure 2. Area of aeromagnetic data acquisition in the Canning Basin, Western Australia. Data acquisition began in April 2007.

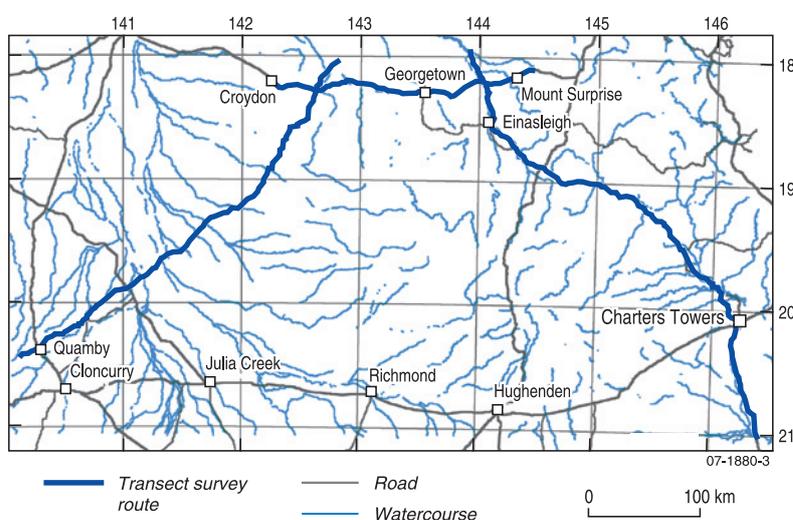


Figure 3. Transect route for deep seismic reflection survey in Cloncurry–Georgetown–Charters Towers regions, Queensland.

Data acquisition

Continent-wide acquisition of new airborne radiometric data began in March 2007 and is due to be completed within 12 months (figure 1). The tie-line survey data (75 kilometres nominal line spacing) will provide a national radiometrics datum to adjust existing radiometric data to a common datum. This will assist the assessment of the uranium and thorium potential of the Australian continent. The survey will also provide an important dataset for a wide range of other uses, including land and environmental management.

The National Geochemical Survey of Australia will sample transported regolith at surface and at 60 to 80 centimetres depth from approximately 1400 large catchments across most of the continent. This will be the first dataset of its kind for Australia, and will deliver new national-scale geochemical data on uranium, thorium and a wide range of other elements related to energy and other mineral commodities. In a second geochemical initiative under the OESP, a regional program of geochemical re-analysis of calcrete samples from the Gawler Craton of South Australia for uranium, thorium and other elements is underway, in collaboration with Primary Industries and Resources South Australia.

Acquisition of aeromagnetic data in the Canning Basin of northern Western Australia began

in April 2007 (figure 2) to aid the planning of a future seismic survey. Both datasets will be used to reassess the petroleum and gas potential of the onshore part of the basin. In addition, seismic data tapes from surveys of the Canning Basin in the 1980s are being remastered to modern digital formats in collaboration with the Geological Survey of Western Australia.

A program of deep seismic data acquisition in the Mt Isa region of Queensland was completed in December 2006 in collaboration with the Geological Survey of Queensland. A further major seismic survey in the Cloncurry–Georgetown–Charters Towers regions of northwest and north Queensland commenced in May 2007 (figure 3). Both these surveys will greatly assist the assessment of the potential of northwest Queensland for new uranium and geothermal energy resources.

A major AEM survey of the Paterson Province of northern Western Australia is due to begin in July 2007 (figure 4). The results will be used to assess the region's potential for uranium resources. The undeveloped Kintyre uranium deposit, discovered in 1985, and the operating Telfer gold mine are close to or within the region of the new survey. This survey is the first of several AEM surveys being

scoped across the continent to target uranium and thorium mineral systems. The AEM data may also be used for a variety of other purposes, such as land and water management.

Parts of the Cooper Basin in southwest Queensland will be covered by a new gravity survey that began in May 2007 (figure 5). The survey is gathering new data to aid the assessment of the geothermal and hydrocarbon potential of the southwest Queensland section of the basin. Seismic surveys are also being scoped in New South Wales, Queensland, South Australia, the Northern Territory, and northern Western Australia. Included in these is a proposal to acquire seismic data in the southeastern Darling Basin in western New South Wales to define the nature of the sedimentary fill and basement structure, and test the hydrocarbon potential of a poorly explored part of the basin.

Updates on the OESP will be included in forthcoming issues of *AusGeo News*, in Geoscience Australia's monthly *Minerals Alert*, and on a dedicated new website that is being developed.

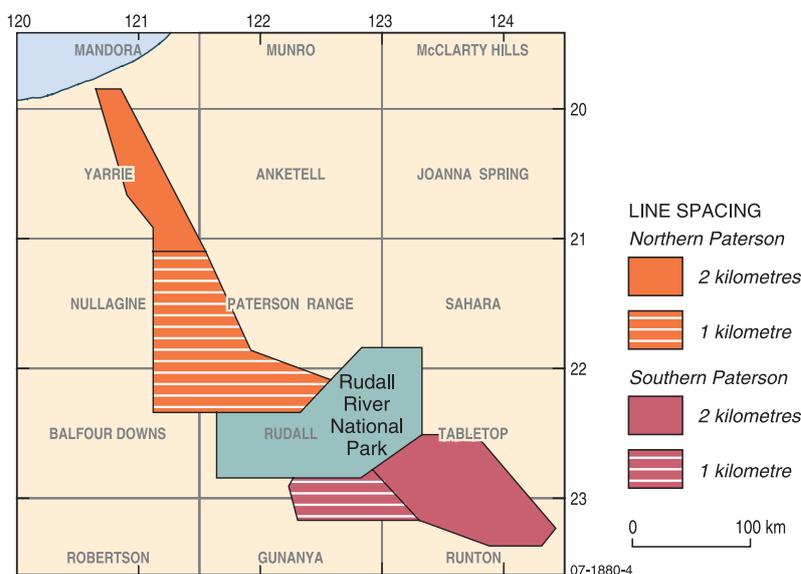


Figure 4. Proposed airborne electromagnetic survey area, Paterson Province, Western Australia.

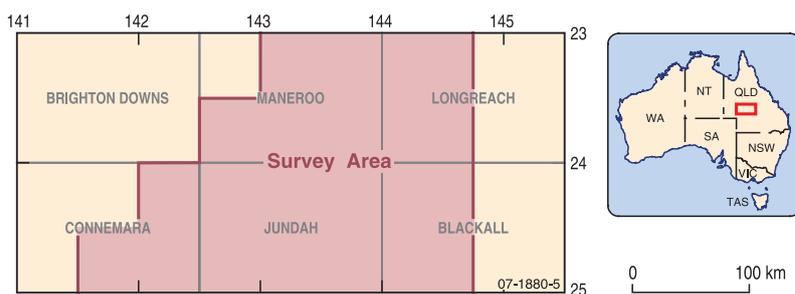


Figure 5. Cooper Basin North gravity survey area, Queensland.

For more information

phone James Johnson on
+61 2 6249 9236
email james.johnson@
ga.gov.au

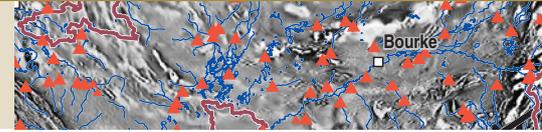
Related websites/articles

AusGeo News 84: Onshore Energy Security Program underway
www.ga.gov.au/ausgeonews/ausgeonews200612/onshore.jsp

Regional geochemical study paves way for national survey

Geochemistry of near-surface regolith points to new resources

Megan Lech and Patrice de Caritat



The Thomson Regional Geochemical Survey covered an area of approximately 155 000 square kilometres in northwestern New South Wales (figure 1), encompassing parts of the Thomson Orogen and the adjacent Lachlan and Delamerian Orogens (Greenfield et al 2006a).

