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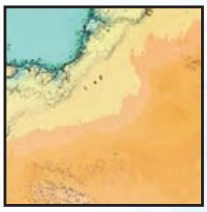
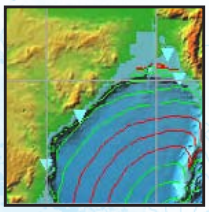
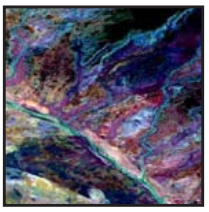

Welcome to the NEW ON-LINE *AusGeo News*

In this issue we are able to bring you some of the new detailed geoscience relating to the Boxing Day tsunami, in which over 200 000 people died amid widespread destruction in Indonesia, Sri Lanka, India and Thailand, and on the east coast of Africa.

As a result of this tragic event, the Australian Government is now actively planning for a higher level of involvement in disaster preparedness, both within Australia and in the surrounding region. Geoscience Australia is involved in discussions with Emergency Management Australia and the Bureau of Meteorology to establish a tsunami warning system for the region. We are also playing a major role in the development of a tsunami scenario to help the Catastrophic Disasters Working Group of the Australian Emergency Management Committee to exercise Australia's emergency management capability.

Other feature articles in this issue report on the progress of Geoscience Australia's 'Big New Oil' program, which provides pre-competitive information to support industry's search for new offshore oil provinces. The program began in 2003 with the Australian Government's Budget decision to fund a vital new phase of data acquisition and preservation of the data archive. Already one hundred thousand deteriorating seismic data tapes storing hundreds of thousands of kilometres of geoscience information from many offshore basins have been remastered onto new stable media. This represents about a third of the archive, with the process on track to be completed over the next three years.

The first of the major new seismic acquisition programs—the South West Frontiers Survey—has been completed, and the data collected will be available to explorers at the cost of transfer from April 2005. This includes processed seismic lines covering the proposed exploration acreage in the Bremer Sub-basin. Please note that the article on the offshore acreage release is embargoed till the ministerial announcement of the 2005 release areas in April at the APPEA Conference in Perth.

Other items of interest include an investigation into the application of groundwater geochemistry to assist mineral exploration under cover, as well as the latest editions of our annual assessment of Australia's identified mineral resources and the Australian and international geomagnetic reference field models.

Another important recent release is the first of the revised 100 000 scale topographic data and maps which are being updated in collaboration with state emergency management and mapping agencies as part of a pilot project in several locations across Australia.

I hope you enjoy this issue of *AusGeo News*. The new format will allow greater flexibility in content and production, and also allows us to report more promptly on items of current interest. As always, we are keen to receive your feedback and would like to have your comments about the new format.

Comment

Neil Williams

NEIL WILLIAMS
CEO Geoscience Australia

THE BOXING DAY 2004 TSUNAMI —A REPEAT OF 1833?

Phil Cummins and Mark Leonard

An article in the September 2004 issue of *AusGeo News* discussed how massive earthquakes in the Sumatra subduction zone have the potential to cause tsunamis large enough to affect the entire Indian Ocean basin.

This potential was demonstrated three months later when a magnitude 9 earthquake off northern Sumatra triggered the Boxing Day tsunami. Over 200 000 died amid widespread destruction in Indonesia, Sri Lanka, India, and Thailand and on the east coast of Africa.

Despite this major event, the danger of tsunamis in the Indian Ocean has not passed. A regional tsunami warning system could help to prevent further tragic loss of life.

▲ **Figure 1.** Great earthquakes in the Sumatran subduction zone. Note that other large earthquakes occurred in the Andaman and Nicobar Islands in 1881 and 1941.

The magnitude 9.0 Sumatra–Andaman Islands earthquake of 26 December 2004, which caused the most destructive tsunami in recent history, was the largest earthquake since the magnitude 9.2 Alaskan earthquake of 1964, and was among the five largest earthquakes in the past century. Such massive earthquakes only occur in subduction zones where two of the rigid tectonic plates that comprise the earth's surface are converging, and one plate, usually composed of heavier oceanic material, dives beneath another, usually composed of lighter continental material. The Boxing Day earthquake occurred in the Sunda subduction zone, where the Indo-Australian plate is sliding beneath Sumatra.

The locations of this and other major earthquakes along the Sumatra subduction zone are shown in figure 1. The great 1833 earthquake ruptured a segment of the subduction zone about 1000 kilometres southeast of the rupture area of the 2004 shock. Like the 2004 tsunami, the one following the 1833 earthquake devastated the adjacent coastal area of Sumatra. However—as shown in figure 2—most of the energy of the 1833 tsunami was directed into the open Indian Ocean. While the tsunami may have had an impact on Sri Lanka, the Maldives and other islands in the Indian Ocean, its origin further southeast along the zone prevented it from causing much damage in the Bay of Bengal, and there would have been little effect on Thailand. The wave height on the Australian coast may have been somewhat larger than during the 2004 tsunami, but Australia would still have been spared the main plume of energy radiated into the Indian Ocean.

Like the 1833 event, the effects of the 2004 tsunami in Sumatra were catastrophic. Tsunami run-up exceeded 30 metres in some places in Sumatra, where people had little time to escape and whole villages were razed. The 1833 event would not have produced the waves, 5–10 metres high, that hit Thailand and Sri Lanka last year about one to two hours after the earthquake.

As is typical in a subduction zone earthquake, on Boxing Day the seafloor rose near the plate boundary and subsided 100–200 kilometres landward of the boundary (see figure 1 of the September 2004 article). This resulted in a wave travelling to the east whose leading edge was receding, causing the sea to withdraw, while to the west the leading edge inundated the coast.

Thus, people in Thailand were given some warning by the sudden withdrawal of the sea, and in some cases lives were saved when this warning was recognised and acted on. In many cases, however, people did not understand the phenomenon and the subsequent sudden inundation killed many. In Sri Lanka, the first effect of the wave was inundation, giving people little or no warning. This would also have been the case in most areas hit by the 1833 tsunami.

Could victims of the 2004 tsunami in Sri Lanka and Thailand have been warned in time? The September 2004 *AusGeo News* article pointed out that tide gauges on Christmas Island and the Cocos Islands could provide effective warning of tsunamis caused by Sumatran earthquakes such as the one of 1833. The 1833 earthquake occurred off southern Sumatra, much closer to the Cocos Islands than was the 2004 earthquake.

While a tsunami like that of 1833 would arrive at the Cocos Island within about 20 minutes of the earthquake occurring, this was unfortunately not the case with the Boxing Day tsunami, whose source zone was closer to Thailand and Sri Lanka than to the Cocos Islands. A plot of the 2004 tsunami travel times (figure 3) shows that the tsunami had already passed Thailand and Sri Lanka by the time it reached the Cocos Islands. Clearly, a tsunami warning system will require more instrumentation in this region if it is to deliver effective warnings to those countries.

The extent of rupture along the arc and potential for future events

Earthquake ruptures relieve stress on the subduction zone plate boundary, so a zone segment that ruptures during a major earthquake might not be expected to rupture again for some time. In assessing the risk of future earthquakes and tsunamis in the region, the crucial question is: how much of the subduction zone ruptured during the 2004 earthquake?

As shown in figure 1, this earthquake did not rupture the segments of the subduction zone that ruptured during the 1833 and 1861 earthquakes. These segments can be expected to have been accumulating strain energy for 172 and 144 years, respectively, and so they have to be considered at risk for future earthquakes.

The 2004 earthquake did, on the other hand, rupture a substantial length of the subduction zone north of the rupture areas of the 1833 and 1861 shocks. While aftershocks appear to be active over a 1300-kilometre section of the zone stretching from the Andaman Islands in the north to the earthquake epicentre below the northern tip of Sumatra, the seismic waveform data appears to indicate that only a 450-kilometre length of the subduction zone off northern Sumatra ruptured (figure 4).

Has the stress on the plate boundary north of Sumatra been released or is it still accumulating, to be released in a future earthquake, perhaps generating another large tsunami? This is especially important for assessing the potential for further tsunami impact in Thailand, Sri Lanka and the Bay of Bengal.

Seismic waves will be generated efficiently only if the entire fault slips as a unit at essentially the same time (that is, within few minutes). Rupture over a longer time interval will not be as efficient, but tsunami waves may still be generated as long as the rupture occurs within 10–20 minutes. The arrival time of the tsunami in the Bay of Bengal—in particular at the tide gauge at Vishakapatnam, where it arrived two hours and 36 minutes after the earthquake occurred—suggests that the northern tip of the rupture that generated the tsunami is in the northern Nicobar Islands (i.e. between the northern boundary of the rupture area inferred from seismic waves and that inferred from aftershocks).

Finally, there are reports of widespread uplift and subsidence in the Andaman Islands, consistent with fault movement.

All these observations are consistent with a rupture offshore from Sumatra with rapid, coherent slip that generated seismic waves. As the rupture propagated northwards, the fault slip may have been less sudden, and therefore progressively less efficient at generating first seismic and finally tsunami waves. The suggestion is that stress was relieved on the plate boundary along the entire extent of the aftershock zone, but whether the stress was totally or only partially relieved has yet to be determined.

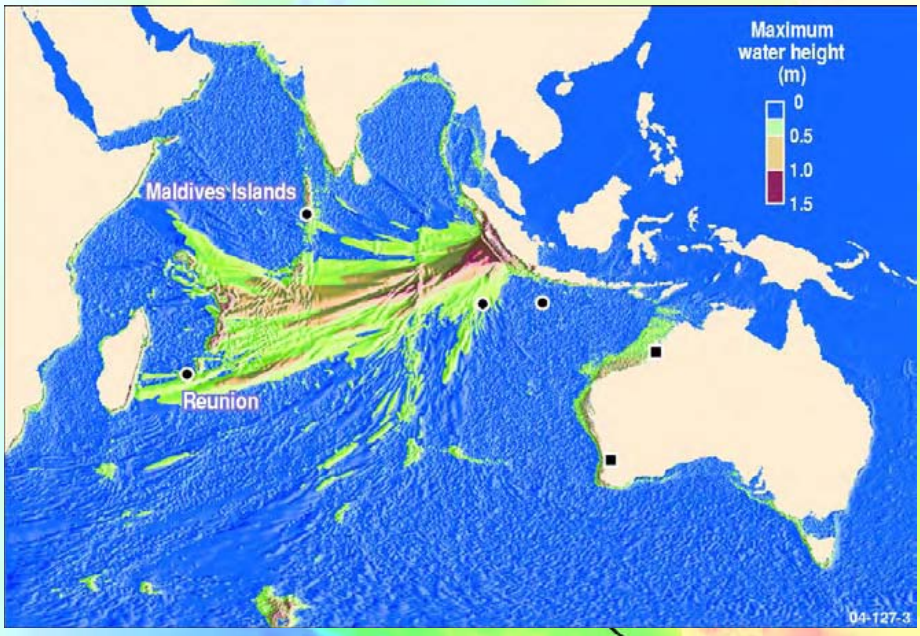

Figure 2. Calculated maximum amplitude of the tsunami caused by 1833 Sumatra earthquake. Most tsunami energy was directed into the open Indian Ocean, away from the Bay of Bengal. (Numerical modelling performed by David Burbidge of Geoscience Australia.)

