



Contents

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CEO comment

2



34th International Geological Congress— AUSTRALIA 2012

3

Major geoscience event comes to Oceania



New opportunities for offshore petroleum exploration

6

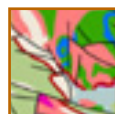
2012 Acreage Release areas includes Australia's southern margin



Vulnerability assessment of Timor-Leste's groundwater resources to climate change

16

Project builds capability for assessing, monitoring and managing groundwater



Dating Australia's uranium deposits

21

Chemical dating of uraninite to encourage explorers

In brief

First trans-Tasman collaborative workshop a resounding success 26

Product news

Increasing role for gas in the Australian and global energy mix 28

New geophysical datasets released 28

Events

31



CEO comment



Dr Chris Pigram – CEO Geoscience Australia

Australia is preparing to host the country's largest ever international geoscience event when the 34th International Geological Congress (IGC) is held at the Brisbane Convention and Exhibition Centre between 5 and 10 August. The Congress will feature international expertise in environmental impacts, energy sources, mineral exploration and climate change. The importance of the minerals and petroleum industries to Australia will be strongly reflected in the Scientific Program and exhibits at the GeoExpo to be held during the Congress.

Geoscience Australia is heavily involved in the IGC having contributed to the planning and organisation of the meeting and will have staff involved in the science program and field trips. This issue includes details of the Congress and a new book on Australia's geology—*Shaping a Nation: A Geology of Australia*—which has been co-published by Geoscience Australia and the Australian National University E Press.

Details of the 2012 release of Offshore Acreage for petroleum exploration, which includes 27 exploration areas covering approximately 200 000 square kilometres in nine offshore basins, are included in this issue. The areas are located in Commonwealth waters off the coast of the Northern Territory, Western Australia, South Australia, Victoria and Tasmania. The usual strong representation of release areas on the North West Shelf is well balanced with nine areas along Australia's southern margin in the Bight, Otway, Sorell and Gippsland basins.

The economy and the livelihood of the people of Timor-Leste, are heavily dependent on groundwater resources that are sensitive to climate change. This issue reports on a project, involving Geoscience Australia in close partnership with Timor-Leste Government agencies, which is building a groundwater knowledge base and monitoring capacity in Timor-Leste. The project has delivered a series of reports, national maps, guidelines and monitoring tools, as well as training, which will provide a fundamental knowledge base and practical tools to assess climate change impacts on groundwater.

Australia hosts the largest uranium reserves in the world, boasting 23 per cent of the global total, and is currently the third ranked uranium producer behind Kazakhstan and Canada. To encourage

exploration for uranium, Geoscience Australia researchers undertook dating of selected uranium deposits. Our article outlines the results from the Kintyre deposit in Western Australia and the Oasis deposit in Queensland.

This issue also includes a brief report on the *Australian Gas Resource Assessment 2012* which was prepared in conjunction with the Bureau of Resources and Energy Economics. This assessment builds on the *Australian Energy Resource Assessment* (see *AusGeo News* 98) released in March 2010 and documents the significant changes which underpin the increasing role for gas in the Australian and world energy mix.

As usual we always appreciate your feedback and encourage you to use the email address at the end of each article.



Dr Chris Pigram
CEO Geoscience Australia.



34th International Geological Congress— AUSTRALIA 2012

Major geoscience event comes to Oceania

Paul Kay



Australia will host the country's largest ever international geoscience event when the 34th International Geological Congress (IGC) is held at the Brisbane Convention and Exhibition Centre between 5 and 10 August. This will be the second time in the IGC's 134 year history that the Congress has been held in Oceania: the 1976 IGC was held in Sydney and attracted more than 3500 delegates.

The 34th IGC will combine a comprehensive resources and energy program with opportunities for attendees to connect with world-leading geoscientists. It will feature international expertise in environmental impacts, energy sources, mineral exploration and climate change. The importance of the minerals and petroleum industries to Australia will be strongly reflected in the Scientific Program and exhibits at the GeoExpo to be held during the Congress.

The Congress will also encompass other events, including meetings of the International Union of Geological Sciences' Commissions, Task Groups and Joint Programs as well as the second Young Earth Scientists (YES) Congress. There will also be the launch of a new book on Australia's geology—*Shaping a Nation: A Geology of Australia*—co-published by Geoscience Australia and the Australian National University E Press.

The scientific sponsor is the International Union of Geological Sciences; while Vale, the world's second largest mining company, is the major commercial sponsor. The IGC also has the benefit of UNESCO patronage.

High level of interest

Based on confirmed registrations and the number of abstract submissions the Congress will attract more than 4000 delegates, making it the largest geoscience meeting ever held in Australia. Over five thousand abstracts were submitted from 110 countries for around 200 Symposia covering all facets of the geosciences. Interest and early registrations were strongest from Australia and north Asia, particularly China, while Russia and the Americas are well represented. To date, the level of interest from Western European countries appears to be down on previous Congresses.



The 34th IGC will also include a large GeoExpo featuring commercial, government and academic exhibitors. Over 250 booths in the GeoExpo, which will fill two of the Brisbane Exhibition and Convention Centre's exhibition halls, have already been sold.

Plenary sessions and Keynote Speakers

The overall theme for the Congress is 'Unearthing our Past and Future—Resourcing Tomorrow', recognising the crucial contributions of the geosciences in meeting societal needs and sustaining planet Earth. The program, which emphasises future minerals and energy supplies, is underpinned by Australia's experience in developing a strong and sustainable mineral and energy resources sector. Other major



themes include climate change and its impacts on natural resource management and communities, as well as understanding and mitigating geohazards.

Plenary sessions planned for the Congress will cover high profile topics:

- Resourcing Tomorrow: meeting the needs of a growing population
- The Earth and man: living with a restless Earth
- What does the geological record tell us about past climates in relation to projected climate change?
- Energy in a carbon-constrained world
- Digital Earth—the information explosion

Plenary Speakers confirmed to date include: Professor Iain Stewart (the BBC's *How Earth Made Us* series), former Shell chairman Lord Ron Oxburgh, Vale's Executive Director for Exploration, Energy and Projects Management, Eduardo Ledsham, and the Chinese Minister for Land and Resources.

The final scientific program for the Congress will be included in the Fifth Circular which will be available by the end of June 2012.

Major data releases and field trips

A highlight of the Congress will be the release of information from major geological and geophysical surveys conducted over a large area of central and eastern Asia. The maps and datasets are the result of collaboration between China, Russia, Kazakhstan, Mongolia and South Korea to provide new insights into the resource potential of this large under-explored region.

The 34th ICG has developed a diverse range of pre- and post-Congress field trips which will offer diverse opportunities to experience the fascinating geology of the Oceania region. These field visits will include all Australian states and the Northern Territory. There will also be field trips to New Zealand, Malaysia, New Caledonia and Papua New Guinea. A range of one-day tours will also be available during the conference.

Professional Development and outreach

Twenty nine optional Professional Development Workshops, which cover a wide range of topics for professional development and training, are being offered during the Congress. They include topics such as: sustainable mining, carbon sequestration, geohazards and groundwater.

The GeoHost program, which supports attendance by selected delegates from developing nations, has benefited from financial support for geoscience training workshops provided by the Australian

Agency for International Development (AusAID) and the Global Carbon Capture and Storage Institute.

Special sessions for educators and high profile public lectures will be also be held during the Congress to ensure that positive messages about the contribution of geoscience to our everyday life reaches the broader community.

Support and contributors

The Organising Committee is delighted to have the support of the Australian and Queensland governments, major global resource and related service companies. The legal entity responsible for the 34th ICG is the Australian Geoscience Council (AGC), the peak body for Australia's major professional and learned societies. These societies are all investing in the Congress which will take the place of a number of their regular meetings in 2012. GNS Science from New Zealand is a valuable partner in organising the Congress on behalf of the Oceania region. Geoscience Australia is making major in kind and financial contributions including providing the Secretary General (Ian Lambert) and Deputy Secretary General (Paul Kay).

Release of new book on Australia's geology

The Congress will also include the launch of *Shaping a Nation: A geology of Australia* (figure 1).

The book is not intended as a definitive text on all aspects of Australia's diverse geology, nor does it follow the 'traditional' time-based treatment of the topic. Rather, the book tells the story of Australia's geological evolution through the lens of human impacts—illustrating both the challenges and the opportunities presented by the geological heritage of the 'lucky country'. The book showcases the excellence of Australian geoscience by integrating geoscience disciplines into a systems framework that address many of the 'big questions' relevant to Australians today.

The opening two chapters set the spatial, temporal and cultural contexts for the book. The following eight chapters are arranged into themes around the various geological influences on Australian society, environment and wealth. These chapters cover the evolution of life in Australia, development of post-Gondwana hydrocarbon systems, evolution of the landscape, the coastal zone, groundwater, minerals and bulk commodities, and, finally, future energy. The concluding chapter considers the major challenges facing the nation and the vital

role that geosciences will play in meeting these challenges. The appendices are a very important component of the book and are available on a dual-layer DVD that is bound with the hard-copy printed version.

Though the book is aimed at geoscientists, the narrative and messages are relevant to society as a whole. Many new advances in the understanding of Australia's geology are covered in a way that minimises discipline-specific jargon. The text is brought to life by the large number of high-quality colour photographs, maps and images.

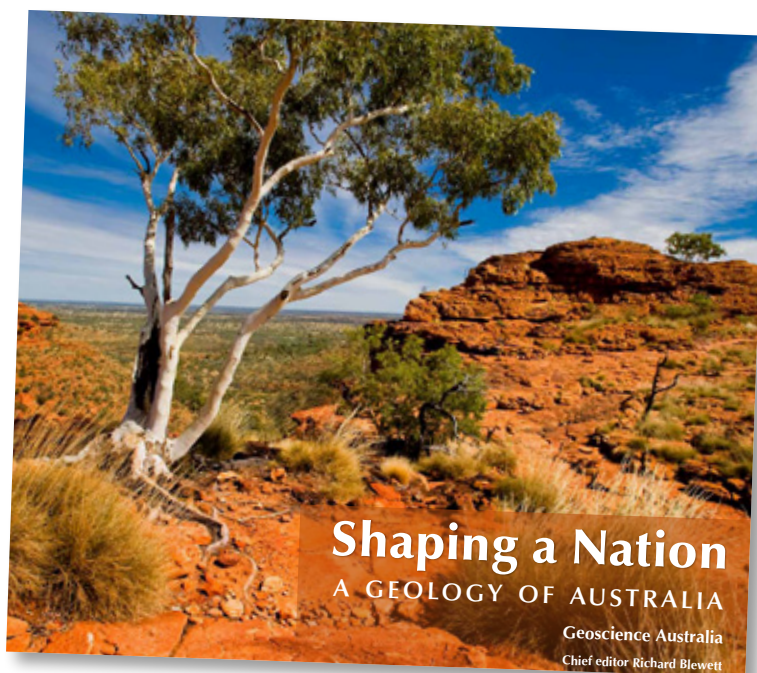


Figure 1. The cover of *Shaping a Nation: A Geology of Australia* which will be launched during the Congress.

Accommodation

Accommodation near the venue and elsewhere in Brisbane is already heavily booked. The organisers suggest delegates make their accommodation bookings as soon as possible as prices could rise closer to the event.

For more information or to register or receive regular updates

email info@igc.org

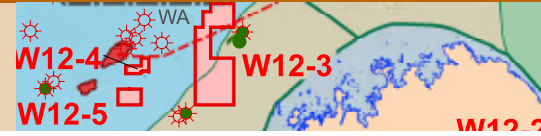
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New opportunities for offshore petroleum exploration

2012 Acreage Release areas include Australia's southern margin

Thomas Bernecker and Jennifer Totterdell



The Australian Government formally released new offshore petroleum exploration areas at the annual APPEA conference on 14 May 2012. The Federal Minister for Resources and Energy, the Hon. Martin Ferguson AM MP, released 27 areas in nine offshore basins for work program bidding. Closing dates for bid submissions are either six or twelve months after the release date, that is, 8 November 2012 and 9 May 2013 respectively, depending on the exploration status of these areas and on data availability.

As was the case last year, the 2012 Release covers approximately 200 000 square kilometres including large areas in offshore frontiers. The 27 areas are located in Commonwealth waters offshore Northern Territory, Western Australia, South Australia, Victoria and Tasmania (figure 1). This year the usual strong representation of new release areas offshore Northern Territory and Western Australia is well balanced with nine areas along Australia's southern margin in the Bight, Otway, Sorell and Gippsland basins. Following the award of four permits in the Ceduna Sub-basin (Bight Basin) to BP in January 2011, additional exploration opportunities are on offer with three more areas being released this year. A mix of shallow water areas close to existing hydrocarbon production and deep water under-explored areas are available in the Otway, Sorell and Gippsland basins.

Multiple industry nominations for this Acreage Release were received, confirming the healthy status of petroleum exploration activity in Commonwealth waters. The Australian Government continues to support these activities by providing free access to a wealth of geological and geophysical data which are made available through Geoscience Australia.