The project aimed to boost greenfield mineral exploration in the region by providing an internally consistent, background geochemical dataset for the southern Thomson Orogen region. It also aimed to refine sampling protocols developed in other regions to ensure their suitability to a range of environments across Australia.

The Riverina survey identified geochemical patterns in the near-surface regolith that relate to geological and mineralisation features below the cover. These included elevated regolith gold concentrations in catchments containing known gold deposits or occurrences, dispersion trains of arsenic and antimony from the Victorian goldfields, and anomalous silver, lead and zinc in the eastern part of the study area which borders the base metal-rich Lachlan Fold Belt.

The Riverina and Thomson results show how regional geochemical surveys can provide fundamental datasets for mineral exploration and resource potential evaluation, environmental monitoring and policy development, and geomedical studies into the health of humans, animals and plants.

The Thomson Regional Geochemical Survey was a collaborative project between Geoscience Australia, the Cooperative Research Centre for Landscape Environments and Mineral Exploration (CRC LEME), and the NSW Department of Primary Industries (Greenfield et al 2006b).

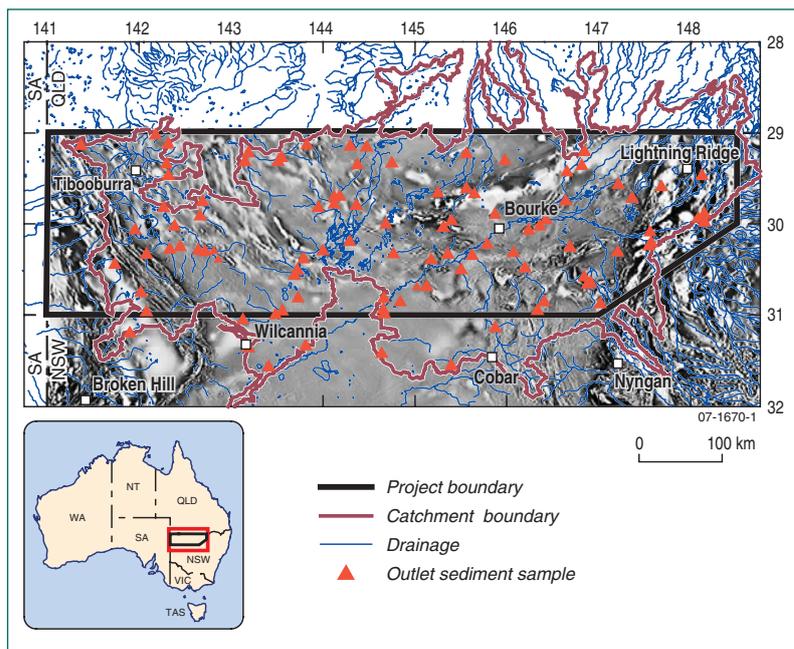


Figure 1. Sample locations over image of the first vertical derivative of the total magnetic intensity (courtesy of NSW Department of Primary Industries).

The region is covered by substantial transported regolith, including sediments from the Cainozoic Lake Eyre, Bulloo–Bancannia and Murray–Darling river basins and Cainozoic sand dunes and sand plains. Outcropping crystalline basement includes various mineral occurrences in the Broken Hill (lead, zinc, tin), Tibooburra (gold) and Cobar (lead, copper, gold) regions.

Interest in conducting a geochemical survey in the Thomson region arose from a similar survey in the Riverina region of New South Wales and Victoria (Caritat et al 2004), and the preliminary interpretations that resulted (Caritat et al 2005).

Floodplain sediments provide evidence

The main sampling medium targeted for the survey was overbank sediments in floodplains. This is more likely than other media to represent an average composition of entire catchments, enabling low-cost sampling of large areas (Ottesen et al 1989, Bølviken et al 2004). Target sample sites were selected by conducting hydrological analysis to determine the lowest point in each catchment. Samples were collected at background locations, away from areas of obvious disturbance or contamination.

At each site, two intervals approximately 10 centimetres thick were sampled: one at 0 to 10 centimetres below the root layer, if present (top outlet sediment, TOS), and another usually at a depth of 60 to 90 centimetres (bottom outlet sediment, BOS). A total of 99 catchment outlet sites were sampled over the area, giving an average sample density of 1 per 1540 square kilometres. To date, geochemical results are available for the first 76 sites.

“The Riverina and Thomson results show how regional geochemical surveys can provide fundamental datasets for mineral exploration and resource potential evaluation, environmental monitoring and policy development, and geomedical studies into the health of humans, animals and plants.”

Samples were dried and sieved at <75 μm and <180 μm fractions before geochemical analysis. The concentrations of over 60 major and trace elements were determined by X-ray fluorescence and inductively coupled plasma – mass spectrometry (ICPMS). Sample preparation for ICPMS involved 4-acid ‘near-total’ digestion for multi-element analysis and multi-acid digestion for selenium analysis. Ion selective electrode analysis was undertaken to measure fluorine, and graphite furnace – atomic adsorption spectrometry for gold.

High concentrations at several sites

Figures 2a to c and 3 provide information on the concentrations of copper, lead and antimony with their corresponding geochemical distributions.

A copper anomaly is present in the BOS <75 μm and <180 μm fractions (32 milligrams per kilogram (mg/kg) and 24 mg/kg, respectively) near the Barrier Ranges north of Broken Hill and 50 kilometres southeast of Brewarrina (29 mg/kg and 27 mg/kg). Seventy kilometres southeast of Tibooburra there is a sample with a notably high copper concentration (25 mg/kg) in the <180 μm fraction. Higher concentrations of copper in the central west are only a few kilometres away from a recent exploration company drill hole that intersected bedded pyrite mineralisation (figure 2a).

Elevated lead concentrations (21.7 mg/kg) are visible in the southeast, presumably reflecting proximity to the Barrier Ranges, and northeast of Cobar near outcrop of the Lachlan Fold Belt. Both regions have known lead mineral occurrences. Elevated lead values (19.48 mg/kg and 19.22 mg/kg in the <180 μm fraction) also occur in the central west, coincident with elevated copper values (figure 2b).

Antimony shows similar geochemical patterns to lead and copper. Antimony is notably higher northeast of Cobar and in the central west (0.70 mg/kg) in the <180 μm fraction. Values of 0.86 mg/kg and 0.79 mg/kg for the <180 μm fraction were recorded in samples collected 40 kilometres north of Cobar on Yanda Creek (figure 2c).