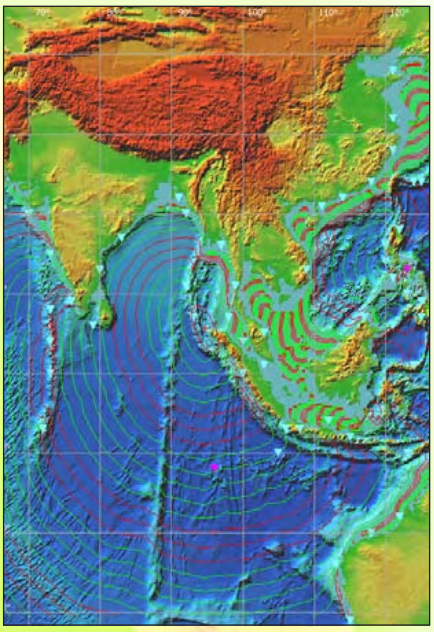

Figure 3. Travel-time contours for the Boxing Day tsunami. The source zone is roughly constrained by the tsunami arrival times at the Vishakapatnam and Cocos Islands tide gauges. (the latter is indicated by the magenta inverted triangle southwest of Indonesia). Contours are at 15-minute intervals, and alternate colour every hour. (Figure generated using software provided with the Integrated Tsunami Database for the Pacific, by Slava Gusiakov.)

Need for a tsunami warning system in the Indian Ocean

The tragic events of Boxing Day 2004 make starkly evident the importance of establishing a tsunami warning system for the Indian Ocean. More and better instrumentation, and a long-term program to educate people about the dangers of tsunamis, are clearly needed.

The short one to two hour lead time (figure 3) between an earthquake in the Nicobar–Andaman Islands region and the arrival of a tsunami in Thailand or Sri Lanka places stringent requirements on the operation of the technical component of such a warning system.

There is a far shorter lead time for tsunami impact on Sumatra itself. While the shaking due to the earthquake and the first, receding wave of the tsunami are likely to provide some warning, an extensive and long-term public education program is needed if the local population is to recognise these signs and be aware of evacuation routes.

As the September 2004 *AusGeo News* article surmised, the greatest tsunami threat in the Indian Ocean appears to be posed by great subduction zone earthquakes off Sumatra. It seems likely that the 2004 earthquake has relieved stress on the plate boundary from northern Sumatra to the Andaman Islands, so that great earthquakes are less likely to occur there in the near future. However, the possibility cannot be discounted that enough stress remains to cause an earthquake that might lead to another large tsunami in the Bay of Bengal.

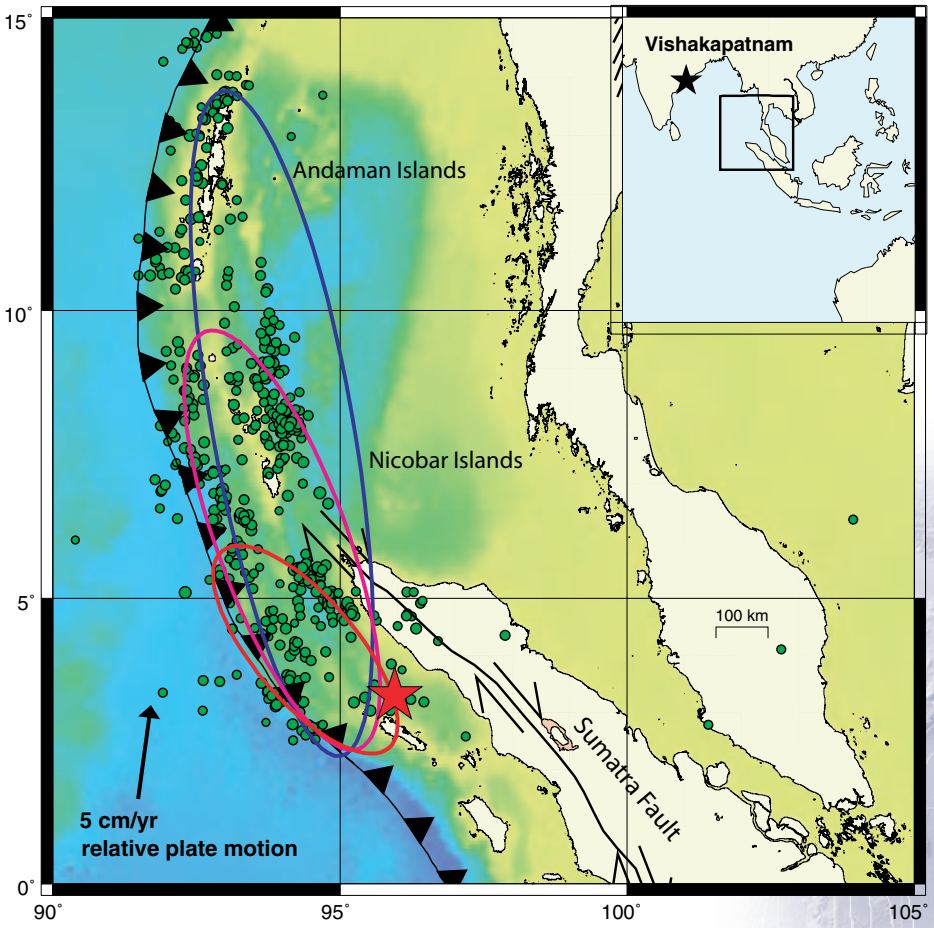

Figure 4. The 26 December 2004 Sumatra–Andaman Islands Earthquake. The red star indicates the epicentre of the main shock, and green circles those of aftershocks, estimated by the US Geological Survey. The red, magenta, and blue ellipses indicate respectively the area of seismic wave generation (from a model by Chen Ji of California Institute of Technology), tsunami generation (from travel time computations by Kenji Satake and Eric Geist), and crustal deformation (from information supplied by Roger Bilham of the Cooperative Institute for Research in Environmental Sciences). The position of the tide gauge at Vishakapatnam is indicated.

Further south, the plate boundary off central and southern Sumatra has not ruptured since the mid-1800s, so we know that these areas have accumulated considerable strain energy that could be released in a massive earthquake resulting in another ocean-wide tsunami.

Finally, the Makran subduction zone off the coast of Iran and Pakistan is another source zone for large tsunamis, as we know from the magnitude 8 earthquake and tsunami that occurred there in 1945.

The Indian Ocean countries, including Australia, cannot ignore the potential for future destructive earthquakes and tsunamis. The need for an Indian Ocean tsunami warning system is as urgent as ever.

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Geoscience Australia's Southwest Frontiers Geophysical Survey:
NEW DATA AND OPPORTUNITIES FOR PETROLEUM EXPLORATION

Barry Bradshaw, Alexey Goncharov and Fred Kroh

A geophysical survey of the southwestern Australian continental margin is the latest project to be funded by the Australian Government's $25 million 'New Oil' initiative.

Geophysical data collected during the Southwest Frontiers survey will be used to assess the petroleum potential of offshore basins on the southwest margin that are not currently held under permit. These include the frontier Mentelle Basin, the Bremer Sub-basin (part of the western Bight Basin) and the previously explored Vlaming Sub-basin (part of the Perth Basin).

Acquiring seismic data in this area is very challenging, with shallow carbonate hard-grounds in the Vlaming Sub-basin, deep water conditions (200–4000 m) in the Mentelle Basin and Bremer Sub-basin, and a system of submarine canyons throughout the Bremer Sub-basin.

Geoscience Australia contracted Veritas DGC to undertake the survey using its MV *Pacific Sword*, a dual-source, dual-streamer seismic vessel equipped with advanced integrated geophysical and navigation data acquisition systems.

Undertaken in October and November 2004, the survey acquired 2700 kilometres of industry-standard, 106-fold seismic reflection data recorded to 12 seconds two-way time using a 6–8 kilometre digital streamer and 4900 cubic inch air gun array. Seismic data collected includes 11 lines (1300 km) in the Bremer Sub-basin, seven lines (1100 km) in the Mentelle Basin, and three lines (300 km) in the Vlaming Sub-basin (figure 1).

This is the first seismic reflection data to be acquired in the Mentelle Basin and Bremer Sub-basin in almost 30 years, and the first in over a decade from the Vlaming Sub-basin. The new data provides a regional coverage of the Bremer Sub-basin and Mentelle Basin, and will help determine if suitable geological conditions exist in these frontier basins to have generated and trapped hydrocarbons.

The survey will also provide the first deep seismic reflection data (> 6 seconds two-way time) in the Vlaming Sub-basin. This data will be integrated with a 2000-kilometre grid of recently reprocessed data to improve our understanding of the geology and petroleum prospectivity of the sub-basin.

Launching a sonobuoy from the deck of the *Pacific Sword*.

Detail of a sonobuoy before launch

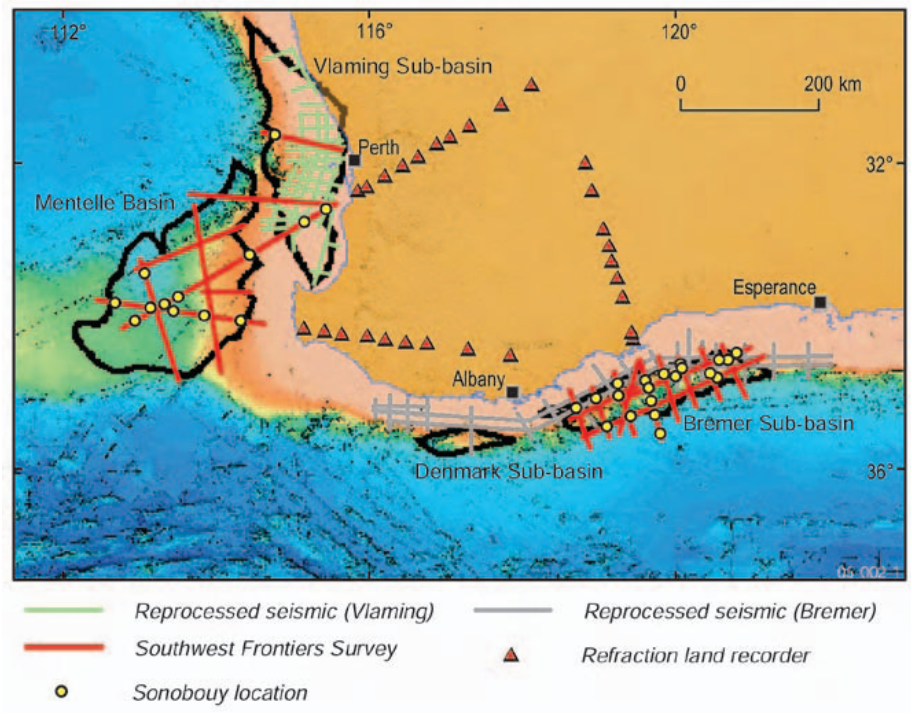


Figure 1. Map showing the location of the Southwest Frontiers offshore seismic survey and the associated land refraction recording stations. Also shown are the line locations of older seismic surveys that have recently been reprocessed.

View astern from the deck of the *Pacific Sword* during seismic collection

MV *Pacific Sword,* the seismic acquisition vessel contracted from Veritas by Geoscience Australia for the Southwest Frontiers survey

The seismic acquisition involved deployment of sonobuoys at sea and recording stations on land. The land stations were placed along the onshore continuation of three key survey lines (figure 1) to record refractions from the seismic vessel's energy source—a 4900 cubic inch air gun array.

The objectives of this refraction work are to:

- estimate seismic velocities to better constrain conversion of reflection time to true depth
- estimate sediment thickness
- constrain gravity modelling
- investigate the nature of basement and crust in this part of Australia.

Twenty-nine sonobuoys (19 in the Bremer Sub-basin) recorded data to maximum offsets of 23 kilometres. The onshore refraction survey deployed 19 stations in line with two survey lines in the Mentelle–Vlaming area, and nine stations collinear with one line in the Bremer Sub-basin. The new refraction seismic data will add substantially to existing onshore and offshore refraction datasets for this region.