Arafura Basin and Money Shoal Basin

Release Areas NT12-1 and NT12-2 are located about 240 kilometres northeast of Darwin on the continental shelf where depths range from 50 metres to 390 metres. Both areas cover part of the Mesozoic to Cenozoic Money Shoal Basin and the underlying Neoproterozoic to Permian Arafura Basin (figure 2). The western part of Release Area NT12-2 covers part of the Calder Graben of the Mesozoic to Cenozoic Bonaparte Basin. The Release Areas are located to the east of the Evans Shoal, Caldita and Barossa-Lynedoch gas accumulations in

Australian waters and the Abadi gas accumulation in Indonesian waters.

Although commercial discoveries have not been made in either the Money Shoal or Arafura basins, there are numerous hydrocarbon shows and indications in wells drilled in the Goulburn Graben (figure 2). A review of available geological data (Struckmeyer 2006), together with the results from a survey investigating potential hydrocarbon seepage in the Arafura Basin (Logan et al 2006), show that the region contains not only all the required elements for petroleum systems to generate, expel and trap hydrocarbons, but also evidence that generation and expulsion has occurred.

Petrel Sub-basin, Bonaparte Basin

Release Areas W12-1, W12-2 and NT12-3 are located in shallow water (10 to 125 metres) between 10 and 100 kilometres offshore northwestern Australia (figure 2). The Release Areas are located adjacent to current offshore petroleum exploration permits and overlie the offshore Petrel Sub-basin, a Paleozoic depocentre of the Bonaparte Basin. The

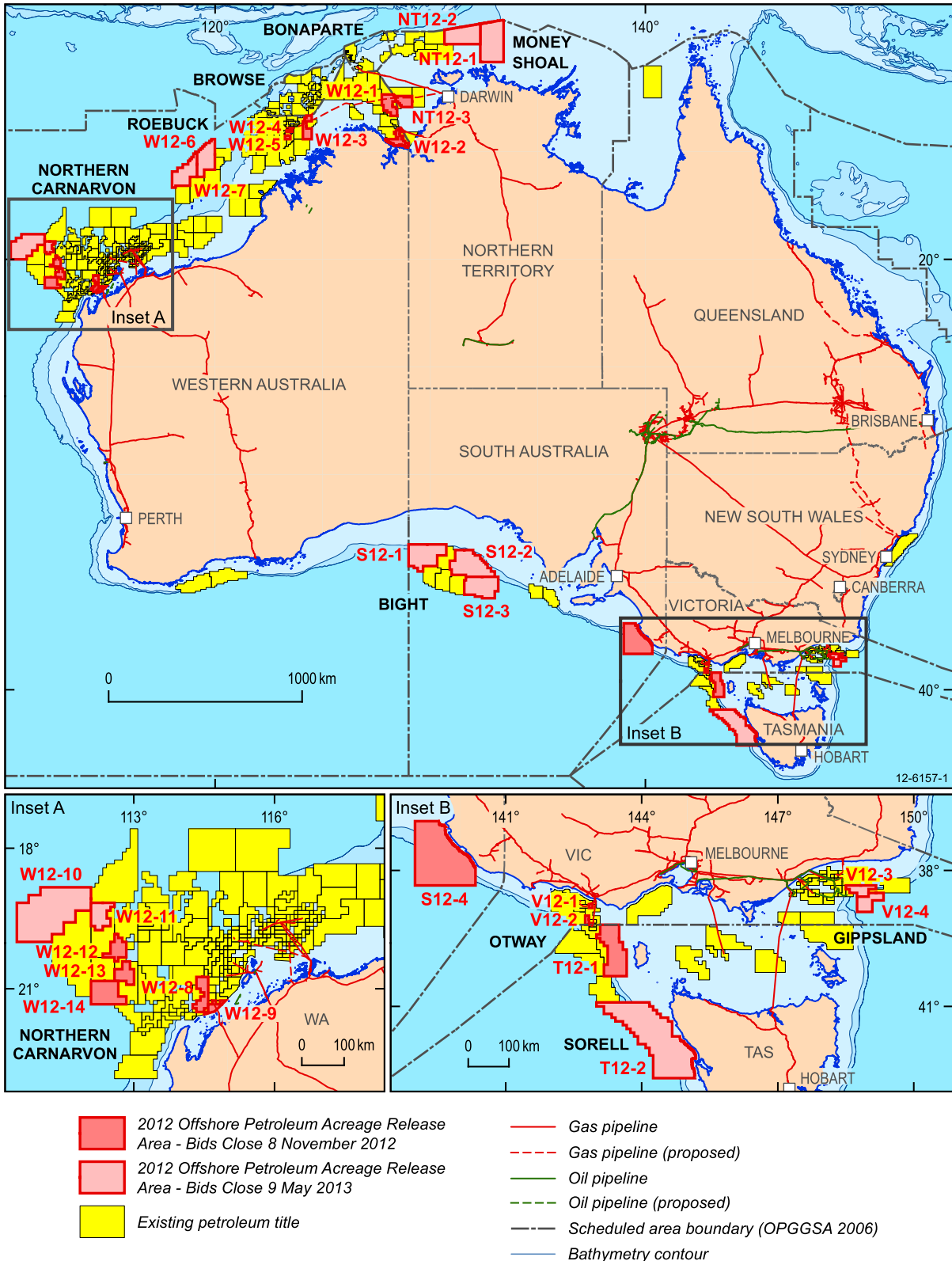


Figure 1. Location map showing the 2012 Offshore Petroleum Acreage Release Areas.

Release Areas are close to the Petrel, Tern, Frigate and Blacktip gas fields. Area W12-2 contains six exploration wells, while Release Areas W12-1 and NT12-3 do not contain any wells.

The most prospective reservoirs within the central Petrel Sub-basin, and Release

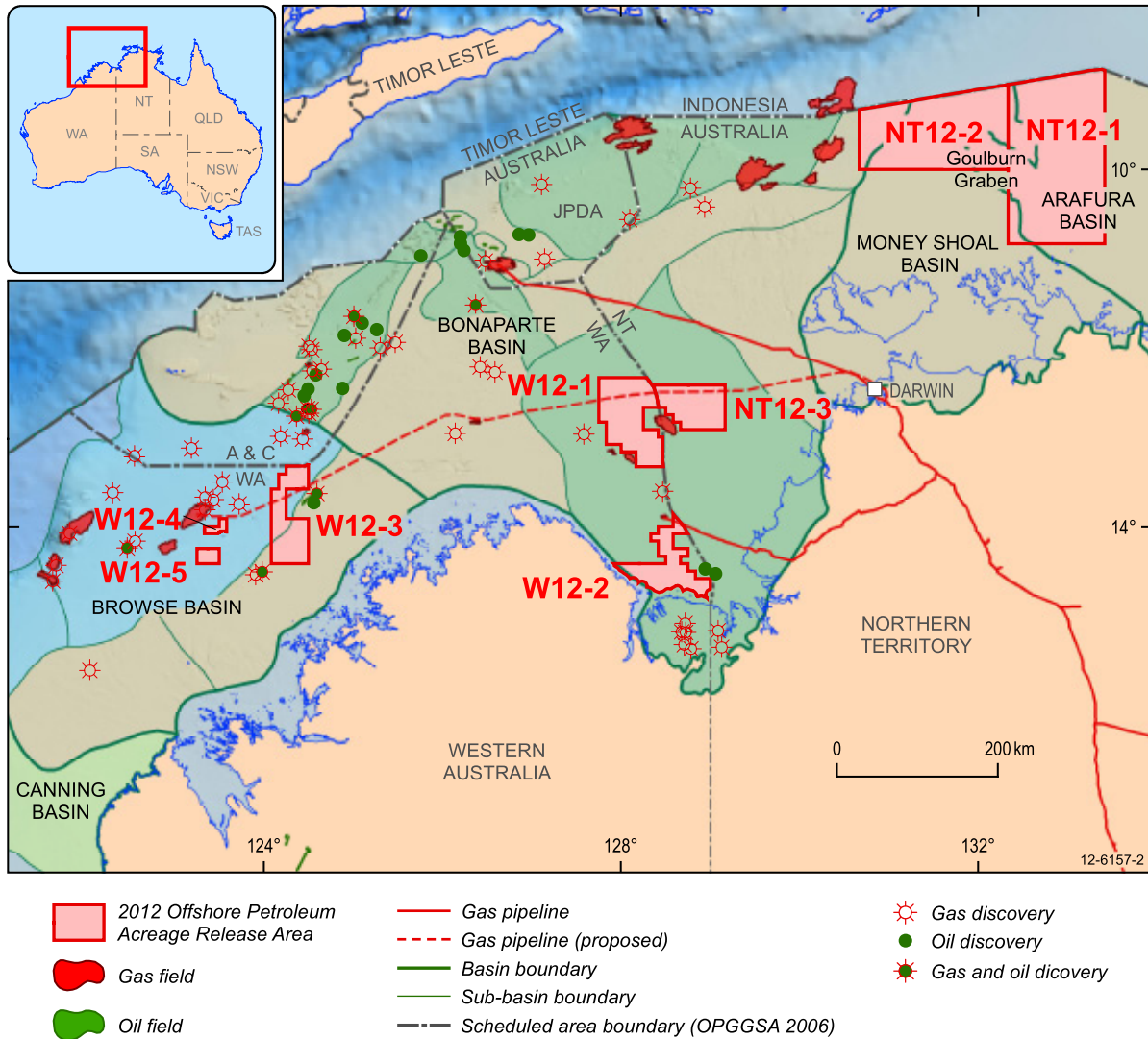


Figure 2. Tectonic elements map of the Browse Basin, Bonaparte Basin and Money Shoal Basin region showing location of the 2012 Release Areas and petroleum accumulations.

Areas W12-1 and NT12-3, are the upper Permian Cape Hay and Tern formations, as exemplified by the gas reservoirs at Petrel and Tern, and the Torrens Formation, which hosts the gas discovery at Penguin 1 (Polkadot 1). In addition, the Penguin Formation is an important reservoir for gas in Fishburn 1. The most prospective reservoirs within the offshore southern Petrel Sub-basin, and for Release Area W12-2, are the Permian Keyling and Treachery formations, the Permo-Carboniferous Kuriyippi Formation, and the Carboniferous Tanmurra Formation, Kingfisher Shale and Yow Creek Formation. These reservoirs host oil accumulations at Barnett and Turtle. Gas at Blacktip 1 is reservoired in sandstones of the Ascalon, Fossil Head, Keyling, Quoin and Treachery formations (Gorter et al 2008). Numerous hydrocarbon traps were created by salt tectonics and related features such as diapirism have been identified across most of the sub-basin.

Caswell Sub-basin, Browse Basin

The Browse Basin is one of Australia's richest offshore hydrocarbon provinces. The Caswell Sub-basin is the major depocentre of the Browse Basin (figure 3) and contains up to 15 kilometres of Paleozoic to Cenozoic sediments. Release Area W12-3 is located on the Prudhoe Terrace and Yampi Shelf, 90 to 120 kilometres off the northwest coast of Western Australia, and

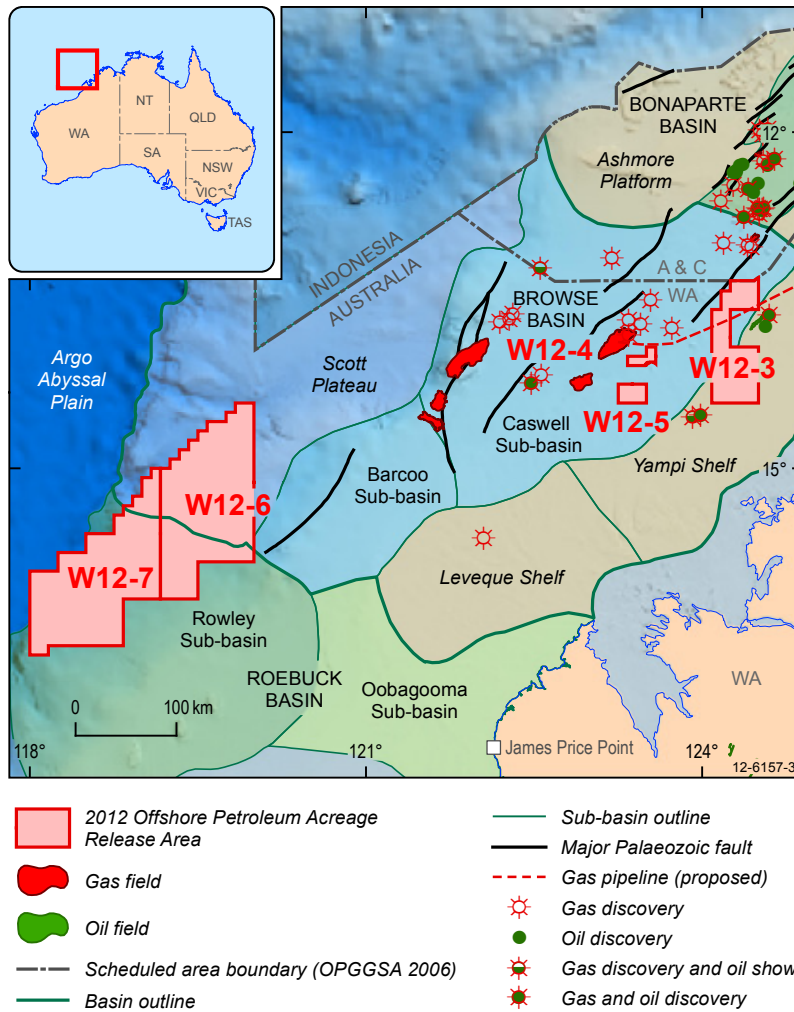


Figure 3. Tectonic elements map of the Browse Basin and Roebuck Basin region showing location of the 2012 Release Areas and petroleum accumulations.

water depths vary between 70 and 150 metres. Release Areas W12-4 and W12-5 are located on the Prudhoe Terrace in water depths ranging from 100 to 250 metres.