Anomalous concentrations of lead, copper and antimony mostly occur proximal to

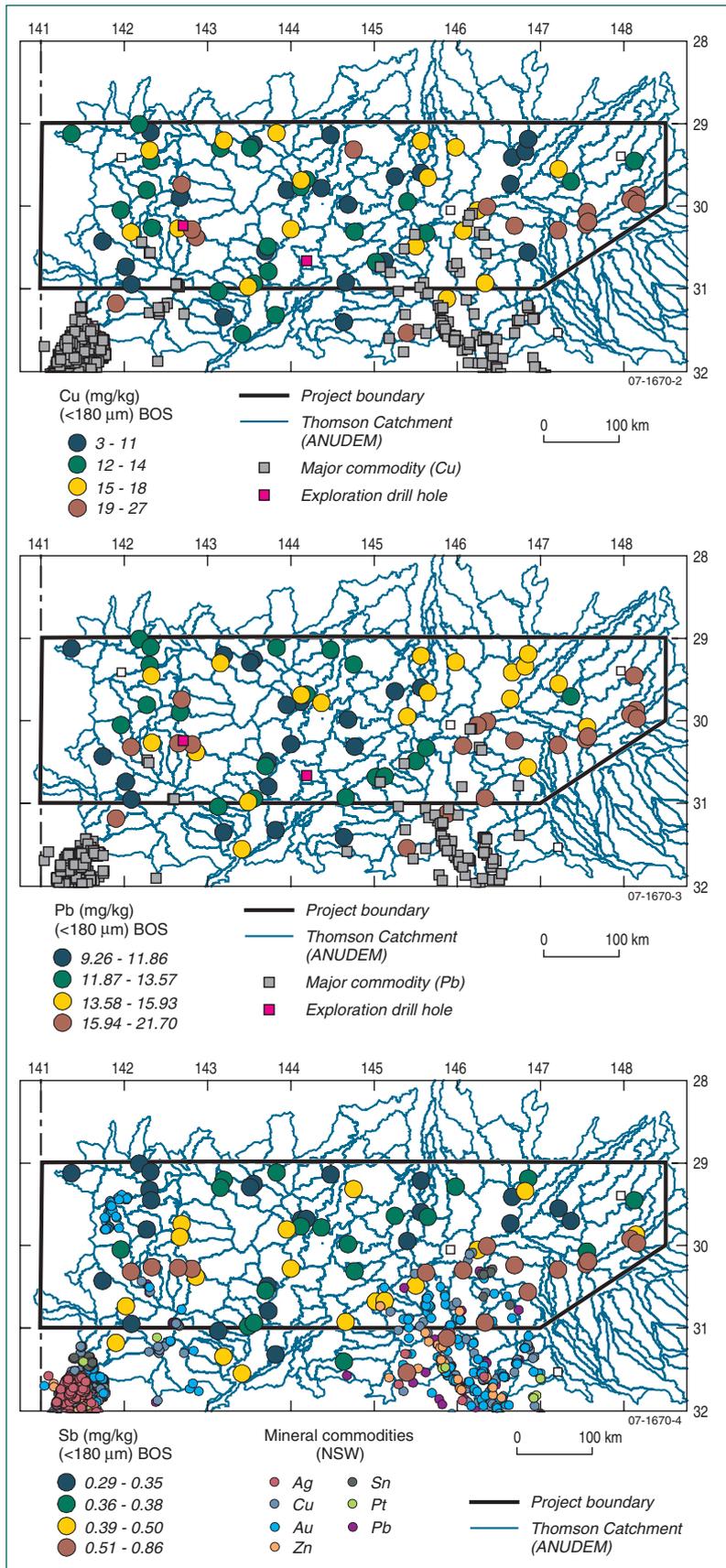


Figure 2. (a) Geochemical map of copper concentrations in the BOS <180 μm fraction with known copper occurrences; (b) Geochemical map of lead concentrations in the BOS <180 μm fraction with known lead occurrences; (c) Geochemical map of antimony concentrations in the BOS <180 μm fraction with known mineral occurrences

outcropping crystalline basement. Three main areas have been identified:

- southwest region, corresponding to the Curnamona Craton which hosts the Broken Hill orebody
- central to southwest region at the junction of the Koonenberry, Thomson and Lachlan crustal elements
- eastern and southern region, where the east and west Lachlan crustal elements adjoin beneath the Cobar Basin.

Lessons for exploration

Lower element concentrations generally coincide with areas of thicker Great Australian Super Basin cover. Thresholds in this area may need to be lowered to correctly assess the prospectivity of these terrains.

Generally, catchments with known mineral occurrences relating to lead, copper or antimony have anomalous concentrations of that element in the outlet sample. Dispersion of elements appears to be at the catchment scale.

Several anomalous concentrations occur away from known mineralisation and warrant further investigation. These include results from recent company drilling north of the Koonenberry Belt and northeast of Cobar.

The success of the Thomson and other pilot geochemical surveys led to the recent announcement of the continent-wide National Geochemical

Survey of Australia project (Baldwin 2007). That project is part of the Australian Government's Onshore Energy Security Initiative (Johnson 2006) and will gather geochemical data that will principally be used to support exploration for Australia's energy-related resources.

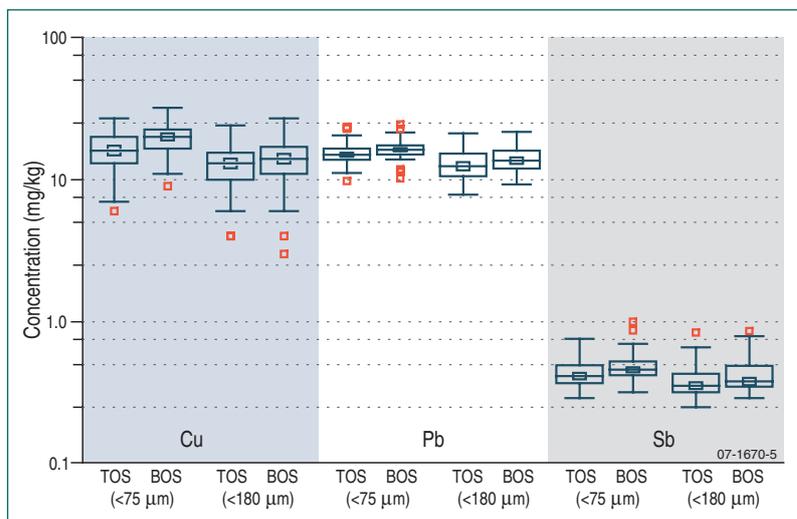


Figure 3. Boxplots of copper, lead and antimony concentrations in the TOS and BOS <75 and <180 μm fractions.

For more information

phone Megan Lech on +61 2 6249 9459

email megan.lech@ga.gov.au

or

phone Patrice de Caritat on +61 2 6249 9378

email patrice.decaritat@ga.gov.au

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AusGeo News 78: Riverina geochemical survey a national first

www.ga.gov.au/ausgeonews/ausgeonews200506/geochem.jsp



High seas and marine protected areas

GIS analysis of seafloor geomorphology exposes conservation concerns

Peter Harris

Oceans cover about 361 million square kilometres of the Earth's surface, of which 219 million square kilometres (or about 60%) is high seas. This area is outside the economic exclusion zone (EEZ) of any nation, and human activities on the high seas are largely unregulated and unrestricted.

“There are currently around 4600 marine protected areas (MPAs), covering 2.2 million square kilometres or about 0.6% of the ocean area.”

While there is increasing support for the conservation of high-seas biodiversity through declaring high-seas marine reserves, there is a lack of information on deep-sea benthic communities. An alternative that offers a quantitative and systematic approach to identifying conservation priority areas is Geographic Information System (GIS) analysis of seafloor geomorphic features as a substitute for biodiversity.

There are currently around 4600 marine protected areas (MPAs), covering 2.2 million square kilometres or about 0.6% of the ocean area. Most MPAs (62%) are within 12 miles of coastal areas, and none is on the high seas (The Sea Around Us 2006).

A geomorphic province map covering the whole of the world's oceans, originally published by Agapova et al (1979), has been scanned, geo-referenced and digitised at Geoscience Australia (figure 1). This map classifies the seafloor into 23 separate geomorphic categories. It shows that the features least common within national EEZs are hilly abyssal plains, mid-ocean rift zones and flanking ridges (that is, more than 85% of these features occur in the high-seas regions).

Hydrothermal vents rarest in Atlantic

Mid-ocean ridges are host to unique hydrothermal vent communities that metabolise hydrogen sulfide. The distribution of vent communities is related to seafloor spreading rate—fast Pacific



ridges that spread at 90 to 170 millimetres per year support one vent every ~5 kilometres of ridge crest, whereas slow Atlantic-type ridges that spread at less than 40 millimetres per year support one vent site every ~350 kilometres (Van Dover 2000). Therefore, the Atlantic Ocean may contain as few as 40 vents, whereas the other oceans (Indian, Pacific and Southern oceans) may contain as many as 12 000 vents. The protection of Atlantic Ocean vents relies more on international cooperation and high-seas MPAs because they are much rarer and isolated from each other than vents in the Pacific.