All seismic reflection data (including field tapes) acquired during the Southwest Frontiers Survey with basic on-board processing (Radon de-multiple, DMO, Stack, Migration) will be available at cost-of-transfer rates from April 2005.

Seismic data acquired from the Bremer Sub-basin and three lines acquired in the Vlaming Sub-basin will be processed further (SRME, XRmult, Pre Stack time and/or depth migration, full stacks, near, middle and far offset stacks), and will also be available at cost-of-transfer rates in April 2005.

Reprocessed seismic datasets from previous industry surveys in the Vlaming and Bremer sub-basins are currently accessible through the Geoscience Australia Data Repository.

For more information, contact Barry Bradshaw at Geoscience Australia: phone +61 2 6249 9035, fax +61 2 6249 9980 or e-mail barry.bradshaw@ga.gov.au

Big New Oil —a progress report

Australia's gas reserves are at an all-time high and continuing to climb steeply, but oil reserves are in decline (figure 1).

The continent and its marine jurisdiction are vastly underexplored; only 8000 wells have been drilled and many offshore basins have never been tested (figure 2). The big fields in any new petroleum province are usually found first, so Australia's best chance of adding major new oil reserves is to find new petroleum provinces.

The Australian Government has made several key policy decisions with the aim of encouraging exploration investment in Australia. These include the decision in 2001 to provide access to government spatial data at the cost of transfer, enabling it to be available free online.

Geoscience Australia's online geological provinces database describes a multitude of offshore basins and sub-basins (144 at last count) and is also linked to detailed well and other data (see related website at the end of this article).

In 2003, the government announced the injection of an additional $61 million, over four years, into Geoscience Australia's petroleum program, to provide pre-competitive data in support of acreage release, and for the search for a new oil province, with new data acquisition and data preservation and archiving. This boost was followed by the introduction in the 2004 Federal Budget of tax incentives for exploration in frontier areas.

Geoscience Australia developed a portfolio of potential projects based on integrated programs of seismic acquisition, geological sampling and oil seep detection. Deepwater frontier basins are among the most promising candidates (figure 3). Some of the most prospective petroleum-bearing frontier provinces considered for new data acquisition are as follows:

- The Bremer Sub-basin, in deep water off the southwest margin between Albany and Esperance at the western end of the Great Australian Bight where reprocessed reconnaissance seismic data shows a thick and well-structured Mesozoic section.
- The Mentelle Basin is another significant Mesozoic depocentre, or area of very thick sediment deposition. The basin extends along the edge of the continental shelf from Perth to the southern tip of the continent and in deep water west to the Naturaliste Plateau.
- The Lord Howe Rise is a submerged ribbon continent in the Tasman Sea between Australia, New Zealand and New Caledonia. Before seafloor spreading in the Late Cretaceous, this continental sliver sat between Australia's first major offshore petroleum province of Bass Strait and New Zealand's petroleum-producing Taranaki Basin. There are more than a dozen depocentres on the Lord Howe Rise and some are thick enough to have generated hydrocarbons if organic-rich source rocks are present.

Following a round of industry consultation, the immediate priority areas selected for new data acquisition were the shallow-water Arafura Basin in northern Australia, and the deepwater frontier basins of the southwest margin. Validation of remote sensing as a reconnaissance technique for detecting hydrocarbon seepage in the vast offshore areas was also seen as an important part of the new program.

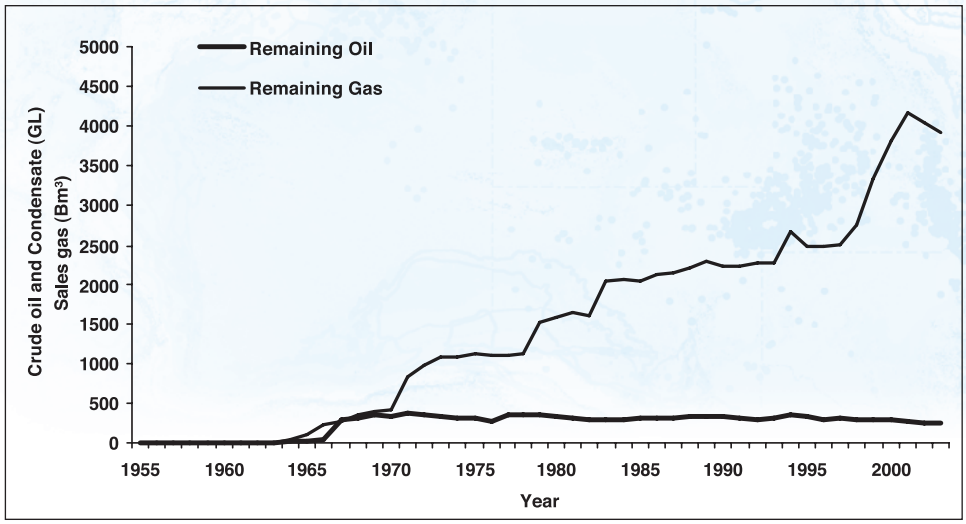


Figure 1. Graph showing Australia's gas and oil reserves through time.

In March 2004, a survey was undertaken in the natural laboratory of the Yampi Shelf on the North West Shelf, an area of known hydrocarbon seepage that is well covered by multiple datasets, including synthetic aperture radar, airborne laser fluorescence, Landsat, 'sniffer' water column geochemistry and 3D seismic. Active gas seepage was found, imaged, and tied back to its expression on seismic and bathymetric records.

In April 2005, the tools and techniques developed on the Yampi Shelf will be applied at a number of sites in the Arafura Basin, where remote sensing and seismic data indicate possible natural hydrocarbon seepage.

Geoscience Australia's program of data acquisition in the deepwater frontier basins of the southwest margin began in February 2004 with a marine sampling survey aboard the national research ship, RV Southern Surveyor. Dredging of submarine canyons recovered tonnes of rocks from the previously unknown sedimentary section of the Denmark and Bremer sub-basins. Analysis of the samples identified reservoir-quality sandstones and potential oil-prone Jurassic and Early Cretaceous source rocks.

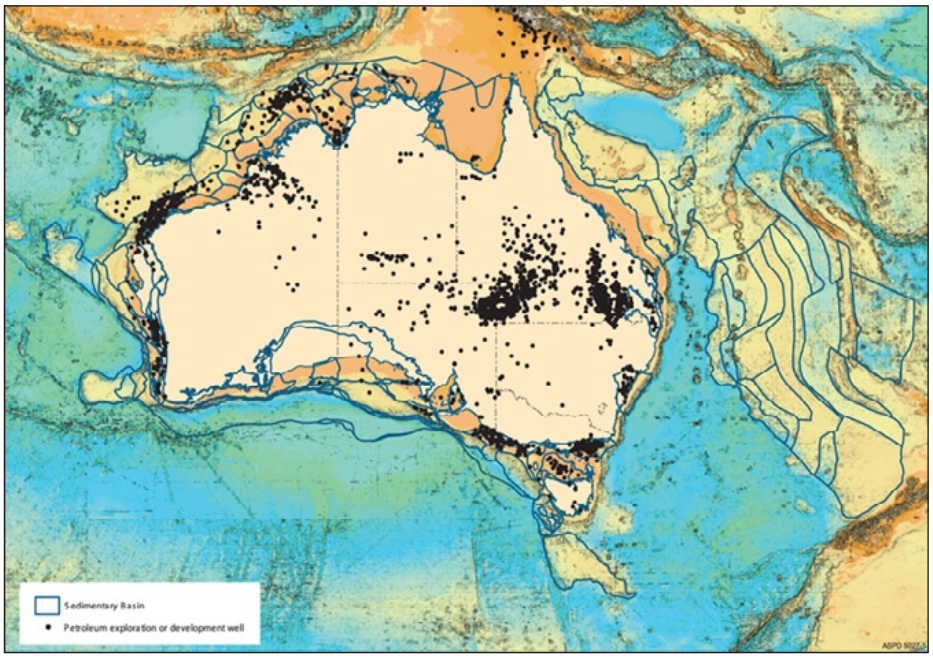


Figure 2. Map of Australia's offshore sedimentary basins draped over the bathymetry and showing the location of petroleum wells.

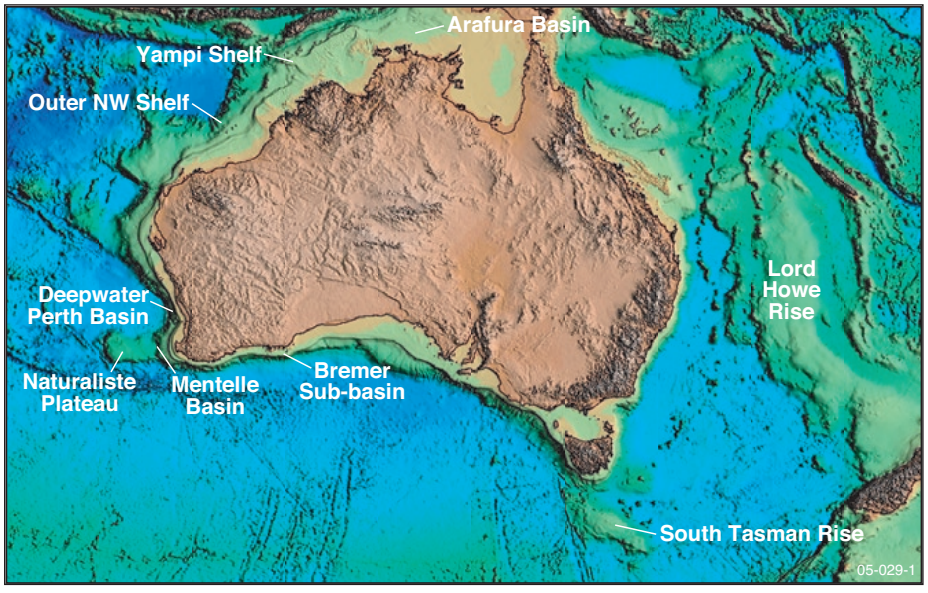


Figure 3. Map showing the location of the portfolio of potential and active Big New Oil projects

The most recent seismic coverage of the Bremer Sub-basin is a 1974 survey shot by ESSO. The age and limited extent of this data allow glimpses into the subsurface geology, but not a full understanding of the area's hydrocarbon potential.

The new seismic data, acquired in late 2004 by Veritas's MV Pacific Sword, better defines the extent, thickness and stratigraphy of the basin fill, and has identified potentially prospective structures. The Bremer is, however, only one of several potentially prospective basins along the southwest margin—the seismic survey has also collected data in the Mentelle and deepwater Perth basins (see the article on Geoscience Australia's Southwest Frontiers Geophysical Survey in this issue).

These first surveys in the Arafura Sea and the frontier basins of the southwest margin are the beginning of a four-year program to develop many new investment opportunities and present them to explorers in the annual release of offshore petroleum acreage (see the article 'Petroleum exploration opportunities in this issue). Other areas planned for data acquisition include the outer margins of the North West Shelf and the Lord Howe Rise.

The historical trend for offshore oil production shows a shift from the Gippsland Basin to the North West Shelf, and from sustained production over decades from a few giant oil fields to many smaller fields of much shorter life. Future trends may be shaped by the results of Geoscience Australia's new seismic data acquisition program.

For more information phone Marita Bradshaw on +61 2 6249 9452 or e-mail marita.bradshaw@ga.gov.au

Online Geological Provinces:
www.ga.gov.au/oracle/provinces

REMASTERING PROJECT — *what's old is new again!*

The national repository of seismic data on the sub-surface geology of Australia's offshore marine jurisdiction is undergoing a media makeover.