The Release Areas in the Caswell Sub-basin have access to oil- and gas-prone petroleum systems. Most of the oil-prone source potential is associated with transgressive marine shale sequences of the Upper Jurassic–Lower Cretaceous Vulcan and Echuca Shoals formations. The more gas-prone source potential is associated with fluvio-deltaic shales of the Lower–Middle Jurassic Plover Formation. Source rocks in and near Release Areas W12-3, W12-4 and W12-5 exist at multiple stratigraphic levels within the Plover Formation, the lower and upper Vulcan formations, the Echuca Shoals Formation and the lower and upper Jamieson formations (Blevin et al 1998a, 1998b; Kennard et al 2004).

Of the numerous gas fields discovered within the basin, four separate developments are currently proposed: the Prelude Floating

Liquefied Natural Gas (FLNG) Development, the Ichthys Development, the Browse Liquefied Natural Gas (LNG) Development (encompassing the Torosa, Brecknock and Calliance fields) and the Crux Liquids Project.

Scott Plateau, Browse Basin and Rowley Sub-Basin, Roebuck Basin

Release Areas W12-6 and W12-7 are located over the outer, deep-water Scott Plateau in the Browse Basin, and the Rowley Sub-basin in the Roebuck Basin (figure 3). This under-explored part of the North West Shelf lies to the southwest of the Torosa, Brecknock and Calliance gas fields in the Browse Basin, and northeast of the established oil and gas fields and production infrastructure of the Northern Carnarvon Basin. Release Area W12-6 is mostly located in water depths of 1400 to 2600 metres, deepening to 4000 metres along the northwestern edge of the Scott Plateau (figure 3). The southeastern part of Release Area W12-7 lies in water depths of 1600 to 3000 metres. The western part of this Release Area is located over the Argo Abyssal Plain in water depths exceeding 5000 metres (figure 3).

The presence of active petroleum systems within Release Areas W12-6 and W12-7 is difficult to confirm given the lack of well control. However, available knowledge about the adjoining Barcoo Sub-basin of the Browse Basin and the Rowley Sub-basin of

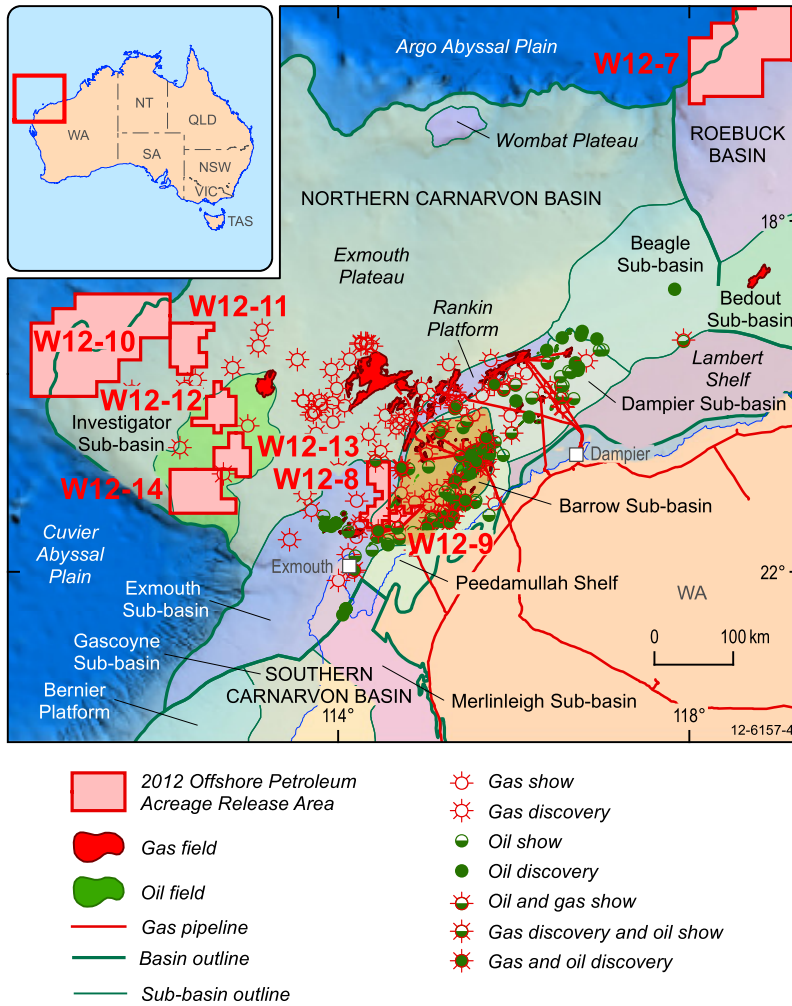


Figure 4. Tectonic elements of the Northern Carnarvon Basin and adjacent basins showing the 2012 Release Areas, oil and gas accumulations and selected wells.

the Roebuck Basin may provide some valuable information. Lower–Middle Jurassic source rocks are likely to occur within the Plover Formation and were deposited under syn-rift, paralic to shallow marine conditions (Hoffman and Hill 2004).

The Triassic and Jurassic successions are the most likely to contain reservoir-quality sandstones including the sandy shoreline, shelf and fluvio-deltaic facies of the Triassic Keraudren Formation and Locker Shale in the Rowley Sub-basin. Equivalents of these in the Browse Basin and the Roebuck Basin are the Lower–Middle Jurassic fluvio-deltaic Plover Formation and the Lower–Middle Jurassic Depuch Formation respectively.

Barrow and Exmouth Sub-basins, Northern Carnarvon Basin

The Northern Carnarvon Basin, Australia’s premier hydrocarbon province, is the southernmost of the late Paleozoic to Cenozoic basins

that underlie the northwestern continental margin of Australia. The sedimentary fill of the Northern Carnarvon Basin is up to 15 000 metres thick and dominated by deltaic to marine siliciclastics and shelfal carbonates of Mesozoic to Cenozoic age.

Release Area W12-8 is located predominantly in the northern Exmouth Sub-basin (figure 4), the southernmost sub-basin in a series of Jurassic depocentres that form the Northern Carnarvon Basin. The southeastern portion of this Release Area extends onto the Alpha Arch in the southwestern petroliferous Barrow Sub-basin. Release Area W12-9 in the Barrow Sub-basin is located approximately 45 to 60 kilometres offshore from production facilities at Onslow. Both Release Areas are located close to numerous oil and gas fields including the Vincent/ Van Gogh oil field, the Macedon gas accumulation (planned for domestic gas production from 2013), the Chinook/Scindian oil and gas field; and the Corowa and Griffin oil fields.

Exmouth Plateau, Northern Carnarvon Basin

Release Areas W12-10 to W12-14 are located on the Exmouth Plateau, a deep-water marginal plateau of the Northern Carnarvon Basin (figure 4). The plateau hosts numerous giant to supergiant gas fields, and has recently become Australia’s premier deep-water gas exploration province.

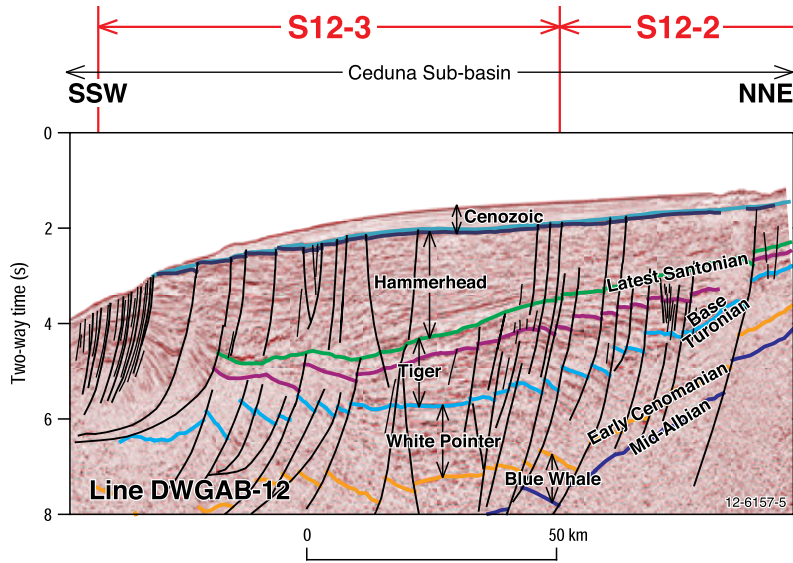


Figure 5. Seismic section across Ceduna Sub-basin showing the main depositional sequences.

The supergiant Io/Jansz gas field, giant Scarborough gas field, and the Jupiter 1 and Eendracht 1 gas discoveries, together with the recent gas discoveries in the Chandon 1, Thebe 1 and 2, Martin 1, Kentish Knock 1/Guardian 1, Brederode 1 and Alaric 1 wells, demonstrate that the deep-water Exmouth Plateau is prospective for large gas discoveries. All these discoveries are attributed to a widespread regional gas system sourced from the Triassic succession. Recent exploration activities on the Exmouth Plateau are based on a model that invokes gas charge from the deeply buried coal and carbonaceous claystone of the Mungaroo Formation. Peak gas generation from these Triassic source rocks is interpreted to be occurring now at depths greater than five kilometres subsea (Bussell et al 2001).

A proven hydrocarbon system has been established across the Exmouth Plateau although the full extent of the system, particularly in the north and west, is yet to be determined. Continued exploration success on the Exmouth Plateau relies on the identification of additional valid traps with access to charge from the gas-prone Mungaroo source.

Ceduna Sub-basin, Bight Basin

Release Areas S12-1 to S12-3 (figure 1) are situated in the central Great Australian Bight, off southern Australia. The areas are located mostly within the frontier Ceduna Sub-basin, in the eastern part of the Bight Basin. The Release Areas are located adjacent to petroleum exploration permits EPP37–40 which were awarded to BP Exploration in January 2011.

The Ceduna Sub-basin contains a sedimentary section in excess of 15 kilometres thick. The key to the petroleum prospectivity of

the sub-basin is the distribution of the Upper Cretaceous marine and deltaic facies. Dredging of upper Cenomanian–Turonian organic-rich marine rocks has confirmed the presence of high quality potential source rocks in this section. These rocks are mature in the central part of the Ceduna Sub-basin and are likely to have generated and expelled hydrocarbons since the Campanian. Mature source rocks are also interpreted to be present within older Albian–Cenomanian marine deltaic sediments in the Sub-basin.

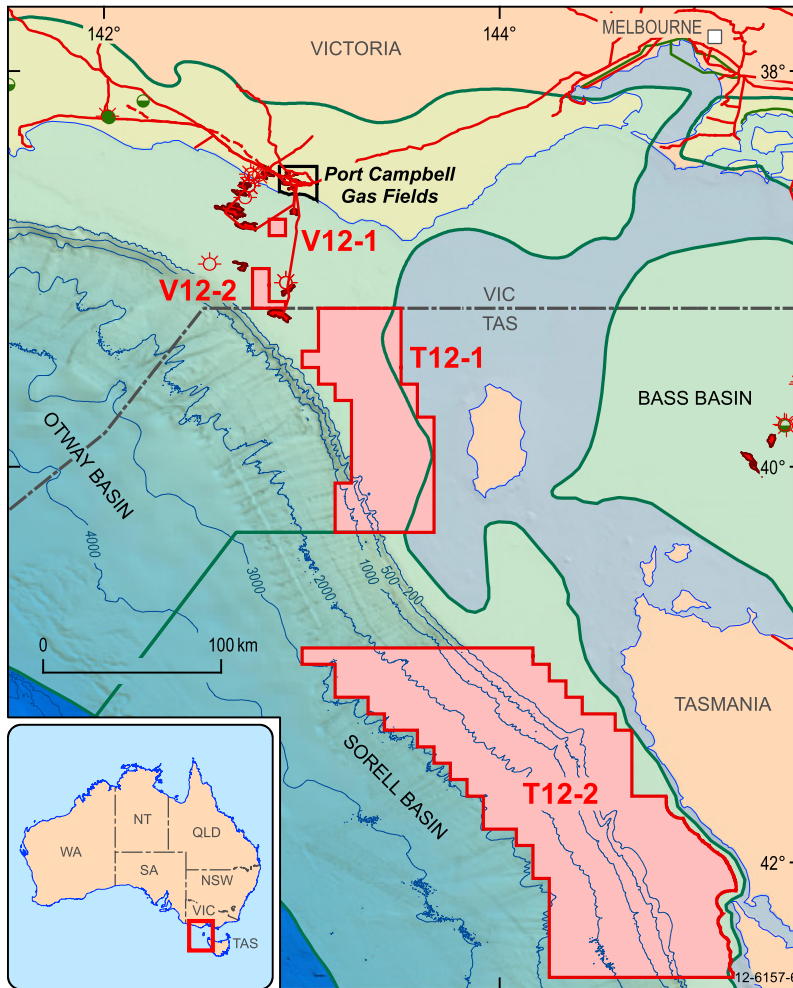
The primary reservoir units in the Ceduna Sub-basin are the deltaic and shallow marine sandstones of the upper Santonian to Maastrichtian Hammerhead Supersequence delta. Seismic facies studies of the Hammerhead Supersequence delta (Krassay and Totterdell 2003; King and Mee 2004) indicate that alluvial and coastal plain facies occur in the inner to central part of the sub-basin (figure 5), while shelf deposits and turbiditic slope and basin floor sands are likely to occur in the central to outer part of the sub-basin.