On the other hand, more than 90% of ocean trenches and island arcs are within the EEZs of individual nations. The protection of these features and their associated biological communities relies on national conservation strategies.

Seamounts scarcest in Southern Ocean

One class of seafloor feature that has attracted much international attention is undersea volcanoes, known as seamounts. Seamounts rise over 1000 metres above the surrounding ocean floor and are

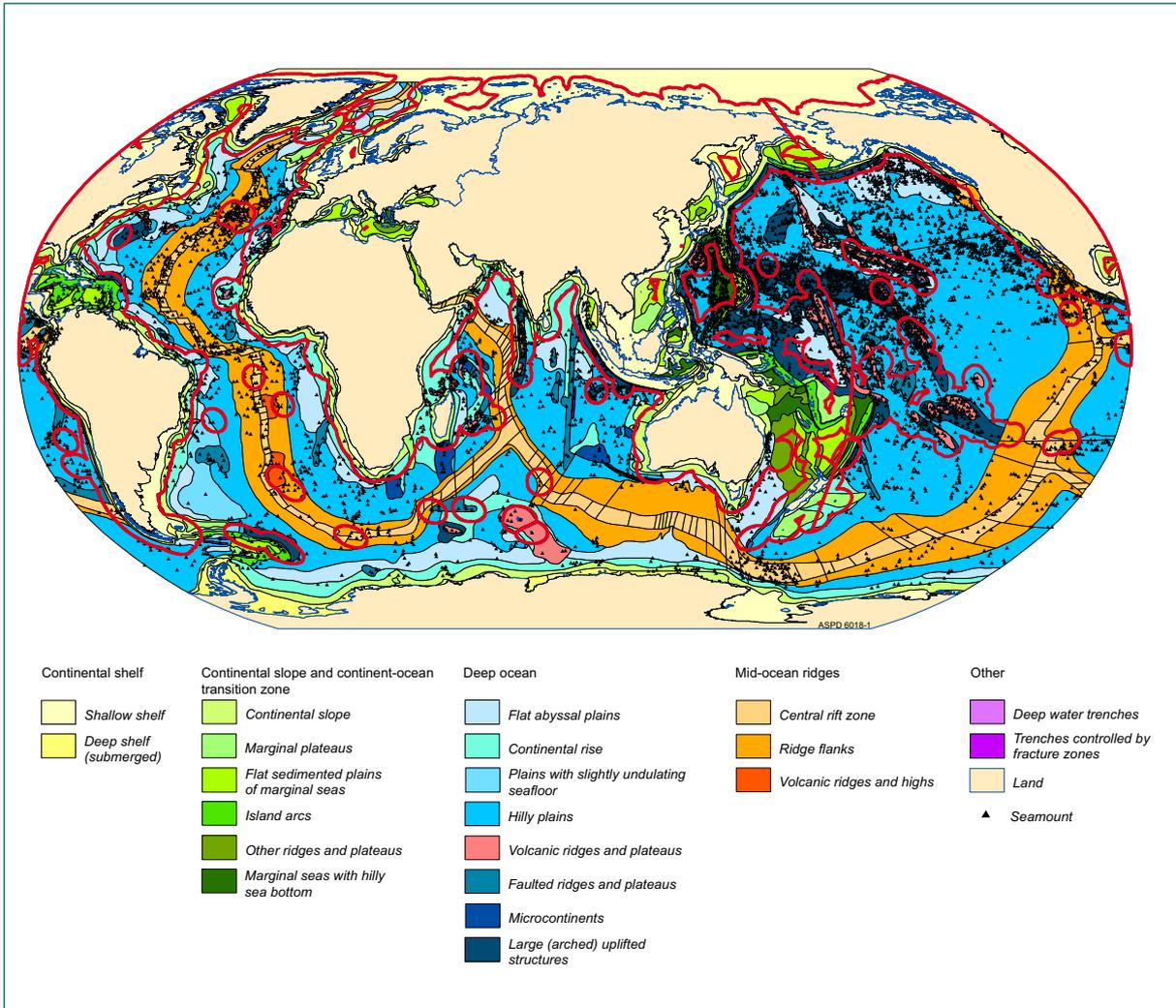


Figure 1. Map of seafloor geomorphic features (after Agapova et al 1979), with distribution of seamounts (after Kitchingman & Lai 2004) superimposed relative to the 200-mile EEZ.

known to interact with the ocean waters moving over them, causing current intensification, upwelling and increased primary production. They support unique faunas that are often peculiar to the area and are directly threatened by destructive bottom-trawl fishing practices which damage coral communities found on seamount summits. These factors make seamounts prime sites for biodiversity conservation.

A number of studies have estimated the number of seamounts in the ocean. The most recent estimate of 14 287 seamounts, published by Kitchingman & Lai (2004), was based on an analysis of the ETOPO2 raster bathymetric dataset produced by the United States National Oceanographic and Atmospheric Agency. The map of geomorphic features (figure 1) shows 6739 seamounts (47%) within EEZs, with the remainder (7548 or 53%) on the high seas. The total area of the oceans covered by seamounts is very small (probably less than 1%), since most seamounts are less than 20 kilometres in radius.

The distribution of seamounts is not equal across the oceans. The

highest density of seamounts occurs in the Pacific Ocean (49.7 per million square kilometres), followed by the Atlantic Ocean (25.8), the Indian Ocean (22.3) and the Southern Ocean (4.3). Consequently, Southern Ocean seamounts are rarer and more isolated from each other than seamounts in the other oceans, resulting in implications for recolonisation and connectivity. This issue would need to be addressed in the declaration of future high-seas MPAs.



Australian EEZ features and the global picture

The significance of this work for Australia is that it places the distribution of geomorphic features within our EEZ into a global context. Australia claims the third largest EEZ in the world, equal to 8.1 million square kilometres (excluding the Australian Antarctic Territory) or around 2.2% of the world's ocean area. The global map of geomorphology identifies some interesting aspects of its composition. For example, Australia's EEZ contains over 10% of the world's marginal plateaus (such as the South Tasman Rise and the Queensland, Marion, Naturaliste, Exmouth and Kerguelen plateaus). Seamounts along Australia's Southern Ocean margin are rare in comparison with seamounts in other oceans. The global context of the geomorphic composition of Australia's EEZ can be a valuable tool in determining the design of our National Representative System of MPAs.

This study demonstrates how information on the geomorphology of the ocean floor can be useful for establishing ocean conservation priorities for Australia and the rest of the world. Future research at Geoscience Australia will aim to refine the global seabed characterisation and improve information on Australia's EEZ.

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For more information

phone Peter Harris on +61 2 6249 9611
email peter.harris@ga.gov.au



GEOSCIENCE AUSTRALIA OPEN DAY

Sunday 26 August 10am – 4pm

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Australian mineral exploration growing strongly

Strong demand underpins higher spending

Lynton Jaques and Mike Huleatt



Australian mineral exploration expenditure rose to \$1.46 billion in 2006, an increase of 28.9% on 2005, according to the Australian Bureau of Statistics. The year ended on a high, with spending in the December quarter up 37% from the same quarter of 2005, the thirteenth consecutive quarterly increase. This strong continuing growth reflects ongoing industry expansion in response to overseas demand for metals, generally low or declining metal stocks, and elevated commodity prices.

“Mineral exploration activity in Australia and worldwide is expected to further strengthen in 2007 as a consequence of current metal and mineral prices, most of which are at or near 20 to 25-year highs, and continuing significant capital raisings.”