Under the Petroleum Submerged Lands Act 1967 (PSLA) all companies and organisations acquiring seismic survey data within the Australian marine jurisdiction have been required to submit the raw and processed data to Geoscience Australia. Data that are part of a work program are confidential for three years from the date of acquisition. After this period the data are accessible by companies or any other interested party.

This repository of information is made available to exploration companies at cost of transfer. However, much of the data is recorded on outdated media, including 9 and 21 track tapes and 3480 cartridges, making it increasingly difficult to access and expensive to store.

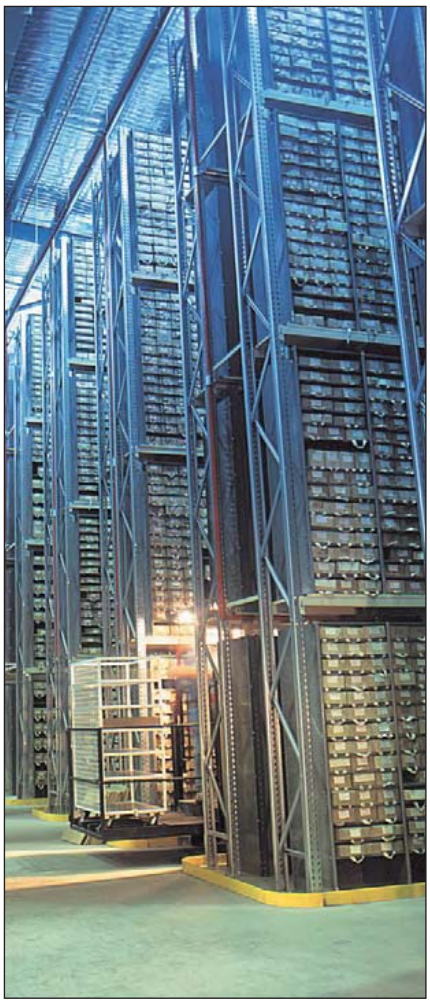
Companies have been required to borrow the large number of older media associated with a seismic survey and return copies to Geoscience Australia. To preserve older data and make it accessible to explorers, Geoscience Australia was allocated $10 million in the 2003–04 Australian Government Budget to be used for the copying and concatenation of the data onto high-density media.

The overall project involves copying around 285 000 old tapes onto about 12 000 3590B tapes. This media—which holds 10 gigabytes of data per tape—has been the industry standard since 1990. More than 90% of Geoscience Australia's repository of seismic data has been collected in that time, and is stored on just over 40 000 3590B tapes.

Transcription, quality control and physical disposal are being carried out by commercial companies in Perth. The transcription contracts were awarded to Guardian Data and SpectrumData, and quality control is being undertaken by GeoCom Services Australia. After copies are approved, the original tapes are disposed of in Perth to be recycled into plastic products.

The remastering project has been running for one year. To date, about 100 000 nine-track tapes and 40 000 3480 cartridges have been transcribed (see table 1 for list of completed surveys).

The project is delivering easier access and lower costs for petroleum companies and other clients.



Data storage at Geoscience Australia's national repository of seismic data

Table 1.

Survey	Year	Basin	State
NT/P36 Marine Seismic (Arafura Sea S81)	1981	Arafura Basin / Money Shoal Basin	NT
Bridge Bass 1990 Marine Seismic	1990	Bark Sub-basin / Bass Basin / Boobyalla Sub-basin / Durroon Basin	Tas.
Donna Marine Seismic	1995	Barrow Sub-basin / Carnarvon Basin	WA
C81A Marine Seismic	1982	Barrow Sub-basin / Carnarvon Basin / Exmouth Plateau	WA
C81B Marine Seismic	1981	Barrow Sub-basin / Carnarvon Basin / Exmouth Plateau	WA
C81B Marine Seismic	1981	Barrow Sub-basin / Carnarvon Basin / Exmouth Plateau	WA
Hummock Marine Seismic	1996	Bass Basin	Tas.
Bass 1988 Marine Seismic	1988	Bass Basin	Tas.
HB 80A and Pookanah Detail Marine Seismic	1980	Bass Basin	Tas.
BS89A/B – BS90A/B and T89/2 Marine Seismic	1990	Bass Basin / Torquay Sub-basin	Tas.
Mahakam Marine Seismic	1992	Beagle Sub-basin / Carnarvon Basin	WA
Mohaku 1993 Seismic	1993	Beagle Sub-basin / Carnarvon Basin	WA
Dampier–Beagle Marine Seismic	1975	Beagle Sub-basin / Carnarvon Basin / Dampier Sub-basin	WA
Helvetius 1992 Marine Seismic	1992	Bonaparte Basin	WA

Andromeda Marine Seismic	1996	Bonaparte Basin	NT
Van Diemen Rise Seismic	1969	Bonaparte Basin	NT, WA
Caspian Marine Seismic	1991	Bonaparte Basin	WA
HV11 Skua 3D Marine Seismic	1990	Bonaparte Basin	NT
PC95 Marine Seismic	1995	Bonaparte Basin	WA
Anderdon Marine Seismic	1990	Bonaparte Basin	NT
B89 Marine Seismic	1989	Bonaparte Basin	NT, WA
Copernicus Marine Seismic	1992	Bonaparte Basin	NT
NT/P47 and NT/P48 Marine Seismic	1997	Bonaparte Basin	NT
H2683D Jabiru and Extension Marine Seismic	1984	Bonaparte Basin / Browse Basin / Vulcan Sub-basin	NT
Endeavour Marine Seismic	1995	Bonaparte Basin / Vulcan Sub-basin	WA
SPA 4SL/95–96 (Browse Basin) Marine Seismic	1996	Browse Basin	WA
Calliance Reef Marine Seismic and Seismic Refraction	1983	Browse Basin	WA
Churchill 1980 Marine Seismic	1980	Browse Basin	WA
Interpretation of the Greater Caswell Area Marine Seismic	1984	Browse Basin	WA
Sascha 1992 Seismic	1992	Browse Basin	WA
C94A Marine Seismic	1994	Canning Basin	WA
Lambert Shelf Marine Seismic	1980	Canning Basin / Carnarvon Basin	WA
Minden 3D	1995	Carnarvon Basin	WA
HH88 Marine Seismic	1988	Carnarvon Basin	WA
SPA 3D Marine Seismic (Parker 3D)	1991	Carnarvon Basin	WA
C83A Marine Seismic	1983	Carnarvon Basin	WA
C83B Marine Seismic	1983	Carnarvon Basin	WA
X95A Marine Seismic (Scarborough 2D)	1995	Carnarvon Basin	WA
C92A Marine Seismic	1992	Carnarvon Basin	WA
Boronia Marine Seismic	1983	Carnarvon Basin	WA
Eaglehawk Marine Seismic	1996	Carnarvon Basin / Dampier Sub-basin	WA
Michelle Marine Seismic	1993	Carnarvon Basin / Dampier Sub-basin	WA
Exmouth South 1996 SPA 6SL (95–96)	1996	Carnarvon Basin / Exmouth Sub-basin	WA
Cuvier 1992 Marine Seismic	1992	Carnarvon Basin / Gascoyne Sub-basin	WA
Rundle Marine Seismic	1994	Carnarvon Basin / Gascoyne Sub-basin	WA
NT/P32 1980 Marine Seismic	1980	Carpentaria Basin	NT
Carpentaria Basin 1980 Marine Seismic	1980	Carpentaria Basin	NT
Denman Basin Marine Seismic	1972	Denman Basin	SA
Offshore Twilight Cove Seismic	1970	Eucla Basin	WA
X78A Marine Seismic	1978	Exmouth Sub-basin	WA
GS81A Marine Seismic	1982	Gippsland Basin	Vic.
GP–81A Marine Seismic	1981	Gippsland Basin	Vic.
GUT–83A Marine Seismic and Magnetic	1983	Gippsland Basin	Vic.
GUT–83P Marine Seismic and Magnetic	1983	Gippsland Basin	Tas.
G89A Marine Seismic	1990	Gippsland Basin	Vic.
GH82A Marine Seismic and Magnetic	1982	Gippsland Basin	Vic.
G89A Marine Seismic: Blackback 3D Grid	1990	Gippsland Basin	Vic.
GS95A Marine Seismic (Basker Manta 3D)	1995	Gippsland Basin	Vic.
G84A Marine Seismic	1985	Gippsland Basin	Vic.
OH91B Marine Seismic	1991	Otway Basin	Vic.
OS90A	1990	Otway Basin	Vic.
Geelvink Channel Seismic	1970	Perth Basin	WA

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Australian Government
Geoscience Australia

Petroleum exploration opportunities – 2005 Acreage Release

The 2005 offshore acreage release offers explorers new opportunities to build on recent successes that have significantly increased known oil and gas reserves.

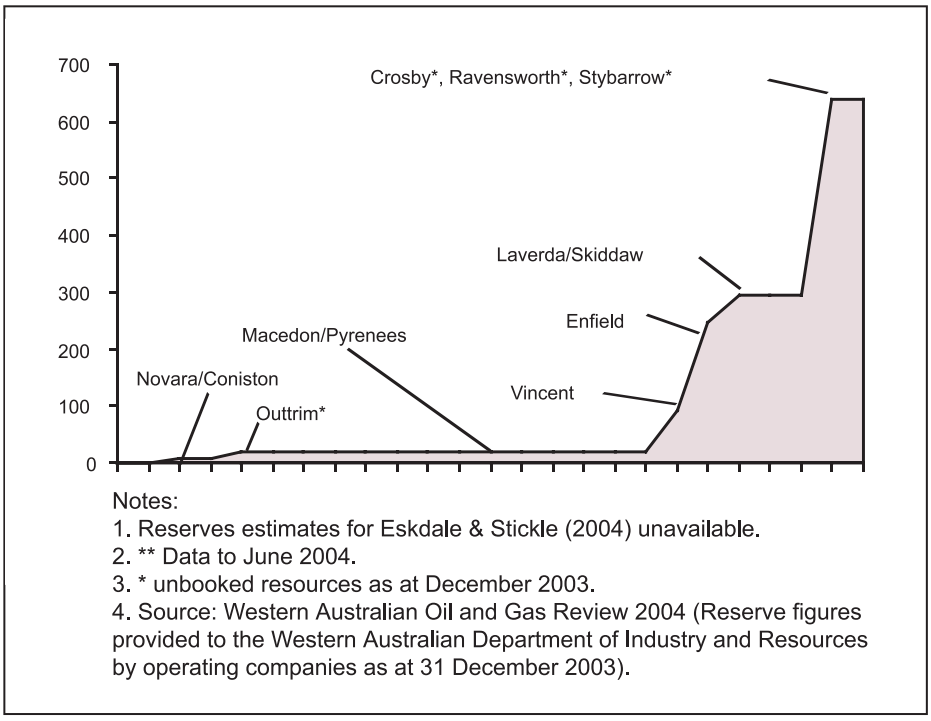
Interest in offshore exploration for oil and gas is rising, with 15 of the 35 areas offered in 2003 awarded and others still under consideration. This uptake rate is underpinning increases in associated exploration expenditure.

Commercial interest in the 2004 offshore acreage release is just as encouraging, with bids received on nine of the eleven areas offered in the first closing round. New entrants to the Australian exploration scene include Canadian companies Avery Resources and Vermillion Energy Trust, the UK's Paladin Resources and the French super major Total. Six permits in the 2004 acreage release will attract a 150% tax uplift as an incentive for oil exploration in frontier areas. Several permits in the 2005 acreage release will also receive this tax uplift, subject to approval by the Minister for Industry, Tourism and Resources, the Hon. Ian Macfarlane.