One of the key risks identified prior to the most recent exploration phase was the possible lack of an effective source rock and thus adequate hydrocarbon charge (Somerville 2001). This risk has been significantly reduced by the sampling and identification of a high quality marine source rock of Cenomanian to Turonian age (Totterdell et al 2008; Totterdell and Mitchell 2009).

Otway Basin

The Otway Basin is a northwest-striking passive margin rift basin that extends from southeastern South Australia to its boundary with the Sorell Basin west of King Island. It belongs to a series of basins, including the Bight, Otway, Sorell, Bass and Gippsland basins, that were formed during the break-up of Gondwana and Antarctic-Australian separation. Four areas are included in this year's release: S12-4 in the western part of the Otway Basin offshore South Australia (figure 1), V12-1 and V12-2 in the eastern Otway Basin offshore Victoria, and T12-1 offshore western Tasmania (figure 6).

Release Area S12-4 extends from the shallow shelf into deeper water reaching water depths of around 3000 metres (figure 1).



- | | |
|--|---------------------------------------|
| 2012 Offshore Petroleum Acreage Release Area | Scheduled area boundary (OPGGSA 2006) |
| Gas field | Bathymetry contour (depth in metres) |
| Gas pipeline | Gas discovery |
| Gas pipeline (proposed) | Gas show |
| Oil pipeline | Oil show |
| | Oil discovery and gas show |

Figure 6. Simplified tectonic elements map of the eastern Otway and Sorell basins.

Previous sporadic exploration in the shallow water parts of the Release Area resulted in the discovery of an uneconomic gas accumulation at Troas 1 ST1, and the identification of numerous gas shows and one oil show, confirming the presence of at least two working petroleum systems. Release Area S12-4 contains nine wells but little exploration has been carried out in the outboard areas beyond the continental shelf; Morum 1, drilled in 277 metres of water, is the only well to have been drilled seaward of the continental shelf. Release Area S12-4 offers numerous opportunities to test existing and new play concepts, within both shelfal and deepwater areas.

Release Area V12-1 is located in the eastern Shipwreck Trough, southwest of the Minerva accumulation and east of Casino 1 (figure 6). Release Area V12-2 lies further to the southwest and overlies the western Shipwreck Trough and eastern Voluta Trough. Release Area T12-1 is located on the southern extension of the Prawn Platform to the southeast of the Shipwreck Trough, west of the King Island High.

Recent geochemical studies suggest two petroleum systems are accessible within the Release Areas. The Early Cretaceous Austral 2 petroleum system is a known gas producer in the eastern Otway Basin, while the Late Cretaceous Austral 3 petroleum system, based on potentially mature Turonian source rocks in the deeper water area, remains untested.

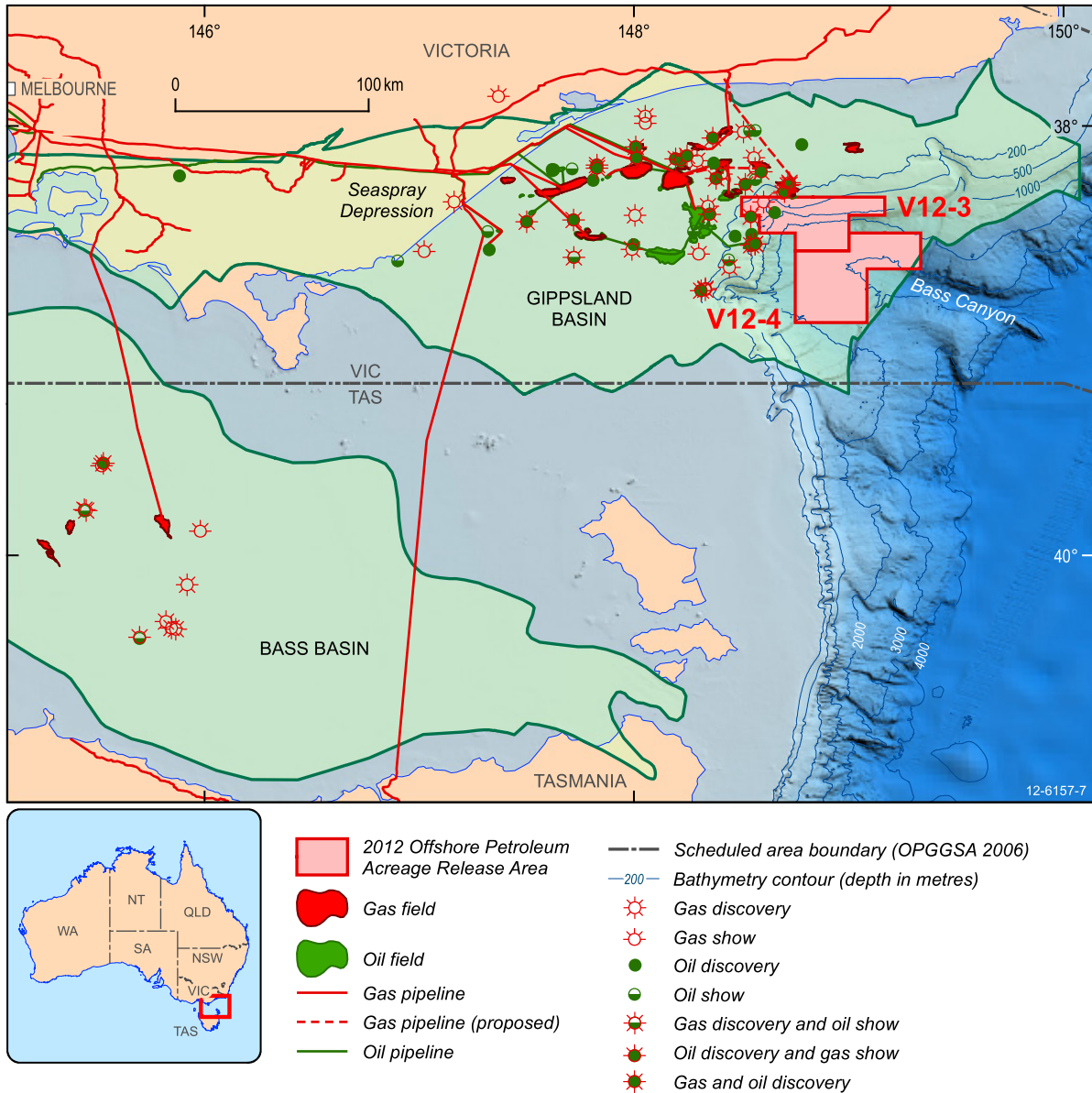


Figure 7. Simplified tectonic elements map of the Gippsland Basin.

Sorell Basin

The Sorell Basin is one of the easternmost elements of Australia's southern rift system. Release Area T12-2 is located over the Sandy Cape and Strahan sub-basins of the Sorell Basin, offshore western Tasmania (figure 6), in water depths ranging from 50 to 3000 metres. The Sorell Basin is one of the least explored of the major southeast Australian offshore sedimentary basins. The focus of exploration has been on the northern sub-basins, where three petroleum exploration wells have been drilled.

The Sorell Basin is contiguous with the Otway Basin, with which it shares a common stratigraphy. The depositional sequences that host active Austral 2 and 3 petroleum systems in the producing areas of the Otway Basin are interpreted to be present in the Sorell Basin.

Lower Cretaceous (Otway Group) and Upper Cretaceous (Sherbrook Group) successions have been mapped throughout the Sorell Basin. While limited well control prevents a thorough understanding of potential reservoir and seal facies in the basin, the few wells that have been drilled provide some encouragement. Cape Sorell 1 intersected a thick, sandy Maastrichtian–Eocene succession;

however, the well was drilled close to the half-graben bounding faults so lateral facies changes are likely. In Jarver 1, the basal Waarre Formation is overlain by a thick mudstone succession, which suggests sealing facies are present in more distal parts of the basin. However, no hydrocarbon discoveries have been made and the basin remains an exploration frontier.

Gippsland Basin

The Gippsland Basin is one of Australia's most prolific hydrocarbon provinces. Despite its relatively small area, the basin contains abundant economic hydrocarbon accumulations, including giant oil and gas fields. Release Area V12-3 is adjacent to producing oil and gas fields (Flounder, Blackback and Basker–Manta–Gummy), and is in water depths ranging from around 200 metres in the northwest to more than 2000 metres in the southeast (figure 7). Release Area V12-4 lies in water depths between 2000 metres and 3000 metres and includes the head of the Bass Canyon (figure 7).

The Release Areas in the Gippsland Basin are both relatively under-explored, especially Release Area V12-4. Only four wells—including discovery wells Bignose 1 and Culverin 1—are located within Release Area V12-3, although seismic coverage is reasonable, especially over the northern area. The 2012 Release Areas were formerly parts of VIC/P49, operated by Nexus Energy Australia, in joint venture with Roc Oil Pty Ltd. In 2007 Nexus acquired about 1700 kilometres of 2D seismic over the area now covering a large part of V12-3 and the northern half of V12-4.

Much of the oil and gas in the Gippsland Basin has been sourced from the lower delta plain shales and coals of the Latrobe Group. However, absence of a thick Cenozoic section in deeper water areas, especially in V12-4, means that the upper Latrobe Group is unlikely to be mature in much of this area. Therefore, the prospectivity of the Release Areas is likely to depend on the presence of older, deeper source rocks. Recent work (O'Brien et al 2008) indicates an older petroleum system may be operating in the Lower Cretaceous Strzelecki Group, generating significant quantities of dry gas. This applies especially along the northern margin of the Gippsland Basin (for example the Sole field) and in the Seaspray Depression onshore (Wombat, North Seaspray and Gangell fields).

Summary

The 2012 Offshore Acreage Release offers a wide variety of geological settings in shallow and deep-water. Area selection continues to be undertaken in consultation with industry and the state and Northern Territory governments. The annual Acreage Release caters for the

whole gamut of exploration companies given that many areas are located within producing regions and close to existing infrastructure, while others are located in offshore frontier regions with very little supportive data. As has been customary in recent years, Geoscience Australia supports the 2012 Acreage Release with an extensive data set, including open file seismic data, well completion reports and well-log data. These open file data are free of charge and made available at the cost of transfer.

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Related articles/websites

2012 Acreage Release:

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Geoscience Australia:

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Data supporting the 2012 acreage release (Seismic data is available in GeoFrame™ and Kingdom formats)

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Vulnerability assessment of Timor-Leste's groundwater resources to climate change

Project builds capability for assessing, monitoring and managing groundwater



Luke Wallace, Baskaran Sundaram, Ross s. Brodie, Sarah Marshall, Sam Dawson, John Jaycock, Gerard Stewart and Lindsay Furness

Timor-Leste, a country to the north of Australia, had a population of just over one million people in 2010. Its economy and the livelihood of its people are heavily dependent on groundwater resources that are sensitive to climate change. Groundwater resources are replenished by rainfall in the wet season providing storage for use throughout the year. Increased demand for groundwater caused by population, industry and agricultural growth in Timor-Leste has caused strain on this resource. The current sustainability of groundwater resources in Timor-Leste is largely unknown. In addition, the effects of climate change on both the quantity and quality of groundwater are also uncertain.

Groundwater in a changing climate

In June 2010, Geoscience Australia, in partnership with the Government of Timor-Leste's National Directorate for Water Resource Management (DNGRA) and the Rural Water Supply and Sanitation Program (BESIK) began a two-year project, the Assessment

of Climate Change Impacts on Groundwater in Timor-Leste. The project aimed to build Timor-Leste water agencies' capacity for assessing, monitoring and managing groundwater resources in a changing climate.

The project was funded by the Pacific Adaptation Strategy Assistance Program under the Australian Government's International Climate Change Adaptation Initiative. Phase 1 of the project included a baseline assessment and review of the existing knowledge of groundwater and Phase 2 was a participatory, capacity-building program, based on practical case studies, to develop groundwater monitoring and assessment capabilities in Timor-Leste.