Gold continued to dominate, accounting for 29% of Australia’s total exploration expenditure, down from 34% in 2005, although spending on gold exploration rose by almost 12% to \$429.8 million (figure 1). Outstanding performers in 2006 were silver–lead–zinc (up 116.6% to \$100.7 million), uranium (up 114.1% to \$80.7 million), copper (up 67.8% to \$177.5 million), iron ore (up 47.6% to \$224.7 million) and coal (up 36.5% to \$198.7 million). Nickel was the only

commodity to record a decline in exploration spending, down 12% to \$147.9 million. Recent record prices should support continued high levels of nickel exploration in 2007. Similarly the continuing strong gold price is expected to maintain and probably increase gold exploration activity.

Western Australia again dominated exploration, accounting for 46.8% of all expenditure, followed by Queensland (17.2%) and South Australia (13.1%) (figure 2). Exploration expenditure rose in all states, with the largest increases in Tasmania (up 118.1% to \$27.7 million), South Australia (up 92.6% to \$191.4 million) and New South Wales (up 53.7% to \$140.3 million). In Queensland, an increase of 36.3% saw spending rise to \$252.1 million, the Northern Territory recorded a 24.5% rise to \$85.4 million, and Victoria increased by 25.5% to \$82.2 million. Western Australia showed the smallest increase, 11.6% to \$685.3 million.

Spending on the search for new deposits rose by 26% to \$532.9 million in 2006, while explorers spent \$931.1 million on investigating known deposits,

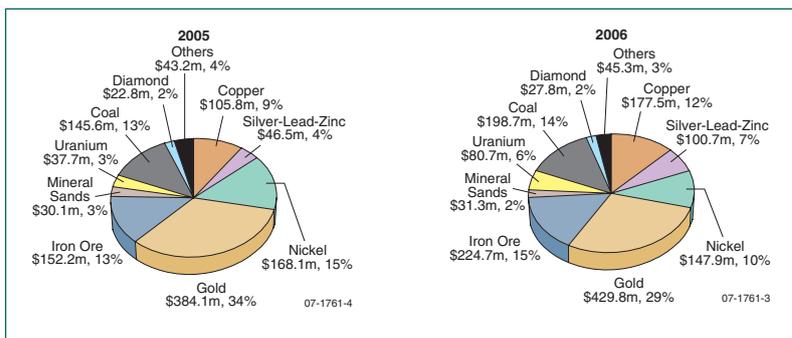


Figure 1. Exploration spending in 2005 and 2006 by commodity (Source: Australian Bureau of Statistics).

up by 30%. In 2006, the percentage of exploration expenditure allocated to searching for new deposits was 36.4%, compared to 37.2% in 2005.

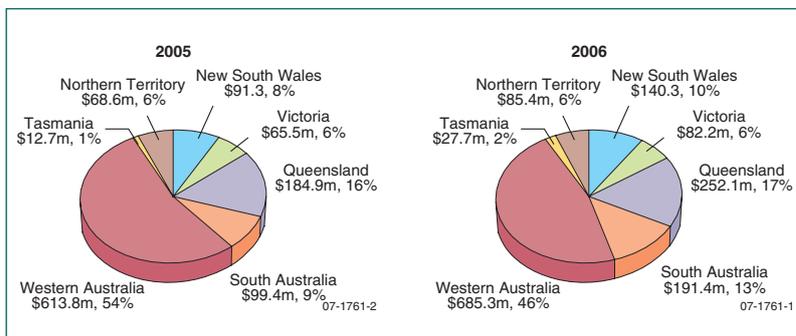


Figure 2. Exploration spending in 2005 and 2006, by jurisdiction (Source: Australian Bureau of Statistics).

The amount of drilling undertaken in mineral exploration in 2006 rose by 16% from 2005 to 7.7 million metres, with 39% directed to finding new deposits.

Mineral exploration activity in Australia and worldwide is expected to further strengthen in 2007 as a consequence of current metal and mineral prices, most of which are at or near 20 to 25-year highs, and continuing significant capital raisings. ABS trend estimates suggest that mineral exploration expenditure in 2006–07 will exceed \$1600 million.

A more detailed overview of mineral exploration in Australia in 2006, including a review of some drill results and highlights of

government programs to help reduce the risk in exploration, is included in *Australian mineral exploration: a review for the year 2006*, available online in a short version and an extended version.

For more information

phone Mike Huleatt on
+61 2 6249 9087
email mike.huleatt@ga.gov.au

Related websites/articles

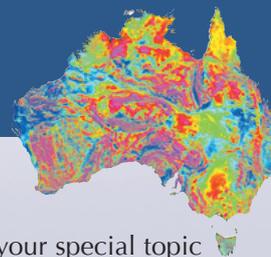
Australian Mineral Exploration
A review of exploration for the year 2006

www.ga.gov.au/image_cache/GA9202.pdf (short version)

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Gnangara geomagnetic observatory—50 years young

Australian geomagnetic studies go back 167 years



Adrian Hitchman

One of nine observatories in Geoscience Australia's geomagnetic network (figure 1), Gnangara, just north of Perth, is the second Australian mainland observatory to join the 'over 50s' club. Toolangi magnetic observatory north of Melbourne operated continuously for 67 years from 1919 to 1986, while Antarctic observatories at Macquarie Island and Mawson began operating in 1952 and 1955.

Mainland observatories commonly face more threats to their existence than Antarctic observatories, often because of urban expansion as buildings, transport infrastructure and powerlines encroach on the quiet zones required for optimal monitoring of the magnetic field. Geomagnetic observatories often have to relocate for these reasons, so Gnangara's longevity—so far—is all the more remarkable.

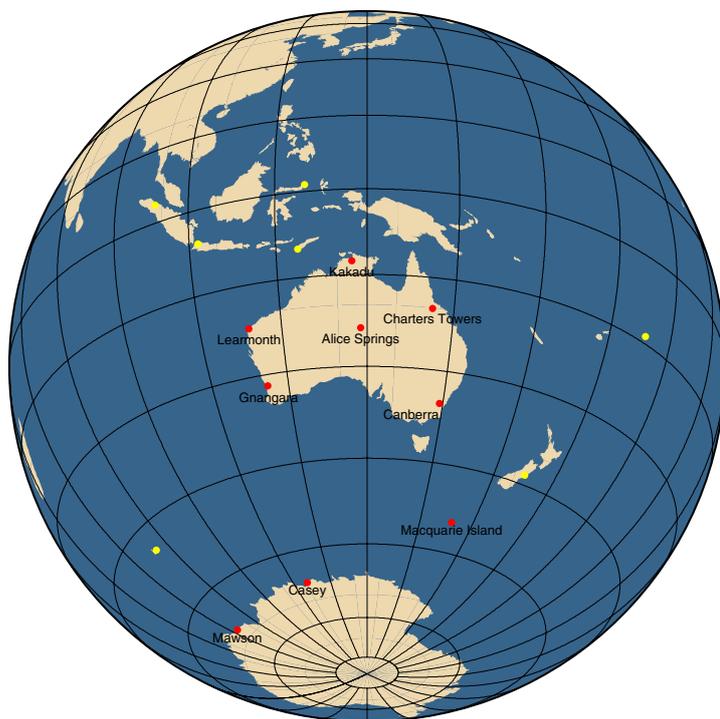


Figure 1. Geoscience Australia's geomagnetic observatory network (red dots) and other regional observatories (yellow dots).

What do geomagnetic observatories do?

Earth is one of six planets in our solar system that possess a magnetosphere or magnetic field. This allows navigation by compass, enables migratory species to find their way to and from breeding

grounds, and protects the planet's atmosphere from being diminished by the solar wind.

The geomagnetic field is constantly changing. Dramatic changes because of solar activity can occur within seconds to hours, while subtle changes caused by the motion of molten fluid in Earth's outer core some 3000 kilometres below the surface operate at time scales of thousands of years. Geomagnetic observatories monitor all these changes to gather information for navigation, oil and mineral exploration, and scientific research.