Gas: giant discoveries and accelerating development

The reputation of Australia's North West Shelf as a world-class gas province was confirmed in 2000 by the discovery of two super giant gas accumulations—Jansz in the Carnarvon Basin, and the Brewster–Ichthys complex in the Browse Basin.

The Jansz accumulation of 20 trillion cubic feet is the largest gas field yet found in Australia; more importantly, the gas is found in a type of structure very different from those previously explored for. The gas is reservoired in Late Jurassic channel sands rather than in a Triassic fault block—the usual habitat of major fields on the North West Shelf. The success of Wheatstone-1, drilled by ChevronTexaco in August 2004, demonstrates that more large gas discoveries remain to be made.



▲ **Figure 1.** Cumulative oil reserves, Exmouth Sub-basin. Source: Oil and Gas Resources of Australia 2003, Geoscience Australia.

Well-established LNG export markets for Australian gas are growing in Japan, Korea and China. The North West Shelf Joint Venture's fourth production train commenced operation in September 2004, and there are plans for a fifth train in 2005. Construction has begun on the Darwin LNG project, which will develop the Bayu/Undan gas/condensate field in the Timor Sea. Other giant gas fields being considered for development to supply export markets are Greater Gorgon and Scarborough in the Carnarvon Basin, Scott Reef and Brecknock in the Browse Basin, and Evans Shoal in the Bonaparte Basin.

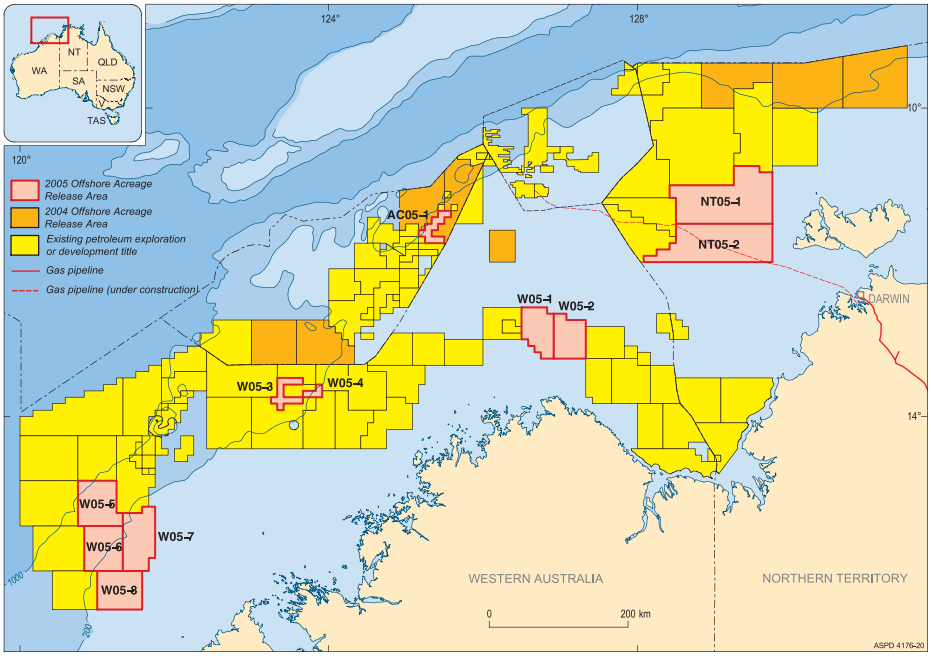
New domestic gas developments are well advanced in southeastern Australia, in the offshore Bass and Otway basins. First gas has flowed this year from the Bass Gas project's Yolla field, and from the Otway Basin Minerva development. In northern Australia, the Blacktip gas field in the Bonaparte Basin is slated for development, with the building of a pipeline across the Northern Territory to the Gove alumina refinery.

Oil: new discoveries in the north, west and east

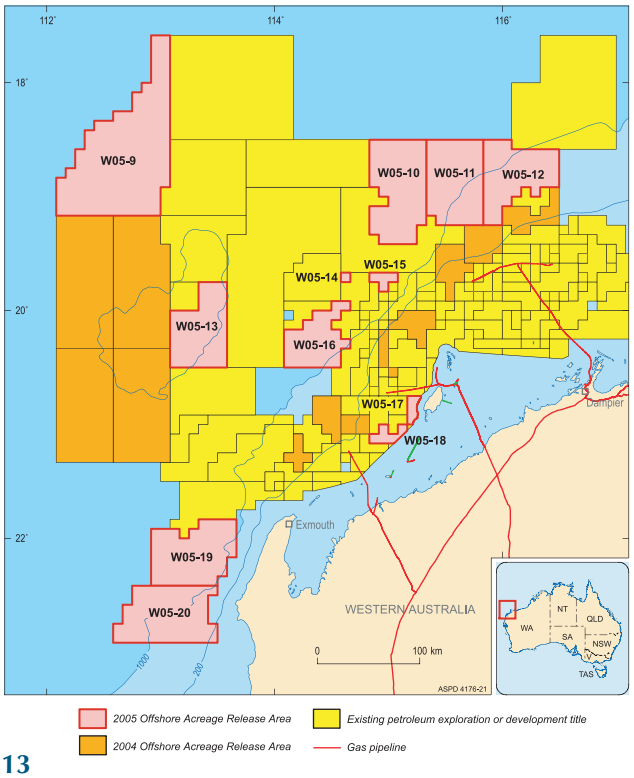
Several significant new oil discoveries inboard of the giant gas fields in the Carnarvon Basin have extended known oil reserves to both the north and the south.

At the northern end, the Exeter field in the Dampier Sub-basin was discovered in 2002. Together with the 1998 Mutineer discovery, this province has some 120 million barrels which is expected to be brought into production in 2005. In the Exmouth Sub-basin at the southern end of the oil trend, discoveries over the past five years include Vincent, Enfield, Laverda, Stybarrow, Ravensworth, Crosby, and Stickle. This significant new oil province with several hundred million barrels of reserves is expected to begin production by 2006 (figure 1).

Explorers have also enjoyed success in areas beyond the North West Shelf. The Cliff Head discovery, drilled in December 2001, is the first major oil find in the offshore Perth Basin, where there have been recent onshore oil and gas discoveries. Development plans are well underway, and production is planned to start this year.



▲ **Figure 2.** 2005 offshore release areas in northwest Australia.



◀ **Figure 3.** 2005 offshore release areas in north Western Australia.

In Bass Strait, development drilling of the Yolla gas field intersected an oil leg and the exploration well Trefoil 1 recovered significant condensate. The most recent oil discovery has been in the Vulcan Sub-basin, where OMV's Katandra well identified a seven-metre oil column. This well, located on the Jabiru trend, is significant for assessment of the 2005 new acreage release area.

New acreage for petroleum exploration

Australia's Offshore Petroleum Exploration Acreage Release for 2005 was announced on 11 April. Twenty-nine areas will be released in 13 different regions (see figures 2–5). Areas on offer include:

- large frontier blocks in the Outer Exmouth Plateau, Bremer Sub-basin and Otway Basin (figures 3, 4 and 5)
- moderate to smaller blocks in the midst of large gas accumulations in the Northern Browse Basin and the Carnarvon Basin (figures 2 and 3)
- moderately sized blocks under various water depths in the immature to sub-mature basins of the Northern Exmouth Plateau, the Barcoo Sub-basin, the Southern Exmouth Sub-basin and the Vlaming Sub-Basin (figures 2, 3 and 4)
- shallow water blocks over the Darwin Shelf and Londonderry High (figure 2) and Otway Basin (figure 5).

All areas will be available for bidding through a work program bidding system. Closing dates for bids will be October 2005 and April 2006, depending on the size and relative exploration maturity of the areas.

Geoscience Australia has a number of products that could help explorers to review potential acreage. For more information on these products or services or about the offshore acreage release, phone Jenny Maher on +61 2 6249 9111 (email jenny.maher@ga.gov.au) or visit our website at www.ga.gov.au

Information on the 2005 Release of Offshore Petroleum Exploration Areas can also be obtained from the Department of Industry, Tourism and Resources website at www.industry.gov.au/petexp

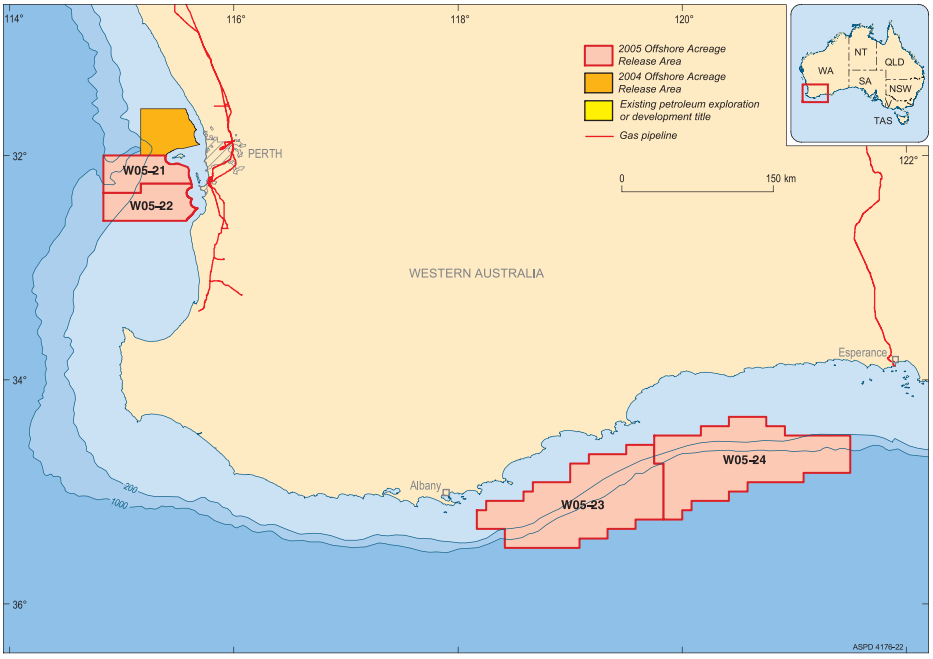


Figure 4. 2005 offshore release areas in south Western Australia.

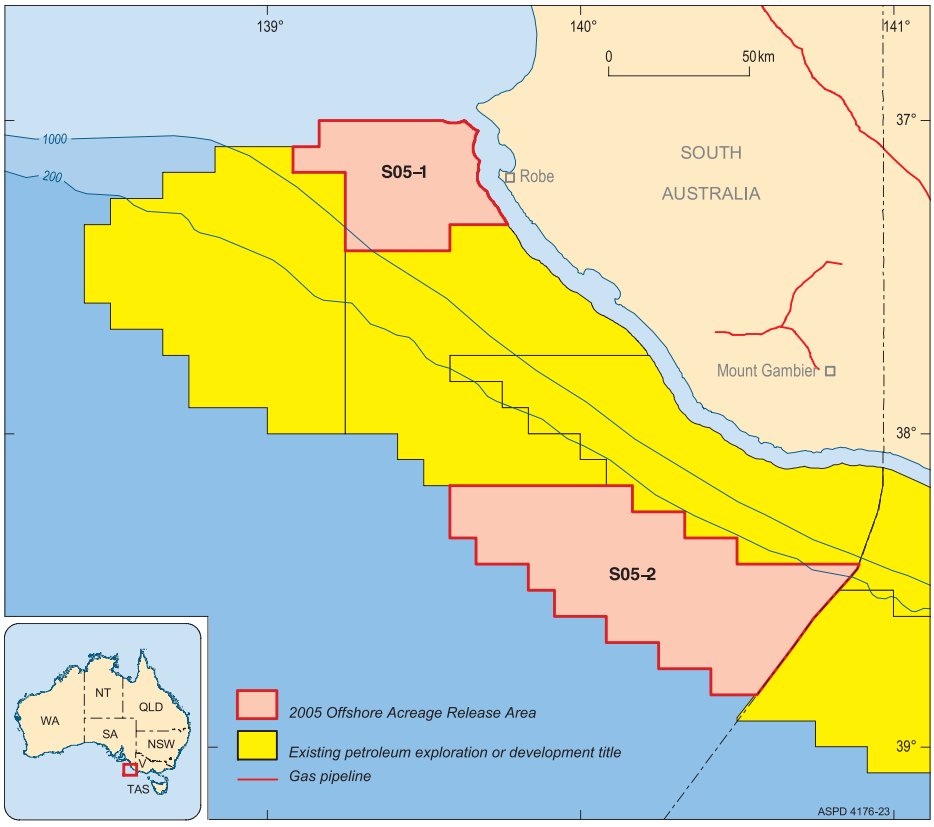


Figure 5. 2005 offshore release areas in South Australia.