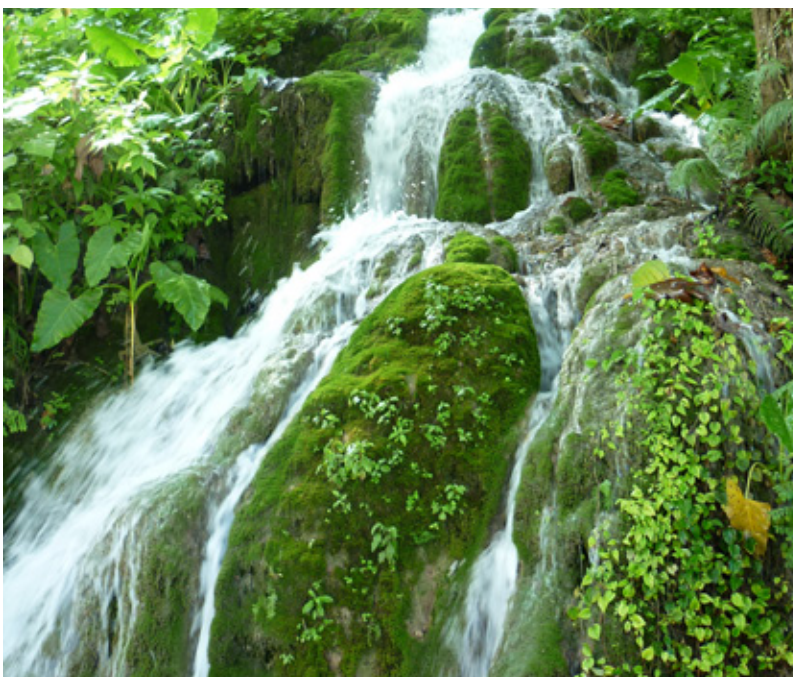


Figure 1. The project provided fundamental datasets and maps to assess the potential impacts of reduced groundwater recharge and availability on people and their livelihoods.

Major products

The project has used a multidisciplinary approach to build groundwater knowledge and monitoring capacity in Timor-Leste during a changing climate. The project has delivered a series of reports, national maps, guidelines and monitoring tools to help water managers and users in Timor-Leste to better understand and manage

groundwater in a changing climate. These products were developed using a participatory and multidisciplinary approach and include the development of the National Hydrogeology Framework, the first National Hydrogeological Map of Timor-Leste to international standards and a National Groundwater Monitoring Field Guide. These products will provide a foundation for all future groundwater management work in Timor-Leste.

National Hydrogeology Framework

A key output was the development of a National Hydrogeological Framework. The framework outlines a method to collect data and categorise, map and monitor groundwater resources and is a useful tool for groundwater managers. The framework is split into two phases, with each phase comprised of four steps.

In Phase 1, the knowledge-based approach, the first step is to define a clear, specific purpose for the project. Then all available existing information and data sets are collected. Thirdly, specialist knowledge for interpreting information and data sets is identified, and the final step is to draft a new map.

Phase 2, the data-based approach, allows detailed, site-specific data to be collected and incorporated to refine the map. The first step is to define the purpose of the groundwater measurement, for example, water level and water quality, followed by selection of suitable case-study field sites to sample. The findings from the new

data collected can then be added to the draft map and be used to interpret sites not yet assessed. The final step of the framework is to continue groundwater monitoring over time.

National hydrogeology map

The 'Hydrogeological Map of Timor-Leste' is the first map which allows aquifer types to be consistently identified across the country. Three main aquifer types were identified:

- Sedimentary porous rock aquifers with intergranular porosity associated with river valleys and coastal low lands
- Fissured aquifers of karst formations within limestone rocks
- Rocks with localised flow comprised of fractured rocks and clay sediments (figure 2).

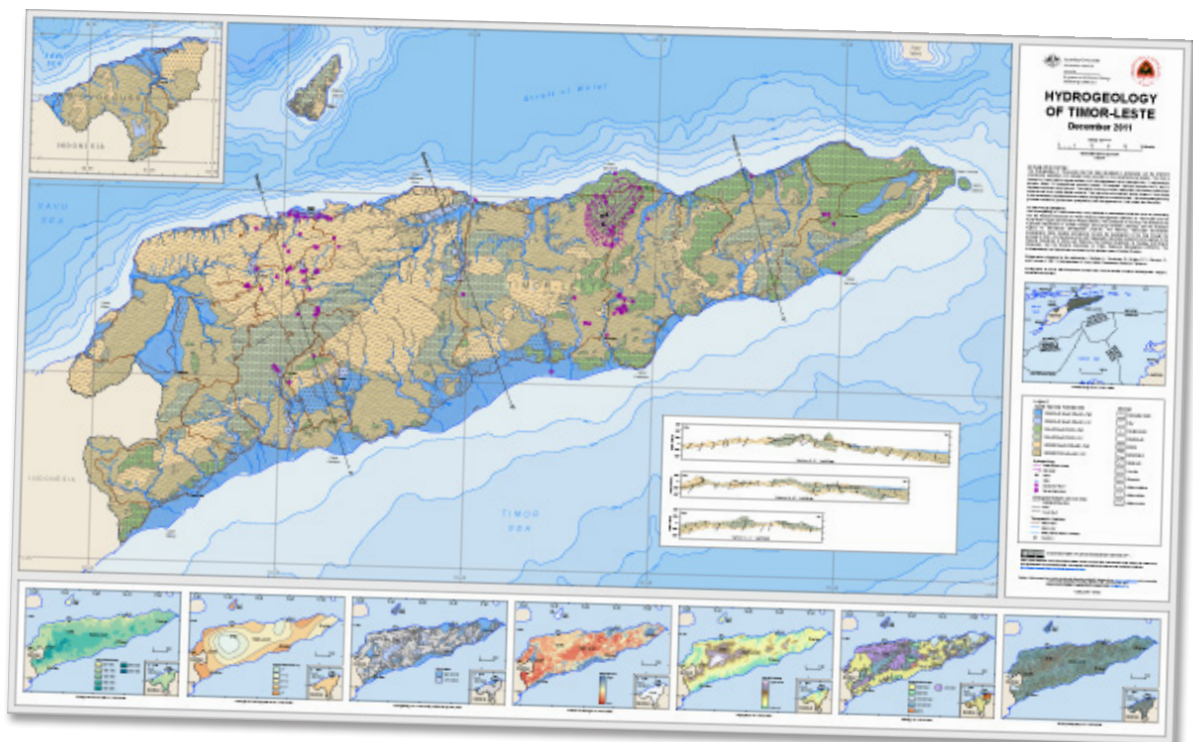


Figure 2. Draft version of the Hydrogeological Map of Timor-Leste which displays the type, potential aquifer yield, and lithology of aquifers across Timor-Leste.

The hydrogeology map also displays the type, potential aquifer yield and lithology of aquifers across Timor-Leste. The combination of aquifer type with potential yield is valuable for prospectivity, indicating where usable groundwater resources are likely to occur. This map can be used to:

- Assess the impacts of climate change on groundwater
- Manage extraction under increasingly variable conditions
- Assist in the design of monitoring programs for groundwater quality and quantity
- Provide a basis to calculate use and sustainable yields for current and future needs.

Fieldwork

Studies were undertaken in Dili, Baucau and Aileu districts as they included Timor-Leste's three major aquifer types: intergranular (sedimentary), fissured (karst) and fractured (localised) respectively. These sites were also chosen because of their greater potential vulnerability associated with the high population densities and/or low water availability. Data was collected during fieldwork in partnership with DNGRA and Charles Darwin University (CDU) with the support of the Timor-Leste Government Directorates, and BESIK (figure 3)

Fieldwork at each of the case-study sites involved:

- 1) ground truthing of the aquifer characteristics
- 2) ground-based electromagnetic geophysical (TEM) surveys by CSIRO to delineate aquifer architecture and groundwater salinity
- 3) direct measurement of groundwater levels and water quality. Data from these case study sites were used to add detail to the National Hydrogeology Map.



Figure 3. Groundwater monitoring during fieldwork in selected sites.

National Groundwater Monitoring Guide

The groundwater monitoring guide was developed to ensure that Timor-Leste's groundwater resources can continue to be monitored long after the project's completion. It provides basic information such as what groundwater is, different types of bore drilling and monitoring methods, how to measure groundwater levels and how to sample and test the quality of groundwater.

Developing groundwater monitoring skills

Groundwater management is essential for ongoing sustainable groundwater use and was a critical component of this project. Monitoring of groundwater requires a full understanding of Timor-Leste's climate, aquifer types and the threats to groundwater systems. Training and workshops were provided in Timor-Leste on the use of monitoring tools and analysis of information on groundwater.

Training

During 2011 the project conducted three lectures and hands-on practical sessions covering Groundwater Fundamentals, Geographic Information Systems (GIS) Mapping, and Groundwater Sampling and Monitoring Methods. Training was attended by staff from the DNGRA and

other Timor-Leste agencies. Groundwater Fundamentals focused on the basics of groundwater, aquifers, mapping, sampling and the hydrogeology of Timor-Leste. In GIS Mapping attendees installed free GIS software and were instructed in GIS basics and used these skills to reproduce the national hydrogeology map (figure 2). The Groundwater Sampling and Monitoring Methods covered the basics of sampling and monitoring. The attendees were also given training in the field on various groundwater sampling and analysis methods.

Workshops

Three workshops were also conducted in Dili during the project. The main purpose of the workshops was to engage with the Government Directorates of Timor-Leste, including the DGNRA, to ensure that their suggestions were implemented effectively throughout the project. Attendees from Timor-Leste included representatives from DNGRA, BESIK, Agriculture and Land-use Geographic Information System (ALGIS), National Directorate for Water Supply and Sanitation (DNSAS), Seeds of Life and Timor-Leste directorates for geology and the environment. Australian representatives from AusAID (Australia's agency for international development), the Department of Climate Change and Energy Efficiency, Geoscience Australia and CDU also attended. The outputs of the project were presented and received by the Australian Ambassador, Miles Armitage, and the Secretary of State for Electricity, Water and Urbanisation, Timor-Leste, Senor Januario da Costa Pereira, respectively.

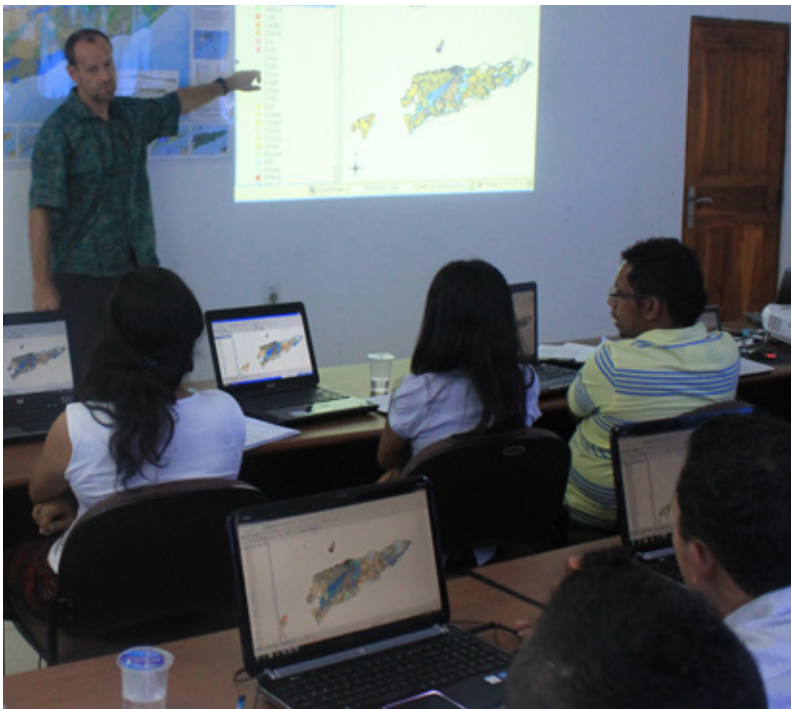


Figure 4. Training in GIS mapping for staff from the DNGRA and other Timor-Leste government agencies. Attendees were instructed in GIS mapping and used these skills to reproduce the National Hydrogeology Map.

Groundwater vulnerability to climate change

Climate change is likely to impact on groundwater resources in Timor-Leste by reducing groundwater recharge and availability and increasing groundwater use as surface water becomes scarce. Groundwater quality in coastal freshwater aquifers may also be affected through seawater intrusion as a result of higher sea levels. In this project, Geoscience Australia investigated the bio-physical vulnerability of groundwater systems to climate change while Charles Darwin University used this data to analyse the socio-economic vulnerability of the Timorese people and their livelihoods with respect to changes in water resources.

The potential impacts on people and their livelihoods, caused by reduced groundwater recharge and availability, are dependent on sensitivity to change (a combination of aquifer types and population densities in particular areas). The vulnerability of a community depends on the potential impact of climate change and the capacity of that community or system to adapt to those impacts. A high adaptive capacity, that is a system's ability to respond to change, can minimise the vulnerability of a community or nation to challenges such as climate change.

Areas of higher vulnerability

The results of the combined bio-physical and socio-economic vulnerability analysis identified Dili, Liquica, Oecussi and Baucau as areas of high potential impact from climate change. High population growth and density increases the potential impacts in Dili and Baucau. Liquica's localised, low yielding aquifers and poor rainfall and the extremely low yield of Oecussi's fractured rock aquifers mean that reduced groundwater availability could have a high potential impact in both of these regions.

Key adaptation options to assist communities in adapting to climate change identified by the project team were:

- Documentation and monitoring of groundwater resources to improve understanding of water availability
- Managed aquifer recharge (storing water underground and re-use)
- Integrated surface and groundwater management
- Integrated water harvesting and irrigation maintenance to build local resilience and adaptive capacity
- Agricultural diversification to build resilience and adaptive capacity
- Improving governance (policy and regulation)

The main outputs of the project will provide a fundamental knowledge base and practical tools to assess climate change impacts on groundwater. The close partnership developed by the project team and the Timor-Leste Government agencies as well as comprehensive training of Timorese staff has ensured that these outputs and the tools developed will continue to be used.