Australian geomagnetic history

Geomagnetic monitoring has a proud history in Australia. Observatories established independently in the western and eastern states initiated stretches of continuous magnetic-field recording in this country comparable to some of the longest in the world.

In the early 20th century, the Carnegie Institution of Washington's Department of Terrestrial Magnetism embarked on an ambitious international program to map Earth's magnetic field. The department's visits

to Australia have left a legacy of many temporary magnetic stations throughout the country (some can still be visited today), as well as Western Australia's first geomagnetic observatory, commissioned at Watheroo on 1 January 1919. Watheroo was in continuous operation for 40 years until its closure in March 1959, after which Gngangara became the state's primary observatory.

Regular monitoring of geomagnetic variations began at Gngangara in June 1957, just in time for the start of the International Geophysical Year in July of that year. The Gngangara and Watheroo observatories ran in parallel for almost two years, so that the magnetic-field difference between the two stations could be accurately determined. Allowing for this two-year overlap, Watheroo and Gngangara observatories have together given almost 90 years of continuous magnetic-field monitoring in southwest Western Australia. This unbroken time span is a significant achievement in observatory operations the world over.

There is also a distinguished observatory history in Australia's eastern states. The very first Australian geomagnetic observatory was established by the Royal Society of London in 1840 in the Domain in Hobart, just eight years after German scientist Carl Friedrich Gauss had built the first 'absolute' observatory in Göttingen in 1832. The Hobart observatory operated from 1840 to 1854, followed in 1858 by observatories in Melbourne's Flagstaff Gardens and Royal Botanic Gardens, then Toolangi, and then Canberra (where operations continue today), giving Australia another impressively long period of almost unbroken magnetic-field monitoring.

Today

Gngangara remains an indispensable part of Geoscience Australia's geomagnetic network. However, the city of Perth has expanded in the past 50 years, causing increasing disruption to the magnetically quiet conditions required for observatory operations. Geoscience Australia is currently considering options to ensure the continuity of high-quality magnetic-field monitoring in southwest Western Australia, which may include moving the observatory to a quieter location north of Perth.

Information on the geomagnetic field, including data measured at Gngangara and Australia's other geomagnetic observatories and magnetic-field models derived from these data, is freely available via Geoscience Australia's website.

For more information

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

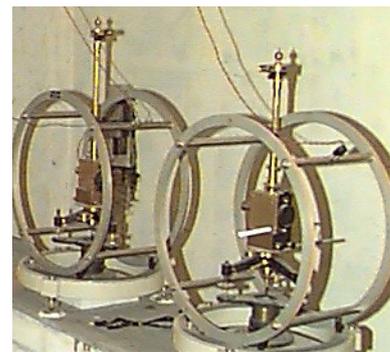


Figure 2. Gngangara's recording vault, showing the historic Eschenhagen equipment. The Eschenhagen variometer was first installed at Watheroo observatory by the Department of Terrestrial Magnetism in 1919. It was transferred to Gngangara in 1960 and operated there until 1991. This historic equipment is now on display in the Geoscience Australia building foyer.

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Related websites/articles

Information on the geomagnetic field, including data measured at Gngangara

www.ga.gov.au/geomag/

AusGeo News 79: Mawson geomagnetic observatory turns 50

www.ga.gov.au/ausgeonews/ausgeonews200509/mawson.jsp

Outstanding contribution to petroleum exploration recognised

The Australian Petroleum Production and Exploration Association (APPEA) has recognised the sustained, high-level contributions to the evaluation of Australia's offshore petroleum potential by Dr Marita Bradshaw from Geoscience Australia, by awarding her the prestigious Lewis G. Weeks Gold Medal at the recent APPEA Annual Conference.

The medal commemorates the work of Dr Lewis G Weeks, the legendary geologist who played a central role in discovering the Bass Strait oil province. The medal is awarded annually to someone who has 'made an outstanding contribution to the art, science and practice of petroleum exploration which in turn has materially encouraged or stimulated the climate for exploring for and producing oil and gas in Australia.'

'Throughout her career, Dr Bradshaw has worked tirelessly to understand the petroleum potential of Australia and to convey that understanding to petroleum exploration companies around the world' observed Geoscience Australia's CEO, Dr Neil Williams. He also pointed out how Dr Bradshaw's enthusiasm and commitment have helped promote Australia's petroleum potential to a large national and international audience, and have especially helped in the search for new petroleum provinces in the offshore areas of Australia.

'With 25 years of government and petroleum experience, she has helped formulate strategies that have cemented Geoscience Australia



Figure 1. Dr Marita Bradshaw.

as a world-class geoscience organisation whilst for the petroleum industry, she has helped provide relevant, quality data and analysis in a timely manner, especially for the annual acreage releases. Dr Bradshaw is a shining example of how industry and government can work together for a superior result, and for the benefit of Australia' Dr Williams said.

New seabed sediment map fills marine knowledge gap

Geoscience Australia in conjunction with the former Department of Environment and Heritage (now Department of Environment and Water Resources: DEWR) has completed a detailed spatial analysis of seabed geomorphology and sedimentology of the Southwest (SW) marine region. These results provide quantitative information

on the geomorphology and sedimentology of the seabed for more than 1000 new and 100 existing samples and fill the largest gap in our knowledge of Australia's marine jurisdiction.

Samples were procured from Geoscience Australia's existing marine sediment repository and from 10 external agencies located in Australia, North America and Europe. Many of the samples used in this study, previously unavailable, are now archived at Geoscience Australia where they can be accessed for future study.

This study represents the most up-to-date and

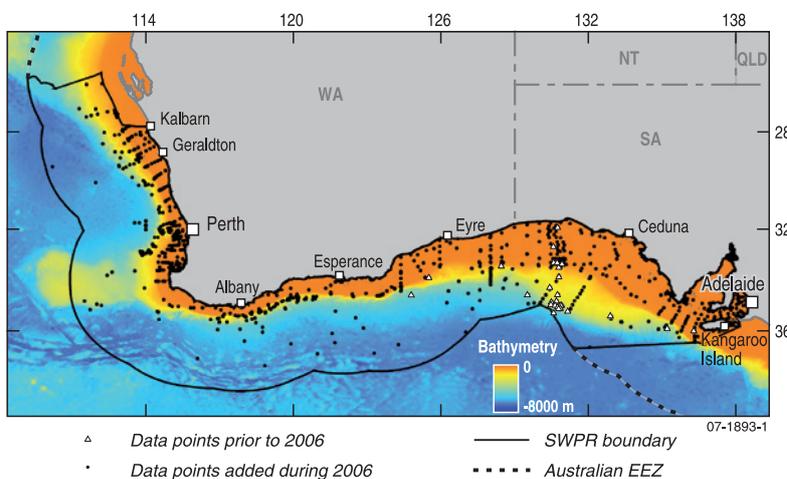


Figure 1. Sample localities, spatial analysis of sedimentology and geomorphology of the Southwest marine region.

Table 1. Dominant sediment characteristics for geomorphic features in the SW marine region.

Geomorphic Feature	Gravel (wt %)	Sand (wt %)	Mud (wt %)	Carbonate (wt %)
Bank/Shoal	0-45	40-100	<5	>60
Deep/Hole/Valley	0-35	>65	<5	>80
Canyon	0	5-45	>75	15-95
Plateau	0	15-65	35-90	85-92
Terrace	<5	10-97	0-90	>75
Tidal sandwave/sandbank	0-40	25-95	2-75	45-100

largest quantitative regional synthesis of the geomorphology and sedimentology ever completed for the SW marine region. The data and geological interpretations will support regional marine planning by DEWR by helping marine managers characterise the seabed, including the identification of unique features.