HYDROGEOCHEMISTRY —*clues to hidden mineralisation*

Patrice de Caritat (CRC LEME, Geoscience Australia) and Dirk Kirste (CRC LEME, Australian National University),

Can groundwater collected from existing pastoral and exploration bores provide evidence of buried mineralisation? Can groundwater assays be used to guide exploratory drilling in areas of transported cover? Can the groundwater's chemical and isotopic composition help rank geophysical anomalies? Our study in the Curnamona Province attempts to answer these and other questions.

This region hosts a supergiant lead–zinc–silver ore body at Broken Hill and numerous smaller deposits (including lead–zinc–silver, copper–gold, tin, tungsten and uranium), which mostly occur in the limited outcrop regions of the Paleo- to Mesoproterozoic basement rocks. The basement includes the metasedimentary and metavolcanic Willyama Supergroup, which contains the Broken Hill mineralisation (Burtt et al 2004). However, approximately 90 per cent of the Curnamona Province basement is concealed by variable thicknesses of Neoproterozoic (meta) sediments, Cambrian and/or Mesozoic sediments, overlain by the Cainozoic sedimentary sequence of the Callabonna Sub-basin and soils.

The areas of exposed basement have undergone mineral exploration for over a century, yet few significant new mineral discoveries have been made. Thus, the province's high potential for Broken Hill style and iron-oxide/copper–gold mineralisation is more likely to be fulfilled under cover.

Traditional mineral exploration methods used in regions of outcrop face challenges when applied to areas of transported cover, especially where this cover is greater than a few metres thick. Different exploration tools are needed to explore effectively in this environment. Groundwater is a geochemical sampling medium that moves through the subsurface, is easily collected and can be analysed with great accuracy and sensitivity. It may have flowed near mineralisation and retained a chemical 'memory' or fingerprint of such an encounter.

Sampling and analysis

We have collected about 350 groundwater samples from existing boreholes in the southern Curnamona Province, both in areas of outcrop in the ranges and in areas of cover in the surrounding basins (figure 1). The aim of this scientific investigation was to test whether groundwater could be helpful in the search for hidden mineral deposits in the Broken Hill region. We determined the major, minor and trace element concentrations of the groundwaters. On selected samples, we also determined the isotopic composition of hydrogen, oxygen (in water and in dissolved sulfate), carbon, chloride, sulfur, strontium and lead.

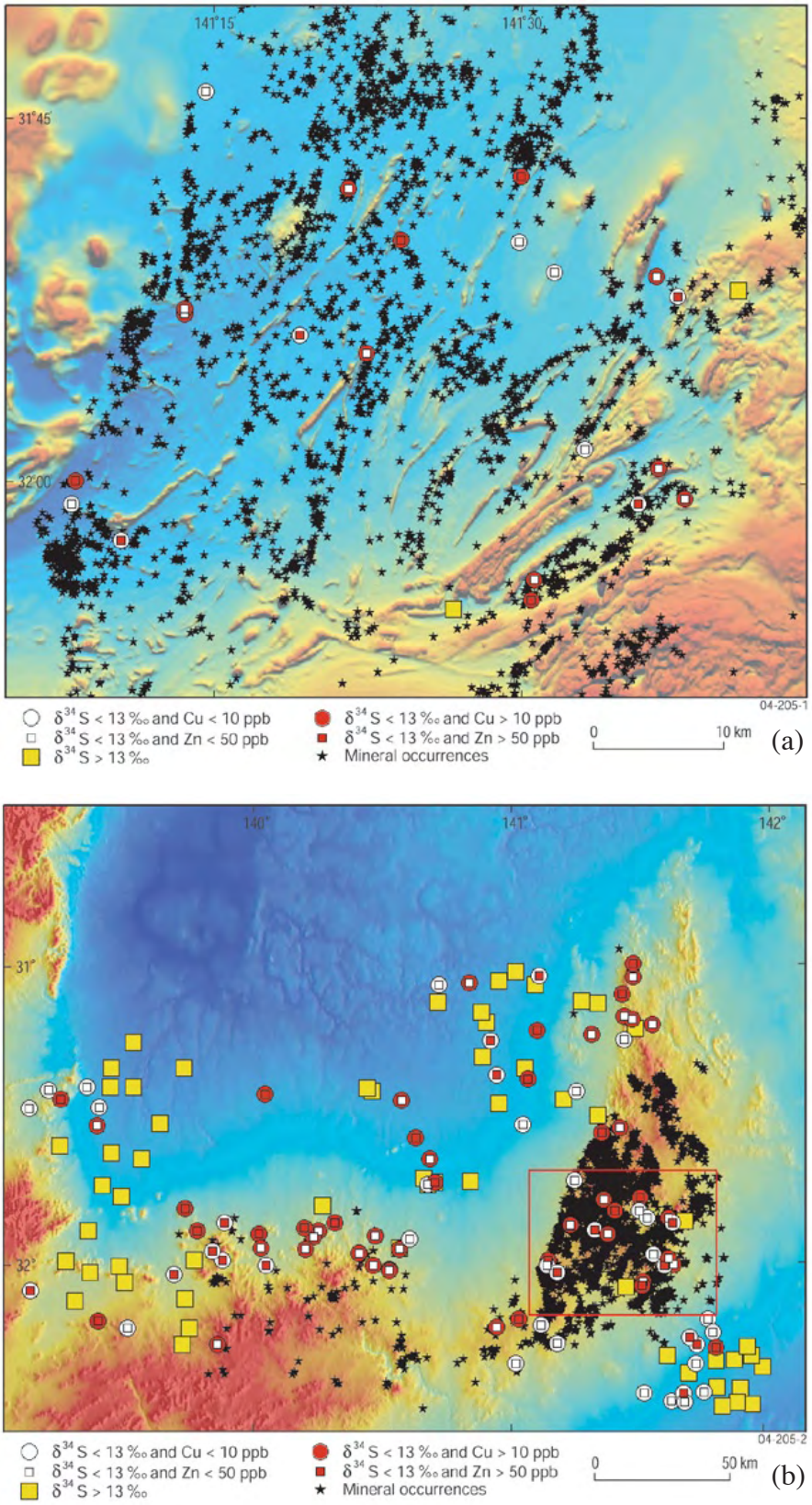
The results indicate that the groundwater's present composition is affected by a number of processes: evaporation, evapotranspiration, mixing, precipitation/dissolution and oxidation/reduction. These occur during an often complex and—in many instances—long evolution. The impact of each of these major processes is teased out using 'conservative' tracers such as chloride or bromide, isotopes and geochemical modelling. To develop hydrogeochemistry into a useful tool for exploration, we have followed a number of steps in the analysis of the data:

1. Calculation of a 'sulfur excess' index to gain knowledge of which samples contain more sulfur than can be accounted for by evaporation or mixing.
2. Determination of the sulfur isotopic composition of dissolved sulfate to identify samples that may have experienced an addition of Broken Hill type (i.e. isotopically light; Bierlein et al 1996) sulfur. Consideration of the oxygen isotopic composition of dissolved sulfate in conjunction with its sulfur isotopic composition can shed light on where sulfide oxidation occurred with respect to the groundwater table (Kirste et al 2003).
3. Evaluation of the specific mineralisation types (Broken Hill type, Thackaringa type etc.) that are compatible with the lead isotope ratios of the groundwater or imply mixing with background lead.

▲ **Figure 1.** Sampling groundwater from a windmill-driven pastoral bore in the southern Curnamona Province.

4. Geochemical reaction-path modelling of oxidation of sulfide minerals (e.g. chalcopyrite, sphalerite, galena) and reactive-transport modelling of the dispersion of reaction products along the groundwater flow path (Kirste et al 2004).

We tested this methodology in the southern Barrier Ranges region, where Broken Hill and a series of minor mineral deposits are located. Of the 23 groundwater samples collected in this mineralised subprovince, 16 (70 per cent) suggest proximity to mineralisation: they have positive sulfur excess, 'low' sulfur isotopic composition and 'elevated' copper and/or zinc concentrations. Inspection of figure 2a shows that most of the 'positive' samples are indeed located within two kilometres of known mineralisation. We subsequently applied the same procedure to the full regional dataset. This revealed several locations under sedimentary cover where our vectors suggest proximity to sulfide mineralisation (figure 2b). More details of the methods and results of this study can be found in Caritat et al (2005).



▲ **Figure 2.** Distribution of groundwater samples in the southern Broken Hill Domain on airborne electromagnetic background (a) and in the southern Curnamona Province on digital elevation model background (b; location of (a) shown as yellow rectangle). Symbols show groundwaters that have 'high' sulfur isotopic compositions as yellow squares and 'low' sulfur isotopic compositions as circles; the latter are coloured red if copper concentrations are greater than 10 parts per billion, or contain a red square if zinc concentrations are greater than 50 parts per billion. Thus background sites (unrelated to mineralisation) are repesented by yellow squares, those related to - but distant from - mineralisation are symbolised by white circles, and those close to (> ~2 km) potential Broken Hill type mineralisation are depicted by red circle and/or squares.

Conclusion

We concluded that hydrogeochemistry may well be one of the novel tools needed to assist mineral exploration under cover. We have demonstrated its potential to fingerprint groundwater–mineralisation interaction through analysing major and trace element concentrations, establishing stable and radiogenic isotope signatures, and modelling geochemical reactions and transport. There are indications that this approach can help delineate areas of interest for subsequent mineral exploration under sedimentary cover, to rank geophysical anomalies and to vector towards mineralisation.

Hydrogeochemistry is a very useful tool and should be part of any multidisciplinary mineral exploration campaign.

Acknowledgments

This study was funded by an Australian Government Cooperative Research Centre grant to CRC LEME. The Mineral Resources Division of the New South Wales Department of Primary Industries is warmly thanked for its financial and moral support to this project. We thank Frank Krikowa, Steve Taylor, Malcolm McCulloch and Graham Carr for assistance with analytical components of this study.

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NEW Geomagnetic Field Models RELEASED

New editions of the Australian Geomagnetic Reference Field (AGRF) model and the International Geomagnetic Reference Field (IGRF-10) are now available from Geoscience Australia.

Both models have a wide range of applications in the scientific, industrial and engineering sectors and the general community. Areas of specialist application include mineral exploration, surveying, mapping, research into the global magnetic field and its secular change, and studies of the Earth's deep interior, crust, ionosphere and magnetosphere. The AGRF model is also a particularly useful tool for anyone using a compass or GPS technology for navigation in and around Australia - including bushwalkers, orienteers, mariners and pilots - and for applications such as aligning satellite dishes or telescopes.