Summary and future research

Some major gaps remain in our knowledge of:

- Timor-Leste's groundwater resource characteristics (such as the size, location, dynamics and sustainability of extraction)

- interactions and connectivity between groundwater and surface waters
- potential threats to groundwater resources (such as salt water intrusion and other contaminants).

There is scope for more detailed studies on aquifers across Timor-Leste to provide additional data for the Hydrogeology Map and more detailed and localised maps of specific areas. A number of research, capacity building and communication activities remain to be carried out to ensure effective management of groundwater resources and source protection in Timor-Leste.

The main outputs of this project have the potential to be applied in other countries or regions. The Hydrogeological Framework presented here provides a means through which countries can build data sets and maps on groundwater resources and assess the threats and vulnerabilities they face, such as climate change

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Dating Australia's uranium deposits

Chemical dating of uraninite to encourage explorers

Andrew Cross, Subhash Jaireth, David Huston and Roger Skirrow

Australia hosts the largest uranium reserves in the world, boasting 23 per cent of the global total, and is currently the third ranked uranium producer behind Kazakhstan and Canada. Nevertheless, there are only scarce geochronological data on the timing of formation for the majority of Australian uranium deposits.

Because uraninite is commonly a major ore constituent of many primary uranium deposits its geochronology has the potential to provide a direct age of mineralisation. This contrasts with other geochronological studies of mineral deposits where the age of mineralisation is based on the inference that the dated mineral (such as muscovite, biotite, monazite and xenotime) crystallised at the same time as the ore. Additionally, the high concentration of uranium in uraninite requires only a relatively short time period for the accumulation of significant concentrations of radiogenic lead.

To encourage exploration for uranium, Geoscience Australia researchers undertook dating of selected uranium deposits as a part of its Onshore Energy Security Program (2006 to 2011; Skirrow 2011). This article outlines the results from the Kintyre deposit in Western Australia and the Oasis deposit in Queensland where the timing of uranium mineralisation was directly dated using Electron-Probe Micro-analysis (EPMA) chemical uranium-thorium-lead (U-Th-Pb) uraninite analysis. This analysis measures the natural radioactive decay of uranium and thorium to lead to measure time.

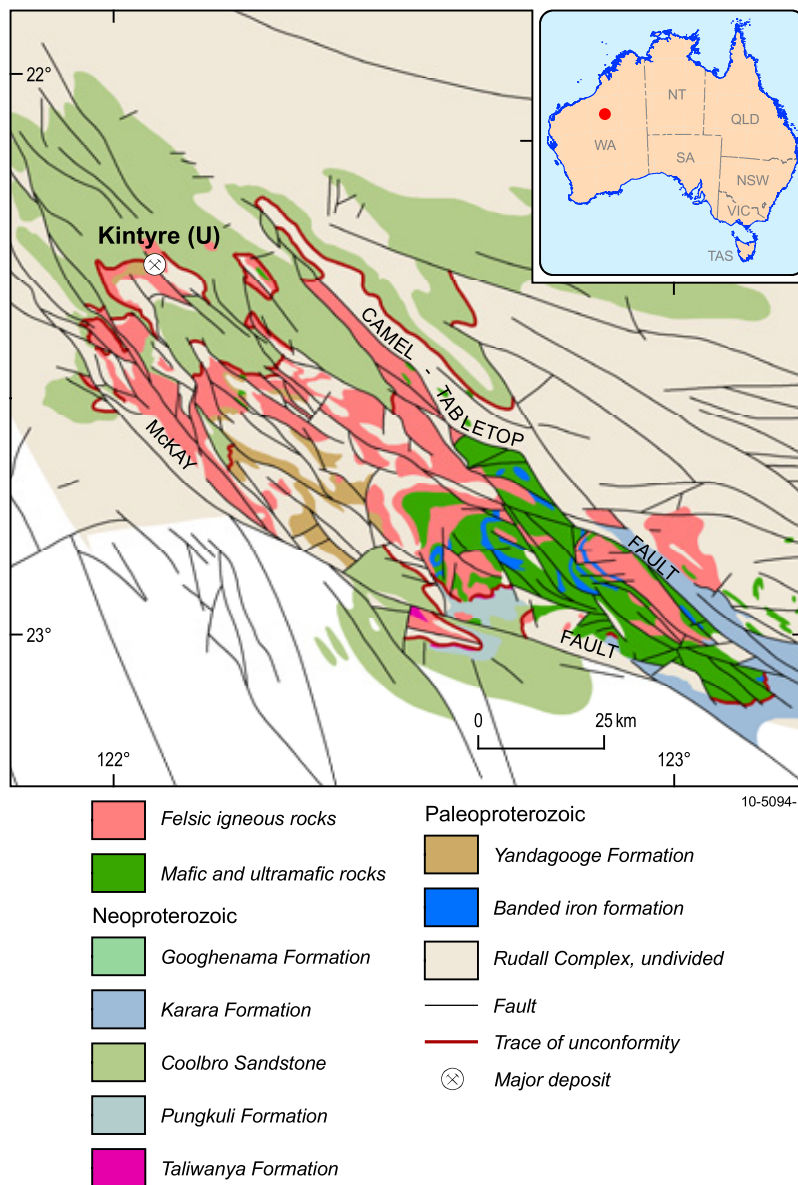


Figure 1. Generalised geological map of the Paterson region (modified after Roach 2010).

Chemical analysis of uraninite

It is just over 100 years since the very first U–Pb age determinations were carried out on uranium-bearing minerals. Although truly landmark studies in their time, the chemical U–Pb ages determined by Bertram Boltwood and Arthur Holmes were done before the existence of isotopes was recognised. They had only rudimentary estimates of the U–Pb decay rate and were unaware that thorium also decays to lead (^{232}Th – ^{208}Pb). Although the vast majority of all U–Pb age determinations undertaken currently are isotopic (that is, ^{235}U – ^{207}Pb , ^{238}U – ^{206}Pb), chemical U–Th–Pb dating has also been used to determine the timing of geological events since the early 1990s. The chemical analyses are almost exclusively undertaken by EPMA and the vast majority of geochronological work has been carried out on monazite (Suzuki & Adachi 1991; Montel et al 1996; Cocherie et al 1998; Williams et al 1999). This method, however, can also be affectively applied to date uraninite (Bowles 1990, Förster 1999, Kempe 2003).

Chemical U–Th–Pb dating is based on the premise that all lead in the sample is radiogenic in origin, derived solely from the radiogenic decay of ^{235}U , ^{238}U and ^{232}Th . A composite age equation combining all three decay schemes is then used together with the EPMA-derived concentrations for uranium, thorium and lead. The equation is then solved by iteratively substituting a value for t (time) into each of the equations until a solution is reached (for a full explanation of the technique see Cross et al 2011 and Montel et al 1996). Cross et al (2011) recently highlighted the potential of this method for dating uraninite by demonstrating a strong agreement between the existing and/or inferred ages of the uraninites studied, with the Chemical U–Th–Pb ages and independent SHRIMP $^{207}\text{Pb}/^{206}\text{Pb}$ results. A potential drawback of the method however, is that common or environmental lead cannot easily be detected and accounted for. Although Bowles (1990) and Cross et al (2011) note very low common lead contents in some natural uraninites, this should not be assumed to be the case for all uraninite. However, Cross et al (2011) concluded that EPMA chemical dating of uraninite is able to provide relatively inexpensive, robust reconnaissance-level age determinations.

EPMA analyses were undertaken using a Cameca SX100 electron microprobe located at the Research School of Earth Sciences (RSES) at the Australian National University (ANU) in Canberra. The uraninite grains were analysed for uranium, thorium, lead, yttrium, silicon, calcium, titanium and iron using a 15 kV electron beam regulated at 100 nA. Full details of the analytical procedures and methodology are described in Cross et al (2011). The uraninite standard U6897 (~1058 to ~1043 Ma (Bill Davis, Geological Survey of Canada, personal communication) was used as an internal check for the EPMA U–Th–Pb chemical dating results.

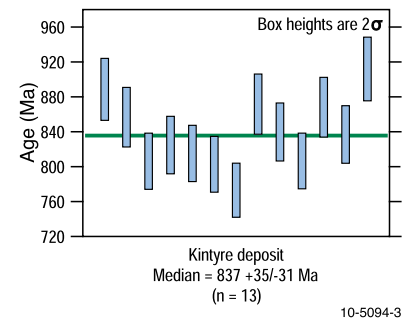
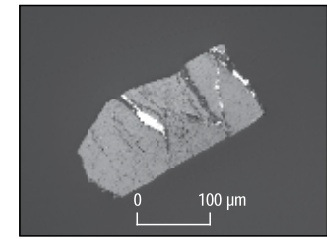


Figure 2. Representative reflected light image of Kintyre uraninite grain (top) and plot of EPMA chemical U–Th–Pb ages for the Kintyre deposit. The highly reflective area in the centre of the uraninite is galena.

Kintyre deposit

The Kintyre unconformity-related uranium deposit (latitude: 122.0709°E, longitude: 22.3387°S) is located about 420 kilometres southeast of Port Hedland, in the Paterson Orogen, Western Australia. It is jointly owned by Cameco Corporation (70 per cent) and Mitsubishi Development Pty Ltd (30 per cent). It is one of the largest unconformity-related deposits in Australia outside the Pine Creek Orogen with a resource of 24 000 tonnes of U_3O_8 (OZMIN database).

The Kintyre deposit is hosted by the Paleo- to Mesoproterozoic Rudall Complex (figure 1), comprising carbonaceous metasediments of the Yandagooge Formation adjacent to the unconformity with the Neoproterozoic Coolbro

Sandstone, the basal unit of the overlying Yeneena Basin (McKay & Mieзитis 2001). The Coolbro Sandstone and Rudall Complex were subsequently folded and deformed during the ~840 to ~810 Ma Miles Orogeny (Huston et al 2010). Uranium typically occurs as uraninite in carbonate–chlorite veins which tend to be concentrated in the hinges of folds and have an orientation sub–parallel to the axial planes.

Geochronological data constrain deposition of sediments in the Yeneena Basin occurred between ~910 Ma, the age of the youngest detrital zircon in the basal Coolbro Formation (Bagas & Nelson 2007), and ~830 Ma, the age of intermediate to mafic rocks that intrude the lower part of the basin (D. Maidment, unpublished data). These constraints are compatible with a Pb–Pb isochron age for carbonate rocks of the Isdell Formation of ~860 Ma (R Maas & DL Huston, unpublished data), interpreted as a diagenetic age. The sample of Kintyre uraninite (ANSTO minerals number Kintyre-13) was collected from the mineralised zone of the deposit in 1997 by CRA Exploration Pty Ltd and analysed by ANSTO in the same year.

The EPMA chemical U–Th–Pb uraninite results from Kintyre were interpreted by Cross et al (2011) to have a crystallisation age of 837 +35/-31 Ma (figure 2). This result is similar to the ~845 Ma age suggested for mineralisation by R. Maas of the University of Melbourne in Huston et al (2009) and confirms that uranium mineralisation post dates the host rocks of the Paleoproterozoic Yandagooe Formation and is likely related to the ~840 to ~810 Ma Miles Orogeny. Importantly, the recognition of unconformity–related mineralisation of Neoproterozoic age in the Paterson Orogen has implications for similar uranium systems related to other Neoproterozoic regions in Australia.

Oasis deposit

The Oasis uranium deposit (latitude: 144.4461°E, longitude: 18.8035°S) is located 20 kilometres northwest of Lynd in the Georgetown Inlier, northeast Queensland. Uranium mineralisation in this region is predominantly volcanic-related and associated with calderas, ring-dykes and linear fracture-controlled intrusion systems (McKay and Mieзитis 2001). The largest deposits in the region are Ben Lamond and Maureen and the mineralisation is thought to have occurred in two main episodes, the late Devonian to early Carboniferous and the late Carboniferous to early Permian (McKay and Mieзитis 2001). The age of the Maureen deposit is inferred to be 330 ± 10 Ma based on a uranium–lead age of fluorite closely associated with mineralisation (Huston et al 2011a).

In contrast to the dominant volcanic-related uranium mineralisation in the Georgetown region, the Oasis deposit is hosted

by a north-trending shear zone that cuts the Mesoproterozoic Mywyn Granite, which intrudes Paleo– to Mesoproterozoic metasedimentary rocks of the Etheridge province. The mineralised zone comprises a mylonitic, biotite-rich unit that is tabular in shape, ranges from less than 10 to 15 metres thick and extends for 300 metres along strike reaching a depth of 175 metres with grades between 0.12 to 0.17 per cent U₃O₈ (Huston et al 2011b). Uraninite is the dominant ore mineral which in some cases appears to have overgrown biotite (Huston et al 2011b).

The host Mywyn Granite is an S-type, strongly deformed foliated, feldspar porphyritic granite. Recent SHRIMP U–Pb zircon geochronology reported by Neumann and Kositcin (2011) has constrained the crystallisation age of this unit to 1559 ± 3 Ma, which provides a maximum age for uranium mineralisation. Analyses of muscovite and biotite from the mineralised mylonitic zone, using the argon⁴⁰/argon³⁹ method (Ar–Ar) have ages between 439 to 429 Ma. The ~439 Ma age was interpreted by Huston et al (2011b) to represent a minimum age of mylonitic deformation, whereas the ~429 Ma age, a later period of muscovite growth.