Although the SW marine region covers 1 375 000 square kilometres or approximately 15 per cent of Australia's Exclusive Economic Zone, the previously available quantitative data for the sedimentology of the seabed came from less than 200 samples. This represented one assay for every 5000 square kilometres and consequently our knowledge of the physical nature of the seabed for this region was relatively poorly-known. Following this study, sample density in the region now averages one sample for every 500 square kilometres of the continental shelf (24 per cent of the total area) plus one sample for every 2000 square kilometres of the deeper water areas (the slope, rise and abyssal plain/deep ocean floor) which make up the remainder (figure 1).

Regional sediment trends are now apparent, particularly the frequency and extent of gravel-rich and non-carbonate sedimentary environments on the continental shelf as well as the absence of coarse and carbonate-rich sediments in the deep ocean.

Quantitative data are now at sufficient spatial resolution to permit the first comparison between known geomorphic features and the sedimentology of the region (table 1). These relationships are being used to guide future sample selection and to develop interpolation methodologies for similar work being undertaken by Geoscience Australia for the other marine regions.

All of the data are available from Australia's national marine samples database, MARS (www.ga.gov.au/oracle/mars). A report assessing quantitative sedimentology and geomorphology of the SW marine region, including maps of interpreted regional sediment distribution, will be made available on the Geoscience Australia website later this year.

For more information

phone Anna Potter on
+61 2 6249 9122
email anna.potter@ga.gov.au

Related website

Geoscience Australia's national marine samples database
www.ga.gov.au/oracle/mars

Global digital geology map

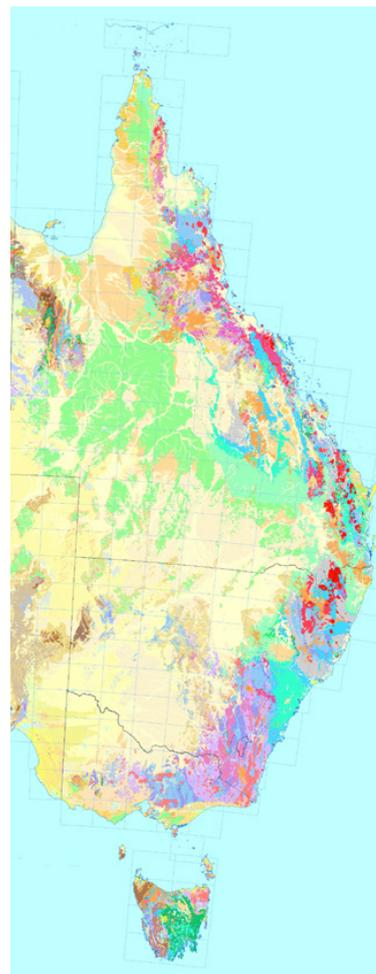
Geoscience Australia is collaborating with similar organisations from more than 40 countries to embark on one of the most ambitious geological mapping programs ever undertaken. The project, titled OneGeology, will provide internet access to the most up-to-date, worldwide geological map data at a scale of 1:1 million as part of the International Year of the Planet Earth program.

Australia was represented by Dr Lesley Wyborn from Geoscience Australia and Dr Simon Cox from CSIRO Exploration and Mining who joined representatives from 53 national and international organisations at a workshop in Brighton, UK, to investigate ways of creating dynamic digital geological map data covering the world.

Each country will make its geological map data available at or about 1:1 million scale using web service technologies for distribution through the OneGeology portal using Google Earth and other dynamic map browsers. The data will be available via a new geological exchange language known as GeoSciML which will allow standardised geological data to be shared and integrated across the Earth.

This project will contribute to the International Year of Planet Earth which was proclaimed for 2008 by the General Assembly of the United Nations. The aim of the Year is to bring together the international knowledge base of geoscience and demonstrate new and exciting ways in which earth sciences can help future generations to meet the challenges involved in ensuring a safer and more prosperous world.

Another benefit of the OneGeology project is that it will also transfer valuable information on web services to the developing world, accelerating the process of bringing people in less developed countries into the digital age.



For more information

phone Lesley Wyborn on +61 2 6249 9489

email lesley.wyborn@ga.gov.au

Related websites

The OneGeology project

www.onegeology.org/

2008 International Year of the Planet Earth

www.ga.gov.au/about/event/index.jsp#IYPE

GeoSciML geological exchange language

www.ga.gov.au/news/archive/2006/nov/index.jsp#see

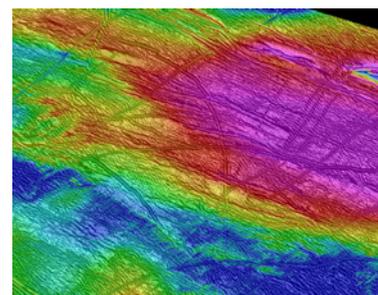
New geophysical datasets for Ashburton, Officer Basin and Mount Isa regions

Datasets from four new geophysical surveys, released since February 2007, will be a valuable tool in assessing the mineral potential of the respective survey areas.

The new data includes three airborne magnetic and radiometric surveys including the Ashburton region and Officer Basin in Western Australia and the Mount Isa region in Queensland as well as a gravity survey in the Mount Isa region.

The data for all surveys were acquired in surveys conducted in 2006 which were managed by Geoscience Australia on behalf of the Geological Surveys of Queensland and Western Australia.

The data have been incorporated into the national geophysical databases. The point-located and gridded data for the four surveys can be obtained free online using the GADDS download facility.



Related websites

Geological Survey of WA:

www.doir.wa.gov.au

Geological Survey of Qld:

www.nrw.qld.gov.au/science/geoscience/

For more information

phone Murray Richardson on +61 2 6249 9229

email murray.richardson@ga.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
Mount Isa South - East (Qld)	Magnetic, Radiometric, Elevation	Aug–Nov 2006	Betoota, Machattie, Connemara, Brighton Downs	400 80 east – west	100,972	Fugro Airborne Surveys
Ashburton (WA)	Magnetic, Radiometric, Elevation	Aug–Dec 2006	Wyloo, Mt Bruce, Roy Hill, Edmund, Turee Creek, Newman Mt Egerton, Collier	400 m 60 m north - south	105,840	UTS Geophysics
Officer Basin (WA)	Magnetic, Radiometric, Elevation	Oct – Nov 2006	Trainor, Bullen, Collier, Robertson	400 m 60 m north - south	105,676	GPX Airborne

Table 2. Details of the gravity surveys.

Survey (State)	Survey Type	Date of Acquisition	1:250 000 Map Sheets	Station Spacing / orientation	Stations	Contractor
Mount Isa Area B (Qld)	Gravity	Sept – Oct 2006	Lawn Hill, Donors Hill, Camooweal, Dobbyn, Mt Isa (western half)	2.0 x 2.0 km east – west on Dobbyn and Camooweal (eastern half); 4.0 x 4.0 km east – west (remainder)	9,857	Fugro Ground Geophysics



New Gazetteer of Australia released

The Gazetteer of Australia 2006 is the authoritative source of Australian place names and their location, whether they are natural features such as mountains and rivers or built features such as homesteads and bridges.

The Gazetteer is revised annually by Geoscience Australia under the auspices of the Intergovernmental Committee for Surveying and Mapping (ICSM) with data provided by state, territory and Commonwealth Government authorities responsible

for administering place names. The 2006 version includes more than 320 000 official and unofficial place names and their co-ordinates in GDA 94 (Geocentric Datum of Australia 1994) covering Australia and its offshore regions.

The latest version includes the addition of new place names, the removal of invalid records and the revision of place names preserved for use in community geographic domain names (for internet sites). To check the spelling of a

town's name or a geographical feature visit Geoscience Australia's Place Name Search facility (www.ga.gov.au/map/names/).