The Australian Geomagnetic Reference Field Model

The AGRF is a mathematical model of the geomagnetic field of Australia, nearby offshore areas, Papua New Guinea and parts of eastern Indonesia. The first model was derived for 1 January 1985 (epoch 1985.0). It has been improved and updated every five years to ensure that slow but unpredictable changes in the geomagnetic field, which originate from within the Earth, are tracked as accurately as possible.

The 2005 revision - the fifth in the series - is a mathematical representation of the undisturbed geomagnetic main field at epoch 2005.0 and its predicted annual change over 2005-2010. The model describes the field originating from internal sources using spherical cap harmonics. The main field is modelled to a nominal minimum wavelength of 1500 km and the annual change to 2000 km.

Extensive vector geomagnetic survey data sets were used to derive the main field model, including magnetic data from the Danish Oersted satellite and the US Magsat satellite, high elevation airborne data, and Australia-wide ground based vector survey data. The main field data sets were updated to epoch 2005.0 using a secular variation model of the Australian region derived from geomagnetic observatory and repeat station data collected from Australia and neighbouring countries over the last 45 years.

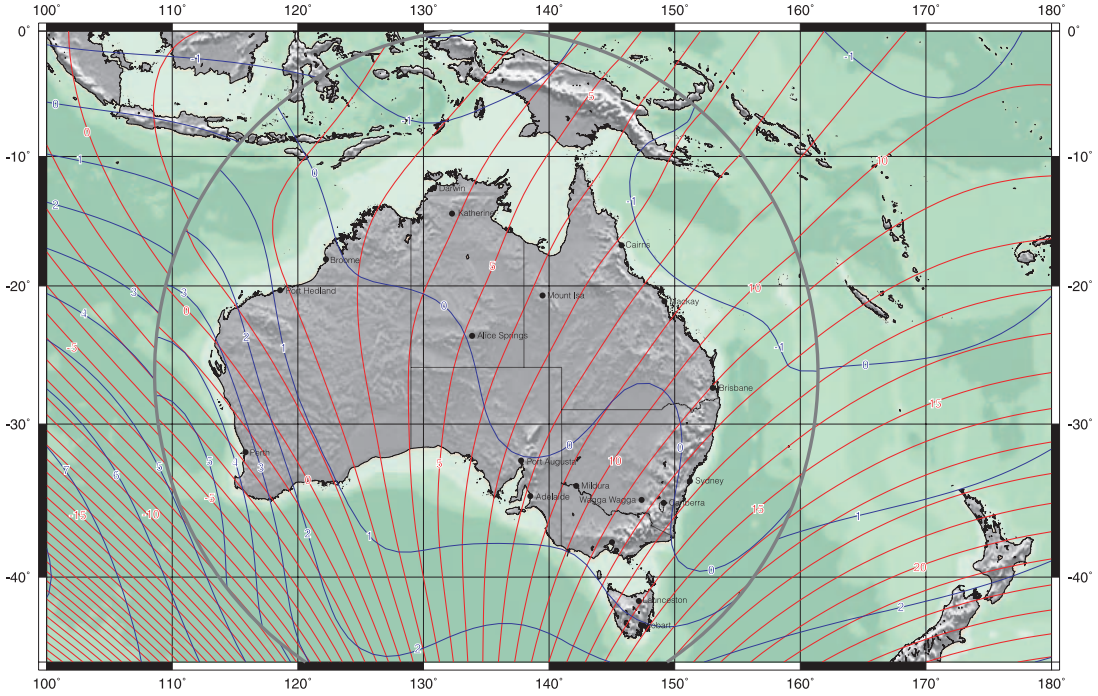


Figure 1. Contours of the magnetic declination in degrees (red) and annual change of declination (blue) in minutes-of-arc per year from the AGRF 2005 model for epoch 2005.0. The circular boundary shows the limit of the AGRF model, contours outside the boundary are from the International Geomagnetic Reference Field Model (IGRF-10 at 2005.0)

The secular variation model in AGRF 2005 is based on a linear extrapolation of the most recently available geomagnetic observatory and repeat station data from Australia and neighbouring countries. Based on knowledge of the past behaviour of the magnetic field the secular variation model should be suitable out to epoch 2010.

The 2005 revision of the AGRF model is built upon the recently released 10th generation of the International Geomagnetic Reference Field, which is a global spherical harmonic model of the geomagnetic field. An on-line calculator for the AGRF is available on the GA web site. Software is also available from GA to evaluate the AGRF at a single point or a grid of points.

The extensive regional data set used in developing the AGRF model makes it the best available model for the Australian regional magnetic field for the interval 2005-2010.

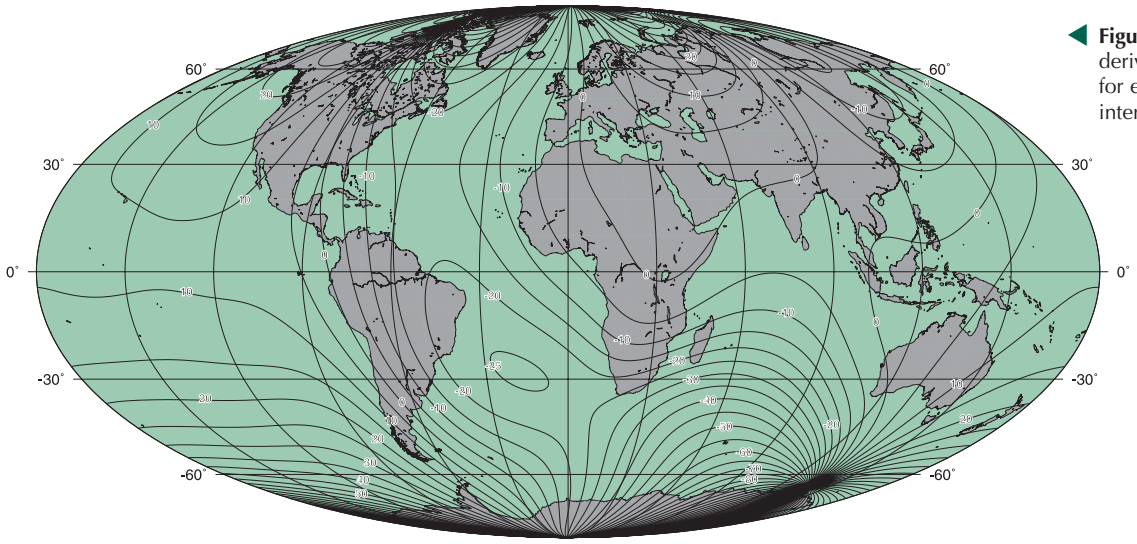


Figure 2. Declination isogons derived from the IGRF-10 model for epoch 2005.0, the contour interval is 5 degrees.

The International Geomagnetic Reference Field

The "10th generation (revised Dec 2004)" of the International Geomagnetic Reference Field (IGRF-10) was released by the International Association of Geomagnetism and Aeronomy (IAGA) in December 2004. This new release adds a main field model for 2005.0 and a secular variation model for the period 2005-2010 to the existing IGRF coefficient sets. IGRF-10 allows the undisturbed long wavelength geomagnetic field originating from sources internal to the Earth to be calculated at any location on, or near, the surface of the Earth over the period 1900 to 2010.

The development of the IGRF is the result of international collaboration between magnetic field modellers and institutions that undertake satellite magnetic surveys and run geomagnetic observatories.

The 9th and 10th generation of the IGRF represent considerable improvements on previous revisions, mainly due to the large quantities of high quality satellite magnetic data currently available. Data from both the Oersted satellite and the German CHAMP satellite were used in developing the IGRF-10 model for 2005.0, as well as data from the global network of geomagnetic observatories. The spherical harmonic degree and order 13 coefficients model the main field at 2005.0 to a minimum nominal wavelength of 3000km. The degree and order 8 secular variation coefficients model the rate of change of the field to a minimum nominal wavelength of 5000km.

The full set of spherical harmonic coefficients for IGRF-10 can be downloaded in several formats from the IAGA V-MOD web site. A single point calculator is available on-line and software to evaluate IGRF-10 at a single point or a grid is also available from Geoscience Australia.

For more information phone Andrew Lewis on +61 2 6249 9764 or e-mail andrew.lewis@ga.gov.au

Geoscience Australia (AGRF):	www.ga.gov.au/oracle/geomag/agrfform.jsp
IAGA V-MOD web site:	www.ngdc.noaa.gov/IAGA/vmod/igrf.html
single point calculator:	www.geomag.bgs.ac.uk/gifs/igrf_form.shtml

In Brief

Science students visit GEOSCIENCE AUSTRALIA

In January, over sixty Year 11 students from Australia, New Zealand and South Africa spent two half-days prospecting for gold at Geoscience Australia.

Their visit was part of the annual National Youth Science Forum, which provides students with experience in science, engineering and technology through a series of workshops, lectures and social activities.

The students' visit to Geoscience Australia was a hands-on experience. They used geochemistry, geographical information systems, geophysics and geological mapping techniques to search for the elusive yellow metal.

The students studied the geochemistry of rock samples from the Leonora district in Western Australia. They employed a variety of lab equipment, and analysed rock core sections with a portable infrared mineral analyser.

The group also explored gravity/magnetics, radiometrics, radioactivity and gamma rays in the quest for gold, and ended the workshop with a presentation of their findings.

Geoscience Australia's scientists and education staff collaborated to develop the course content and run the workshop.

For further information about NYSF and the Geoscience Education Centre contact Kate List on +61 2 249 9571 or email kate.list@ga.gov.au

Remote sensing unit sets up *technical reference group*

Geoscience Australia's remote sensing unit, ACRES, has established a National Remote Sensing Technical Reference Group to advise on strategic positioning and on technical decisions about the provision of 'public good' satellite imagery.

The group held its first meeting in December 2004. Discussion focused on satellite data usage and access, agreement on the group's terms of reference and updating ACRES activities. The group also examined technical contingencies and strategies. Major discussion points included the following:

- ACRES requires input for its development of a LANDSAT contingency plan. LANDSAT is still the preferred data source in Australia for a wide range of environmental, agricultural, land-cover and vegetation monitoring and mining applications, at regional and national scales. The contingency plan is in response to concerns about LANDSAT data continuity, an aging LANDSAT 5 satellite, and the scan-line corrector anomaly on LANDSAT 7.
- National and international remote sensing activities by bodies such as the Australian Government Space Forum, the Committee on Earth Observation Satellites, the Group on Earth Observations and the Global Monitoring of Environmental Security group, and the series of Earth Observation Summits.
- Satellite data providers continue to experience increased demands from users, with satellite data being used in a new and broader range of applications. The shift from 'technology push' to 'user pull' of satellite data heightens the need for improved support and reliable data delivery, particularly for time-critical applications.
- The need for integrated products that provide solutions and decision-support systems, rather than just data, will continue to be a challenge for satellite data providers.
- Continual supply of data into forecast models and the increase in near-real time applications were identified as growth areas for satellite data usage.
- The critical importance of data archives such as the Advanced Very High Resolution Radiometer (AVHRR) and the LANDSAT archives is now being realised in applications such as national drought monitoring, land-cover change assessments and many other applications.
- An extension of X-band network stations to support the growth in near-real time applications and data access, especially in meteorology, means that X-band stations will be needed in Darwin, Casey (Antarctica) and Crib Point (Victoria).

Current members of the National Remote Sensing Technical Reference Group include Mr Max Bye, Mr Tim Danaher, Dr David Griersmith, Dr Alex Held, Dr Adam Lewis, Ms Elizabeth McDonald, Ms Alla Metlenko, Dr Shanti Reddy, Professor John Richards, Dr Kim Ritman and Dr Richard Smith. The group will reconvene in April 2005.