The EPMA chemical U–Th–Pb analyses of uraninite from the mineralised mylonitic zone were interpreted by Huston et al (2011b) to have crystallised at 433 +3/-4 Ma. This result is



well within error of the 439 to 429 Ma mica ages determined from the same samples. Therefore, the period between ~440 to ~430 Ma is seen to be a good estimate for the timing of uranium mineralisation at the Oasis deposit. This result suggests that uranium mineralisation at the Oasis deposit was influenced by the mid-Silurian, Benambran deformational event which affected much of North Queensland including the Camel Creek, Hodgkinson and Charters Towers regions (Champion et al 2009). Additionally, this new age for the Oasis deposit demonstrates that uranium mineralisation in the Georgetown region has occurred in possibly three different time periods, the mid-Silurian, late Devonian to early Carboniferous and the late Carboniferous to early Permian.

Conclusions

The EPMA chemical ages for the Kintyre unconformity-related uranium deposit and the Oasis shear-hosted uranium deposit are considered relatively robust radiometric age determinations. In both cases, the EPMA chemical ages are supported by independent isotopic results. These results demonstrate that in some circumstances, EPMA chemical U-Th-Pb geochronology of uraninite can be used to directly date uranium mineralisation, providing relatively inexpensive, robust, reconnaissance-level radiometric age determinations.

Acknowledgements

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For more information

email ausgeomail@ga.gov.au

Related articles/websites

Uranium mineralisation events in Australia: geochronology of the Nolans Bore, Oasis, Kintyre, Mt Gee-Armchair and Maureen uranium deposits (*Geoscience Australia Record* 2011/12)

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=71639



Short Film Competition

Submit a short film demonstrating
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Join Geoscience Australia and the Australian Science Teachers Association
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First trans-Tasman collaborative workshop a resounding success

On 8 and 9 March 2012, Geoscience Australia hosted the Tasman Frontier Petroleum Industry Workshop in Canberra. The workshop focussed on the vast unexplored frontier region extending between eastern Australia, western New Zealand and New Caledonia (figure 1). The aim of the workshop was to deliver up-to-date pre-competitive geoscientific information on this region to the petroleum exploration industry as well as stimulate discussion on the future of

exploration in the region.

The workshop was the first cross-boundary petroleum industry event held collaboratively by the three trans-Tasman jurisdictions, represented by Geoscience Australia, New Zealand's GNS Science (formerly the Institute of Geological and Nuclear Sciences)

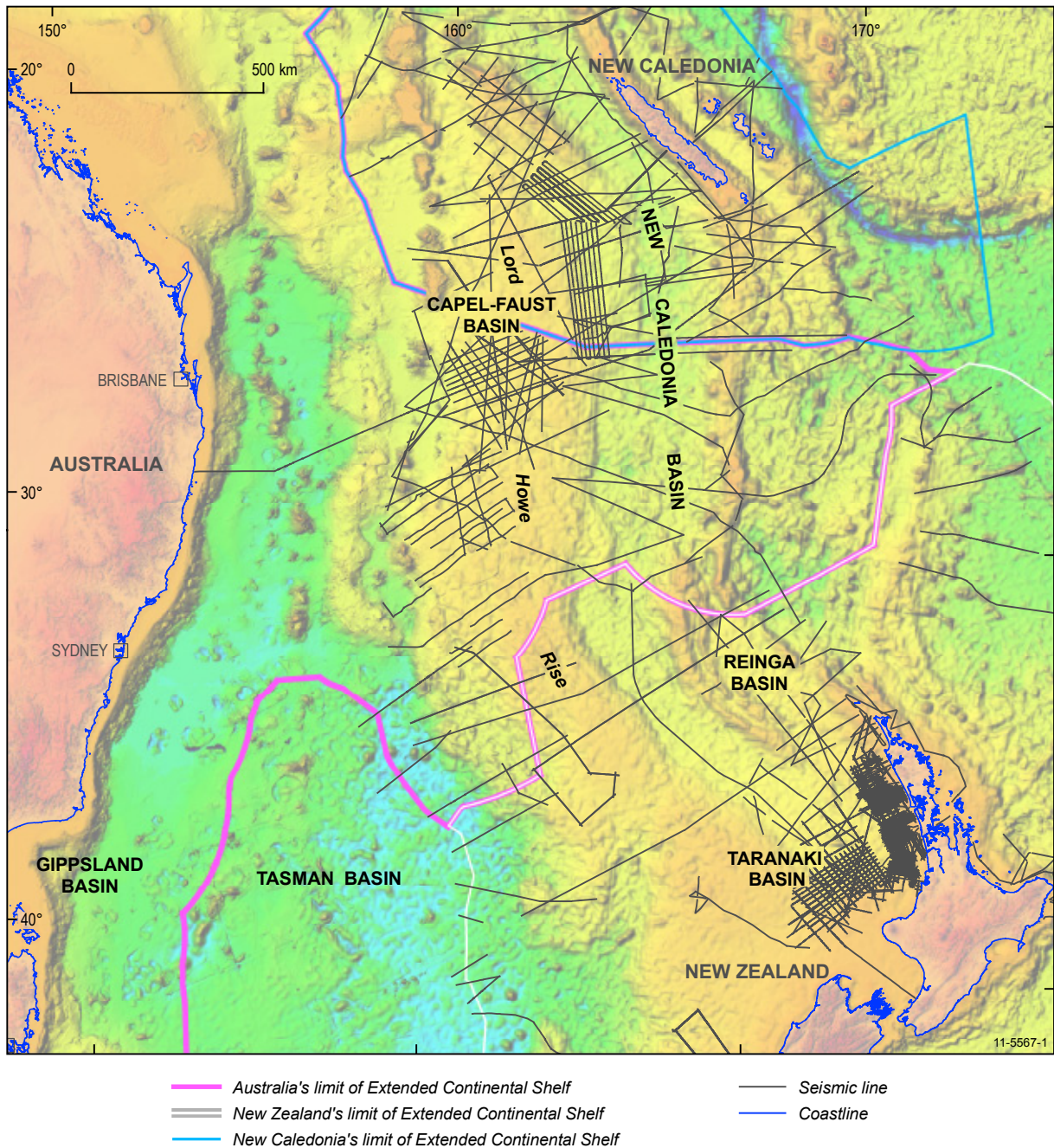


Figure 1. Location of the Tasman Frontier region showing the coverage of reflection seismic data included in the Tasman Frontier Geophysical Database.



and the New Caledonian Department of Industry Mines and Energy (DIMENC). It was attended by over 50 delegates including representatives of 24 exploration-related companies from Europe, China and the United States of America, as well as representatives from government science agencies from Australia, New Zealand, New Caledonia and France.

The first day of the workshop showcased the results of Geoscience Australia's recently completed assessment of the Capel and Faust basins in Australia's remote eastern maritime jurisdiction (see *AusGeo News* 99). Assessments of basins in the adjacent New Zealand and New Caledonian territories, including the Reinga Basin and the New Caledonia Trough, were also presented. On the second day, the presentations focused on regional-scale syntheses of tectonic history, stratigraphy and petroleum potential, and overviews of regulatory regimes for exploration within the region.

A highlight of the workshop was the release of the Tasman Frontier Geophysical Database. The database is a first-ever, comprehensive, cross-boundary compilation of all publicly available digital reflection seismic data from the offshore eastern Australian, New Zealand and New Caledonian jurisdictions. It improves data access considerably by offering a single point of access for seismic data from the three countries. The standardised seg-y data format also enables the quick loading of data to interpretation software platforms. Future updates to the product are planned and it may be expanded to include other data types.

The workshop concluded with an engaging open-forum discussion that covered topics such as geological uncertainties, future potential data acquisition and possible regulatory mechanisms for exploration in remote frontier regions. It was apparent that there is a significant

level of industry interest in exploration in the Tasman Frontier region. One outcome is a follow up meeting, planned for late 2012, after delegates have the opportunity to examine and interpret the information contained in the Tasman Frontier Geophysical Database. One of the largest remaining offshore exploration frontiers in the world may finally be coming into the sights of the global explorer.

***For further information
on the workshop and data
products***

email

tasman.frontier@gns.cri.nz

Related articles/websites

Tasman Frontier web portal

[www.gns.cri.nz/cgi-bin/
tasmanfrontier.asp](http://www.gns.cri.nz/cgi-bin/tasmanfrontier.asp)

AusGeo News 99: Integrated
assessment of the Capel and Faust
basins, offshore eastern Australia

[www.ga.gov.au/ausgeonews/
ausgeonews201009/capel.jsp](http://www.ga.gov.au/ausgeonews/
ausgeonews201009/capel.jsp)



Increasing role for gas in the Australian and global energy mix

Geoscience Australia has recently released the *Australian Gas Resource Assessment 2012* which was prepared in conjunction with the Bureau of Resources and Energy Economics. This report documents the growth of gas resources and infrastructure developments which underpin the increasing role for gas in the Australian and global energy mix.

Some examples of key elements of the report include the doubling of coal seam gas (CSG) reserves since 2010, information about CSG/liquid natural gas (LNG) projects under construction and the identification of tight and shale gas resources. It also provides information on major offshore conventional gas projects which have recently commenced construction, including Prelude in the Browse Basin, the world's first floating LNG project. The release of the report also coincides with the commencement of operations at Australia's third export LNG project, Pluto, in the Northern Carnarvon Basin.

The report builds on the Australian Energy Resource Assessment (AERA) which was published in March 2010 as a supporting document to the Energy White Paper process. The AERA

(Geoscience Australia and Bureau of Agricultural and Resource Economics 2010) is the national prospectus for energy resources.

Since the release of AERA there have been significant changes in gas resources and within the gas market. The report provides an assessment of Australia's gas resources in 2012 and has been released to contribute to the final phase of the White Paper process.

For more information

email ausgeomail@ga.gov.au

Related websites/articles

Australian Gas Resource Assessment 2012

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=74032

Australian Bureau of Resources and Energy Economics

<http://bree.gov.au/>

Australian Energy Resource Assessment (AERA)

www.ga.gov.au/products

New geophysical datasets released

Data from four onshore and offshore airborne magnetic/radiometric, and elevation surveys and three gravity surveys covering onshore Western Australia have been released since March 2012. These datasets can be interpreted to reveal the sub-surface geology of the survey areas and will be a valuable tool in assessing their mineral potential and improving the understanding of basin provinces.

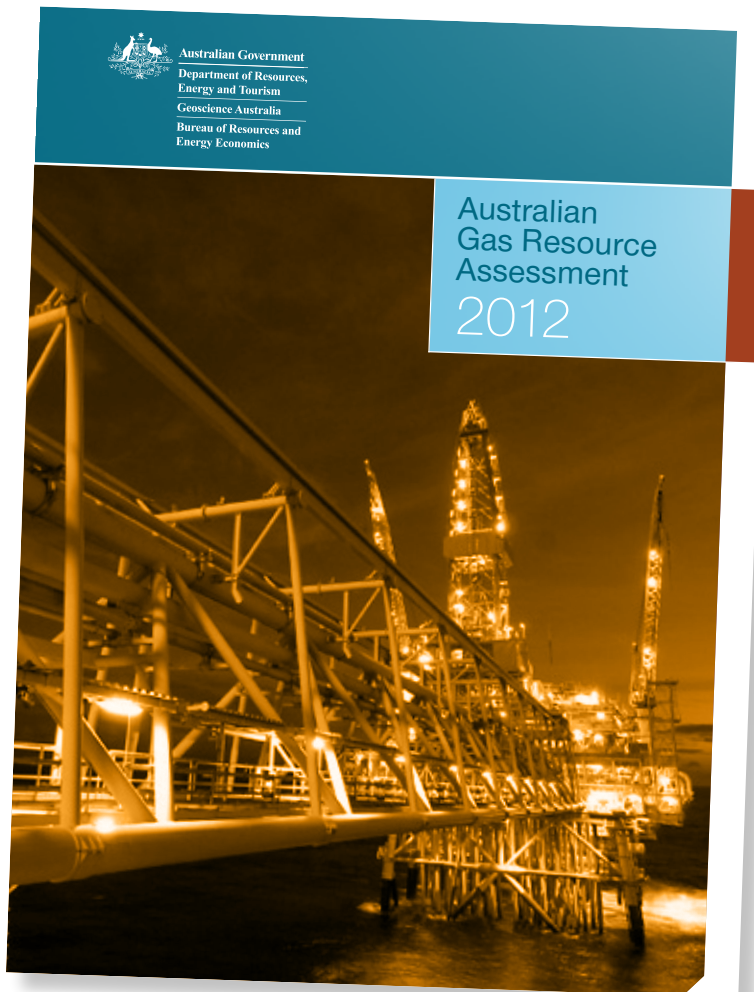


Table 1. Details of the airborne magnetic, radiometric and elevation surveys.