The Gazetteer of Australia 2006 can be used for a variety of purposes including: locating a place on a map, searching by place names or relating services to locations online, showing place names in digital mapping applications (for example, the place name search facility in NATMAP Raster Digital Maps), and adding value to a map.

The Gazetteer of Australia 2006 is available on CD ROM from Geoscience Australia's Sales Centre.



For more information

phone Freecall 1800 800173 (within Australia)
or +61 2 6249 9966
email mapsales@ga.gov.au
visit www.ga.gov.au/nmd/products/thematic/gaz.jsp

Related websites

Geoscience Australia's Place Name Search facility
www.ga.gov.au/map/names/



Geologi short film COMPETITION 2007

Geoscience Australia and the National Geographic Channel invite Australian secondary school students to participate in a short film competition with an 'Earth Science' theme.

The Earth Science theme or message should be conveyed in a short documentary style film. Exciting and diverse use of visuals and sound is encouraged.

The winning entry will be showcased on the National Geographic Channel website.

Prizes include a GPS (Global Positioning System), mineral specimens, DVDs and books.

Registration is required by Tuesday 31 July 2007.

Competition entries must be received by Friday 31 August 2007.

For more information

Phone Fiona Wright on +61 2 6249 9859 or email fiona.wright@ga.gov.au.

www.ga.gov.au/about/event/index.jsp#esw

Team Australia at record-breaking PDAC

The 75th Anniversary Prospectors and Developers Association of Canada's (PDAC) International Convention, Trade Show and Investors Exchange broke all previous records with 17 600 attendees from over 100 countries. The event was held in Toronto, Canada, between 4 and 7 March this year. The Trade Show featured more than 300 exhibitors, including government agencies from 27 countries, promoting technology, products, services and mining jurisdictions.

The mood of the Convention reflected the current vibrant state of the industry as explorers continue to enjoy commodity prices at or near 25 year highs. Australia's profile was boosted by the attendance of the South Australian Minister for Mineral Resources Development, The Hon Paul Holloway MP, who led a delegation from his state. Australia's High Commissioner to Canada, Mr Bill Fisher, again added his support to the Australian promotion. The Australian exhibitors received valuable support from the Austrade office in Toronto.

Australia presented a high-profile promotion by combined industry and government exhibitors at the Trade Show. Geoscience Australia coordinated the government promotion which involved all states and the Northern Territory under the 'Team Australia' banner. The exhibition, in the Australian Pavilion, attracted over 250 significant visitors from 22 countries representing mining and exploration companies and financial and academic institutions. There was strong interest in all commodities especially iron ore, copper, zinc and uranium resources. In addition to the government exhibitors, the Australian Pavilion included five (mainly industry) exhibitors, including Encom Technology Pty Ltd, Intrepid Geophysics, Predictive Mineral Discovery Cooperative Research Centre (*pmd**CRC), Gekko Systems Pty Ltd and AME Mineral Economics. Their participation was coordinated by GeoJAG Australia.

Geoscience Australia also organised a special half-day exploration seminar on behalf of Team Australia to show-case mining and exploration opportunities in Australia. The seminar, 'Exploration Down Under', featured presentations by representatives of three mining companies (Oxiana Ltd, Ivanhoe Mines and Teck Cominco Ltd), the *pmd**CRC, Geoscience Australia and all states and the Northern Territory. It was opened by The Hon Paul Holloway MP and closed by the Australian High Commissioner, HE Mr Bill Fisher. The seminar was attended by up to 140 participants at various times and the feedback received from delegates was very positive.

During the Convention's technical program Dr Richard Blewett of Geoscience Australia delivered a jointly authored presentation on the Yilgarn Craton at a special symposium which highlighted new developments in understanding the geology and metallogensis of Archaean terranes around the world. Geoscience Australia scientists also co-authored a presentation on the Pilbara Craton which was delivered by the Geological Survey of Western Australia.



For more information

phone Mike Huleatt on
+61 2 6249 9087

email mike.huleatt@ga.gov.au

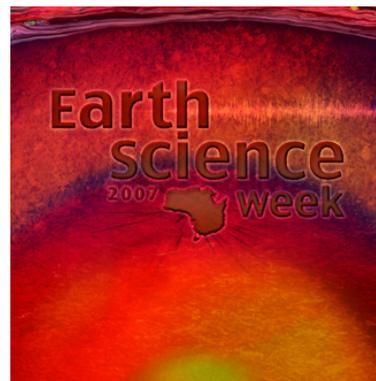
The pulse of earth science

Earth Science Week is an international event which promotes awareness of and provides an opportunity to celebrate the world of earth science. Earth Science Week 2007 runs from 14 to 20 October and is celebrating its tenth year with the theme 'The Pulse of Earth Science.'

This year's theme provides an opportunity for everyone involved in the earth sciences to share the significance of their work with the broader community. It encourages us to identify future challenges and develop national and international programs and activities that will increase the profile of earth science in society.

Once again Geoscience Australia will coordinate Earth Science Week in Australia and is calling for innovative ideas and activities to contribute to the new Earth Science Noticeboard. The noticeboard will assist and promote the sharing of earth science knowledge between individuals, teachers, schools and organisations across the country.

As part of the celebration Geoscience Australia and the National Geographic Channel have collaborated to invite secondary students to participate in the Geologi Short Film Festival. The competition will accept short documentary-style films exploring earth science themes which engage and challenge viewers. Entrants may also wish to incorporate themes from other international earth science celebrations such as the International Year of Planet Earth and the International Polar Year. The presentation of awards to the winners at Geoscience Australia's headquarters will be a highlight of the Earth Science Week celebrations. The winning entries will also be screened on the National Geographic Channel website.



For more information

phone Fiona Wright on
+61 2 6249 9859

email earthscienceweek@ga.gov.au

Related websites

Earth Science Week 2007

www.ga.gov.au/about/event/index.jsp#esw

Earth Science Noticeboard

www.ga.gov.au/about/event/esw_online.jsp

Geologi Short Film Festival

www.ga.gov.au/about/event/esw2007_act.jsp

International Year of Planet Earth

www.esfs.org/

International Polar Year

www.ipy.org/

AMSA 2007 (Australian Marine Sciences Association)

9 to 13 July

University of Melbourne

Contact: Ms Narelle Hall,

PO Box 8, Kilkivian Qld 4600

p +61 7 5484 1179

f +61 7 5484 1456

e amsa2007@amsa.asn.au

www.amsa.asn.au/conference/conf2007/index.php

Diggers and Dealers Forum 2007

6 to 8 August

Goldfields Arts Centre, Kalgoorlie

Contact: Suzanne Christie, Diggers and Dealers Mining Forum,

PO Box 979, West Perth WA 6872

p +61 8 9481 6440

f +61 8 9481 6446

e admin@diggersnddealers.com.au

www.diggersnddealers.com.au/

NSW Mineral Exploration

& Investment 2007 (NSW

Department of Primary Industries)

23 & 24 August

Four Seasons Hotel, Sydney

Contact: Kelly Allert

p +61 2 8289 3929

f +61 2 9286 3208

e kelly.allert@dpi.nsw.gov.au

www.dpi.nsw.gov.au/aboutus/news/events/minerals/

Australian Nickel Conference

24 & 25 October

Sheraton Perth Hotel, Perth

Contact: Samantha Goulding,

Paydirt Media Pty Ltd,

PO Box 1589, West Perth WA 6872

p +61 8 9321 0355

f +61 8 9321 0426

e samantha@paydirt.com.au

www.australiannickelconference.com

Mining 2007

31 October to 2 November

Hilton Brisbane

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/mining2007/

China Mining Congress

13 to 15 November

Beijing International Convention

Center, Beijing

Contact: Doug Bowie, Vertical Events,

PO Box 1153, Subiaco WA 6904

p +61 8 9388 2222

f +61 8 9381 9222

e info@verticalevents.com.au

www.china-mining.com/