For further information about the group's activities, contact Adam Lewis on +61 2 6249 9353 or e-mail adam.lewis@ga.gov.au

ACT Region map *updated after firestorm*

The new 1:100 000 scale topographic map of the ACT region covers a larger area than previous editions. The new map includes a Landsat image showing the state of vegetation after the January 2003 bushfires that claimed four lives and destroyed more than 500 houses in Canberra.

Geoscience Australia worked closely with the ACT Emergency Services Authority to produce the map and a Geographical Information System data product that will be a valuable resource for the region's emergency management workers and community.

The map is part of a cooperative pilot program being undertaken by Geoscience Australia in partnership with state and territory emergency management and mapping agencies. The program addresses issues raised by the House of Representatives Select Committee Inquiry into the Operational Response to the January 2003 Bushfires in the ACT and the Council of Australian Governments' (COAG) National Inquiry on Bushfire Management, Prevention and Mitigation in Australia.

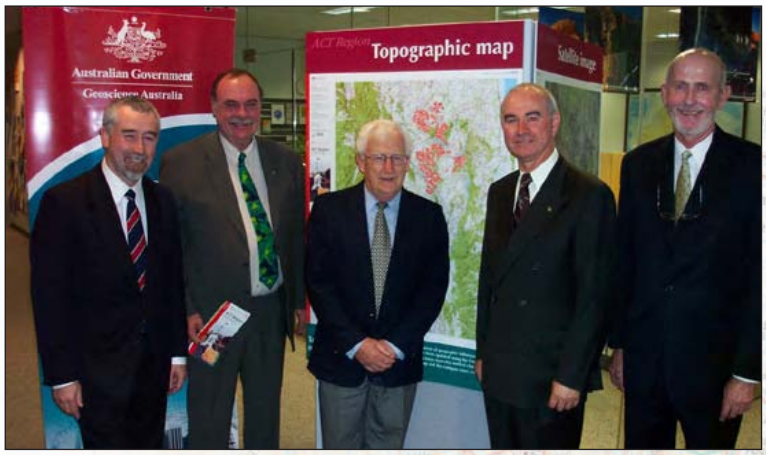
During a recent visit to Geoscience Australia's headquarters, Warren Entsch, Parliamentary Secretary to the Minister for Industry, Tourism and Resources, thanked the staff involved in production of the map and database. He pointed out the importance of accurate maps showing critical infrastructure such as roads, bridges, buildings and dams, for emergency management.

Mr Entsch said the project—a significant undertaking by Geoscience Australia on behalf of the Australian Government— had produced a map that gave emergency service workers this critical information and also provided a good overview of the 'bush capital'.

Gary Nairn, Parliamentary Secretary to the Prime Minister and chairman of the House of Representatives Select Committee, commended Geoscience Australia for its prompt response to the committee's recommendations.

Geoscience Australia initiated the $1 million pilot program in early 2004, in collaboration with state mapping agencies and the Emergency Management Spatial Information Network Australia. The pilot program was set up to improve national cooperation and achieve best practice in mapping and maintaining fundamental information needed for emergency management and other purposes. The findings of the pilot are being integrated into the 2005–06 program.

The COAG inquiry also identified the need for topographic data for operational use at 1:25 000 and 1:50 000 scales. The cooperative program with the states is already allowing Geoscience Australia to develop single 'point of truth' GIS databases that can be used to derive maps at a range of scales.



Left to right: Senator Gary Humphries, Senator for the ACT; the Hon. Warren Entsch MP, Parliamentary Secretary to the Minister for Industry, Tourism and Resources; Dr Trevor Powell, Chief, Spatial Information Sciences; The Hon. Gary Nairn MP, Parliamentary Secretary to the Prime Minister; and Mr Peter Holland, General Manager, National Mapping Division, following the launch of the new ACT Region map at Geoscience Australia on 15 February 2005.

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Australian Government
Geoscience Australia

Product News

LATEST ASSESSMENT IDENTIFIES NEED FOR *new mineral resources*

Australia's mineral and solid fuel resources remain reasonably healthy in the short to medium term, according to Australia's Identified Mineral Resources 2004, released online by Geoscience Australia in late 2004. However, resource trends for some major commodities have plateaued, and our share of global exploration spending continues to fall. In the longer term, the future of the Australian minerals industry depends on more exploration and new discoveries.

Australia's Identified Mineral Resources, published annually by Geoscience Australia, gives governments long-term estimates of ore reserves. The publication also compares our figures with industry estimates, which are generally based on shorter term planning and commercial considerations.

Australia's Identified Mineral Resources 2004 is available on-line. The commodity sections are also accessible via Australian Mines Atlas.

For more information, phone Bill McKay on +61 2 6249 9003 or e-mail bill.mckay@ga.gov.au

Geoscience Australia on-line:	www.ga.gov.au/image_cache/GA5476.pdf.
Australian Mines Atlas:	www.australianminesatlas.gov.au

ASTER satellite data now available

Geoscience Australia's Australian Centre for Remote Sensing (ACRES) has extended the range of satellite image product options available to clients, following an agreement to distribute ASTER satellite data.

ASTER (the Advanced Spaceborne Thermal Emission and Reflection Radiometer) is a sensor on board Japan's TERRA satellite (see AusGeo News 76). The sensor provides data covering 14 discrete spectral bands over a 60-kilometre swath and acquired at spatial resolutions ranging from 15 metres to 90 metres.

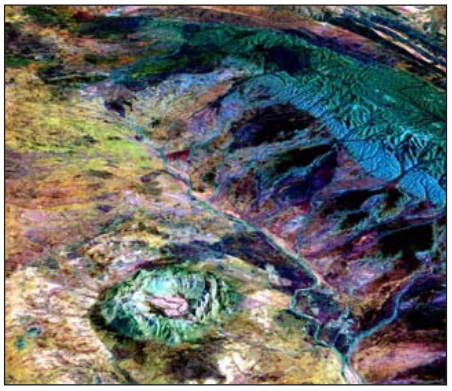
Under the recently signed agreement with the Earth Remote Sensing Data Analysis Centre (ERSDAC) in Japan, ACRES distributes all ASTER data acquisitions (over 800 000 scenes) from ERSDAC's comprehensive archive. This agreement makes it very easy for Australian customers to access ASTER data, simply and conveniently, through ACRES. Importantly, ACRES can also organise future acquisitions of ASTER data covering a customer's area of interest.

ACRES can now provide ASTER data from the ERSDAC archive and the ACRES archive. The ACRES archive currently contains over 20 000 scenes of ASTER data sourced from the United States Geological Survey, acquired over Australia mainly between March 2000 and June 2002.

This archive can be searched on the ACRES Digital Catalogue, which is accessible through Geoscience Australia's website. The ASTER data in the ACRES archive will grow over time as the new imported data is copied into the archive.

Prices for full-scene ASTER data (covering an area 60 km x 60 km) start at a low $99 and range up to $580 for data acquired as a 'future acquisition' (general programming request). Future acquisition products contain path-oriented data in addition to derived ortho-corrected data and Digital Elevation Model (DEM) data.

For more information please contact ACRES Customer Services on +61 2 6249 9779 or e-mail acres@ga.gov.au or visit www.ga.gov.au/acres



View of Gosses Bluff, about 205 kilometres west of Alice Springs in the Northern Territory. It was created by draping a band 7-3-1 RGB composite ASTER image over an ASTER-derived DEM.

ASTER data pricing schedule.

ASTER data from ACRES archive *(sourced from USGS)*	
Single scene data	**$99**
ASTER data from ERSDAC	
Single scene data (Levels 1A or 1B)	**$145**
Single scene data (Ortho-corrected)	**$290**
General Programming Request (price includes satellite programming and data)	**$580**

NEW RASTER makes Australia more accessible

Following the outstanding success of the NATMAP Raster Mosaic of Australia released in September 2003, Geoscience Australia has launched updated versions of this product with even better features—NATMAP Raster 2004 and NATMAP Raster 2004 Premium.

Each version includes a full set of 513 digital topographic maps covering Australia at 1:250 000 scale and should appeal to a wide range of professional and recreational users. The new versions include significant enhancements over the older versions, such as improved ability to measure distances.

Important differences between the two new versions offer specific benefits depending on the intended application.

The standard NATMAP Raster 2004 provides compressed maps best suited for general use, and where memory or speed are issues (such as use with a basic PC). Supplied on a set of four CDs, NATMAP Raster 2004 carries a single image of Australia using latitude and longitude for coordinates, as well as separate map sheets with coordinates for measuring distance and area, and a Landsat satellite image of Australia at 50-metre resolution.

NATMAP Raster 2004 Premium comes on two DVDs and is best for PCs or databases where memory space is not a problem, as the images retain quality by using only minimal compression. While the standard version has separate map sheets for measuring distance, NATMAP Raster Premium divides Australia into seven grid zones, which allow accurate measurement across map boundaries. The premium version also includes a single map of Australia at 1:250 000 scale displaying latitude and longitude and a Landsat image at 25-metre resolution.

Both new versions are ideal for laptop and desktop computers, and feature:

- all published 1:250 000 scale topographic maps to August 2004
- searches by selecting from more than 300,000 placenames, by coordinates, by NATMAP name or by using the index map
- measurable distances and areas
- a dynamic scale bar that changes as users zoom in or out
- display of latitude and longitude or map grid coordinates
- compatibility with GPS software and most geographic information systems
- export of images in JPEG, BMP, GeoTIFF, TIFF and PNG formats
- easy printing.

The new products are available from NATMAP retailers in every state and territory, or directly from Geoscience Australia's Sales Centre.

For more information, phone the Sales Centre on Freecall 1800 800 173 (in Australia) or +61 2 6249 9966 or email mapsales@ga.gov.au

Events Calander 2005

Australian Water Summit
30 and 31 March
Sydney Convention and Exhibition Centre
Contact: Association and Communication Events, PO Box 634, Crows Nest, NSW 1585
phone +61 2 8920 2547
fax: +61 2 9922 5261
e-mail: glenf@acevents.com.au
www.acevents.com.au/water2005

APPEA Conference and Exhibition
Australian Petroleum Production and Exploration Association
10 to 13 April
Perth Convention and Exhibition Centre
Contact: Julie Hood, APPEA Limited, GPO Box 2201, Canberra ACT 2601
phone +61 2 6267 0907
fax: +61 2 6247 0548
e-mail: jhood@appea.com.au
www.appea.com.au

AAPG Annual Meeting
American Association of Petroleum Geologists Annual Meeting and Exhibition
19 to 22 June
Calgary, Canada
Contact: AAPG Convention Department, PO Box 979, Tulsa Oklahoma 74101-0979 USA
phone +1 918 560 2696
fax +1 918 560 2684
e-mail: sbenton@aapg.org
www.aapg.org

AMSA2005
Australian Marine Sciences Association
11 to 13 July
Crowne Plaza, Darwin
Contact: PO Box 902, Toowong Qld 4066
e-mail: amsa2005@amsa.asn.au
www.amsa.asn.au

Central Australian Basins Symposium
16 to 18 August
Alice Springs Convention Centre
Contact: Greg Ambrose, Northern Territory Geological Survey, Department of Business, Industry and Resource Development, GPO Box 3000, Darwin NT 0801
phone +61 8 8999 5342
fax: +61 8 8999 6824
e-mail: greg.ambrose@nt.gov.au
http://conferences.minerals.nt.gov.au/cabs/contacts.html

SSC2005
Spatial Sciences Institute Biennial Conference
12 to 16 September
Melbourne Exhibition and Conference Centre
Contact: ACTS Conferencing Pty Ltd, GPO Box 2200, Canberra ACT 2601
phone +61 2 6257 3299
fax: +61 2 6257 3256
e-mail: ssc2005@ausconvservices.com.au
www.spatialsciences.org.au