Survey	Date	1:250 000 map sheets	Line spacing/ terrain clearance/ Orientation	Line km	Contractor
Carnarvon Basin North WA	July 2011– February 2012	Onslow (pt), Ningaloo (pt), Yanrey (pt), Minilya (pt), Winning Pool (pt), Quobba (pt), Kennedy Range (pt)	400 m/ 60 m/ east–west	106 320	GPX Surveys Pty Ltd.
South Officer 1 WA	June 2010– February 2011	Westwood (pt) Neale (pt), Vernon (pt), Plumridge (pt), Jubilee (pt)	200 m/ 50 m/ north–south	180 000	Thomson Aviation Pty Ltd.
South West 1 (Moora) WA	June 2011– February 2012	Moora (pt), Bencubbin (pt), Perth (pt), Kellerberrin (pt)	200 m/ 50 m/ east–west	138 874	Aeroquest Airborne Pty Ltd.
Barrow-Dampier Offshore WA	August 1993– January 1994	SE50-10 (pt), SE50-11 (pt), SE50-12 (pt), SE50-13 (pt), SE50-14 (pt), SE50-15 (pt), Bedout Island (pt), Barrow Island (pt), Dampier (pt), Onslow (pt), Yarraloola (pt), Ningaloo (pt), Yanrey (pt), SF49-12 (pt)	1000 m/ 80m asl/ 150°–330°	132 640	World Geoscience Corporation Ltd.

Table 2. Details of the gravity surveys.

Survey	Date	1:250 000 map sheets	Station spacing/ orientation	Stations	Contractor
Peak Hill–Collier WA	August 2011– February 2012	Newman (pt), Robertson (pt), Collier, Bullen (pt), Peak Hill, Nabberu (pt)	2.5 km/ NS–EW grid	9170	Daishsat Pty Ltd
Eucla SW, Central, East WA	November 2011–April 2012	Balladonia (pt), Culver (pt), Naretha (pt), Loongana, Madura, Burnabbie (pt), Forrest, Eucla (pt), Noonaera (pt)	2.5 km/ NS–EW grid	14 703	Atlas Geophysics

Table 2 continued over page.

Survey	Date	1:250 000 map sheets	Station spacing/ orientation	Stations	Contractor
Kimberley Road Traverses WA	August 2011– September 2011	Montague Sound (pt), Drysdale (pt), Ashton (pt), Cambridge Gulf (pt), Charnley (pt), Mount Elizabeth (pt), Lissadell (pt), Derby (pt), Lennard River (pt), Dixon Range (pt), Noonkanbah (pt), Mount Ramsay (pt), Gordon Downs (pt), Crossland (pt), Billiluna (pt)	400 m station spacing along 2700 km of gazetted roads	6750	Daishsat Pty Ltd

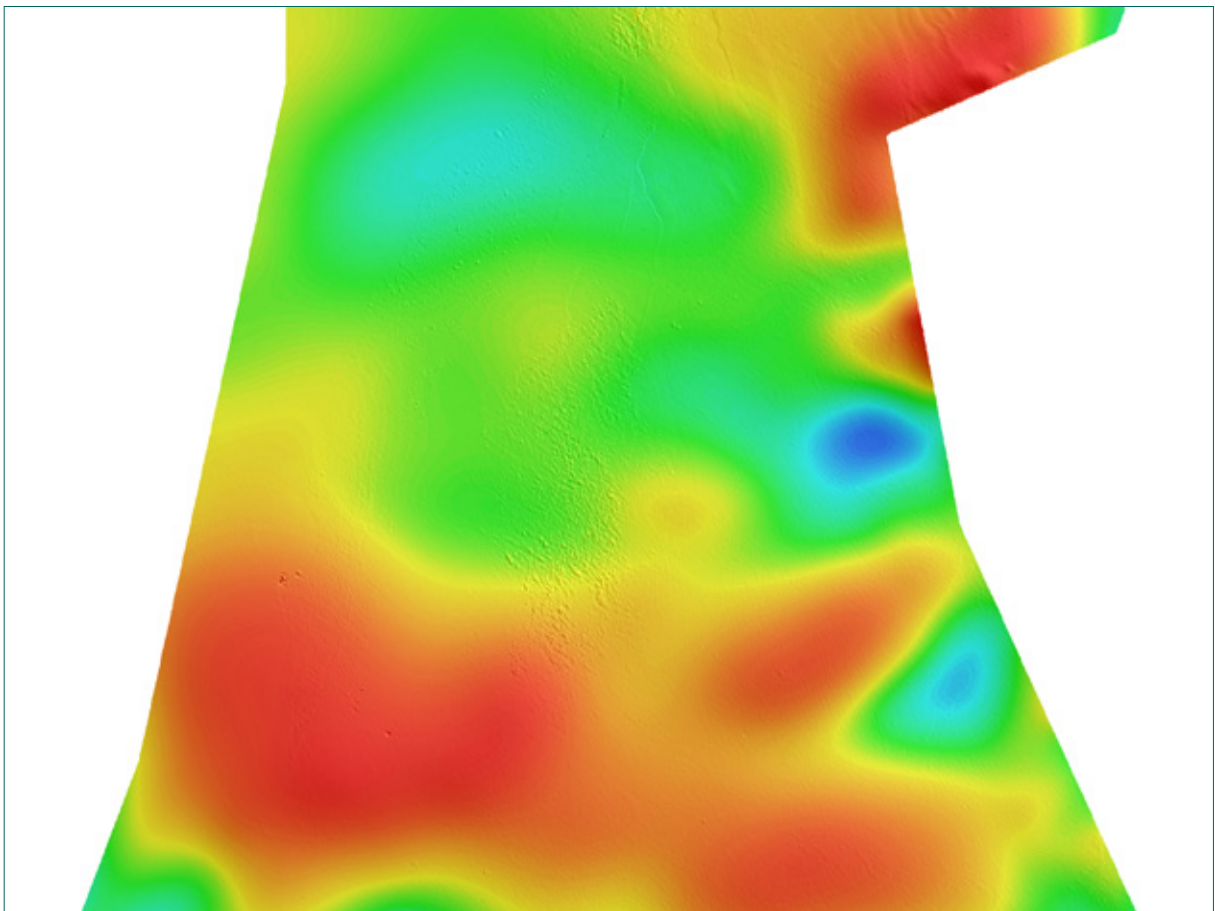


Figure 1. Total magnetic intensity image from the Carnarvon Basin North airborne survey.

For more information

email ausgeomail@ga.gov.au

Related articles/websites

Geophysical Archive Data Delivery System (GADDS)

www.geoscience.gov.au/gadds.



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Discovering the Earth sciences

Geoscience Australia continues to offer extensive education and outreach programs to promote awareness and knowledge of the Earth sciences, and the contribution geoscience makes to the Australian economy, resource management and environmental protection.

Outreach programs, such as Open Day, and participation in activities to celebrate National Science Week and Earth Science Week, aim to raise awareness and promote the programs that Geoscience Australia undertakes.



Figure 1. Two of the winning entries in the 2012 Top GeoShot competition: 'Wilson's Promontory National Park, Victoria' by John Gallagher and 'Lambert Glacier, Australian Antarctic Territory' by Ryan Ruddick.

Geoscience Australia's Open Day will be held on Sunday 19 August 2012. Open Day, which coincides with National Science Week celebrations, is an opportunity for interested members of the public to visit the agency's headquarters at Symonston, ACT. A range of displays, tours and activities will showcase how the agency's research is being applied to some of the major challenges facing Australia today. Building and laboratory tours, an Antarctic experience, a walk back in time, water sample taste testing, rock identification, gold panning and exploding volcanoes are some of the activities planned for the day. A special attraction will be a juvenile Tyrannosaurus roving the building.

Earth Science Week (ESW) is an international initiative to promote the Earth sciences and raise awareness of the contribution geoscience makes to the community. This year's ESW will be held from 14 to 20 October and the theme is 'Discovering careers in geoscience'. Geoscience Australia has hosted Australia's Earth Science Week website and coordinated celebrations across Australia for 14 years.

In the lead up to Earth Science Week, Geoscience Australia also hosts two competitions – *GeoLogi* short film competition and *Top GeoShot* photographic competition.

The *GeoLogi* short film competition is in its sixth year and is hosted by Geoscience



Australia and the Australian Science Teachers Association. The theme for this year's competition is 'Discovering Geoscience'. It is open for individuals, groups or classes from any Australian primary or secondary school to submit a short film that explores the affect on the individual or community of natural hazards, rocks and minerals, geological history, local geology or recent geoscience research.

Top GeoShot photographic competition is open to members of the public. It aims to produce a collection of images that capture the essence of Earth science in Australia and amateur photographers are invited to submit their photographs (figure 1). This year's winning entries (or '*TopShots*') will be announced during Earth Science Week and will be on display in the foyer of the Geoscience Australia building.

Further information and updates on the Open Day and Earth Science Week activities or either of the competitions will be included on the Education Centre website and in the regular *Education Centre Updates* newsletter.

For more information

email education@ga.gov.au

Related articles/websites

Education Centre website
www.ga.gov.au/education/public-events

Education Centre Updates newsletter
www.ga.gov.au/about-us/news-media/education-centre-updates.html

Top GeoShot 2012
Geoscience Australia's Photo Competition

Australian Government
Geoscience Australia

Get the PICTURE ...

Capture the essence of Earth science in Australia
2012 PHOTO COMPETITION

Closing date: 22 September
www.ga.gov.au/education/public-events



AMSA–NZMSS 2012 Joint Conference	1 to 5 July 2012
Australian Marine Sciences Association and New Zealand Marine Science Society West Point Hotel, Hobart, Tasmania Contact: Narelle Hall, PO Box 8, Kilkivan QLD 4600	p +61 7 5484 1189 f +61 7 5484 1456 e amsa@amsa.asn.au www.amsa-nzmss2012.com.au
Central Australian Basins Symposium	16 to 17 July 2012
Petroleum Exploration Society of Australia and Department for Manufacturing, Innovation, Trade, Resources and Energy, South Australia Alice Springs Convention Centre, Alice Springs NT Contact: AGENTUR Pty Ltd, GPO Box 1767, Darwin NT 0801	p +61 8 8981 2010 f +61 8 8942 2150 e cabs2012@agentur.com.au www.pesa.com.au/cabs3/index.html
6th International Sensitive High Resolution Ion MicroProbe (SHRIMP) Workshop	1 to 4 August 2012
Geoscience Australia and Australian Scientific Instruments Pty Ltd Lamington National Park via Brisbane, Queensland Contact: Geoscience Australia	p +61 2 6249 9543 or p +61 2 6249 9044 e SHRIMP2012@ga.gov.au www.ga.gov.au/minerals/projects/current-projects/geochronology-laboratory/geochronology-workshop.html
34th International Geological Congress	6 to 10 August 2012
Australian Geoscience Council Brisbane Convention and Exhibition Centre, Brisbane, Queensland Contact: Carillon Conference Management Pty Limited, PO Box 177, Red Hill QLD 4059	p +61 7 3368 2644 f +61 7 3369 3731 e info@34igc.org www.34igc.org
4th Asian Current Research on Fluid Inclusions (ACROFI) Workshop	11 to 12 August 2012
Queensland University of Technology, Brisbane, Queensland Contact: Terry Mernagh, Geoscience Australia, GPO Box 378, Canberra ACT 2601	p +61 2 6249 9640 f +61 2 6249 9971 e terry.mernagh@ga.gov.au http://acrofiv.herokuapp.com
National Science Week	11 to 19 August 2012
Australian Science Teachers Association Contact: National Science Week Project Coordinator PO Box 334, Deakin West ACT 2600	p +61 2 6282 9377 f +61 2 6282 9477 e nscwk@asta.edu.au www.scienceweek.net.au/



16 ARSPC–Australasian Remote Sensing and Photogrammetry Conference	27 and 28 August
Surveying and Spatial Sciences Institute and Remote Sensing and Photogrammetry Commission Melbourne Convention and Exhibition Centre, Melbourne, Victoria Contact: ICMS Pty Ltd, 84 Queensbridge Street, Southbank VIC 3006	p +61 3 9682 0244 f +61 3 9682 0288 e isprs2012@icms.com.au http://16.arspc.com/
AMEC Convention 2012	4 to 6 September 2012
Association of Mining and Exploration Companies Burswood Convention Centre, Perth, WA Contact: AMEC, PO Box 948, West Perth WA 6892	p +61 8 9320 5150 or p 1300 738 184 (Within Australia) f +61 8 9322 3625 or f 1300 738 185 (Within Australia) e events@amec.org.au www.amecconvention.com.au
Earth Science Week	14 to 20 October 2012
American Geological Institute Contact: Australian Earth Science Week celebrations	e education@ga.gov.au www.ga.gov.au/education/public-events/earth-science-week.html
Mining 2012 Resources Convention	31 October to 2 November 2012
Brisbane Convention and Exhibition Centre, Brisbane Queensland Contact: Vertical Events, PO Box 1153, Subiaco WA 6904	p +61 8 9388 2222 f +61 8 9381 9222 e info@verticalevents.com.au www.verticalevents.com.au/mining2012/
China Mining	3 to 6 November 2012
Tianjin Meijang International Convention and Exhibition Center Contact: Vertical Events, PO Box 1153, Subiaco WA 6904	p +61 8 9388 2222 f +61 8 9381 9222 e info@verticalevents.com.au www.verticalevents.com.au/chinamining2012/

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

