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AUSGEO news
ISSUE 88 Dec 2007

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**ISSUE 88** Dec 2007

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# CEO comment

**Neil Williams** – CEO Geoscience Australia

Following the swearing in of the new Australian Government this month Geoscience Australia is now part of the new Department of Resources, Energy and Tourism which has been excised from the former Department of Industry, Tourism and Resources. The new Minister is The Hon. Martin Ferguson, AM MP who will be a member of the Cabinet. Secretary of the new department is Dr Peter Boxall who was previously the Secretary of the Department of Employment and Workplace Relations, and before that, the Department of Finance and Administration.

Early indications are that Geoscience Australia will continue to provide 'Geoscience research and information services including geodesy, mapping, remote sensing and land information co-ordination'.

This issue includes details of some major milestones for the Onshore Energy Security Program. I am happy to report that the flying component of the Australia-wide airborne geophysical tie-line survey (AWAGS 2) has been completed and the final processed data should be with Geoscience Australia in March 2008. In other news from the Program, gravity data over parts of the Cooper Basin are now available, and the airborne electromagnetic survey of the Paterson Province in Western Australia is approximately one-third complete.

There is also an article on the acquisition and processing of deep seismic data from the Mt Isa-Georgetown-Charters Towers region of northern Queensland. Geoscience Australia's involvement in this major collaboration with the Geological Survey of Queensland was also part of our Onshore Energy Security Program.

The Proterozoic Wealth Project, which will assist mineral explorers in area selection, is also reported on in this issue. Since most of our world-class mineral deposits are from the Proterozoic Eon, the Project has developed models for the tectonic evolution of the Australian Proterozoic to predict where undiscovered mineral wealth may lay beneath the surface.

This issue also includes a report on the marine survey of a section of the coast off New South Wales which discovered many remarkable seabed features. The survey also gathered baseline data that will assist Geoscience Australia assess those areas of the continental shelf prone to underwater landslides which could potentially generate tsunamis.

There is also an article on the National Exposure Information System (NEXIS) which includes information on buildings, people, businesses, employment, and infrastructure that could be affected by natural hazards. This project is part of Geoscience Australia's contribution to research to protect Australia from natural hazards in the urban landscape and mitigate their future impacts.

There is also a review of expenditure on mineral exploration in Australia which reached record levels during 2006-07. Spending for the year reached a total of $1714.6 million, an increase of 38 percent from 2005-06.

New products reported on include high-resolution magnetic data over areas of the offshore Canning Basin, including areas in the 2007 Acreage Release, as well as new geophysical datasets covering areas in Queensland (Mt Isa and the Cooper Basin) and Western Australia (offshore and onshore areas in the Canning Basin). A new physical dataset of the Great Barrier Reef Marine Park seabed will help scientists, natural resource managers, and the community to better understand the nature and layout of seabed habitats.

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

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# Flight to find new energy resources

## *Airborne geophysical survey marks major milestone*

*James Johnson and Bill McKay*

The Australia-wide airborne geophysical tie-line survey (AWAGS 2) was one of the world's largest airborne geophysical surveys.

The project, flown under contract by UTS Geophysics, was part of the five-year Onshore Energy Security Program (OESP), which commenced 18 months ago.

Data acquisition for AWAGS 2 began from Albany, Western Australia in March and flying was completed in December 2007. The survey, across the entire Australian mainland and Tasmania, included the acquisition of more than 145 000 kilometres of radiometric and magnetic data on north–south flight lines spaced 75 kilometres apart, with a nominal flying height of 80 metres above ground level (figure 1).

The survey acquired radiometric data from a single aircraft, calibrated to international standards. The specially prepared aircraft flew at about 260 kilometres per hour, acquiring radiometric readings every 70 metres and magnetic readings every 7 metres (figure 2). The aircraft flew for eight or nine hours each day using a crew of two pilots. The survey was planned and executed such that flights were continuous on most days.

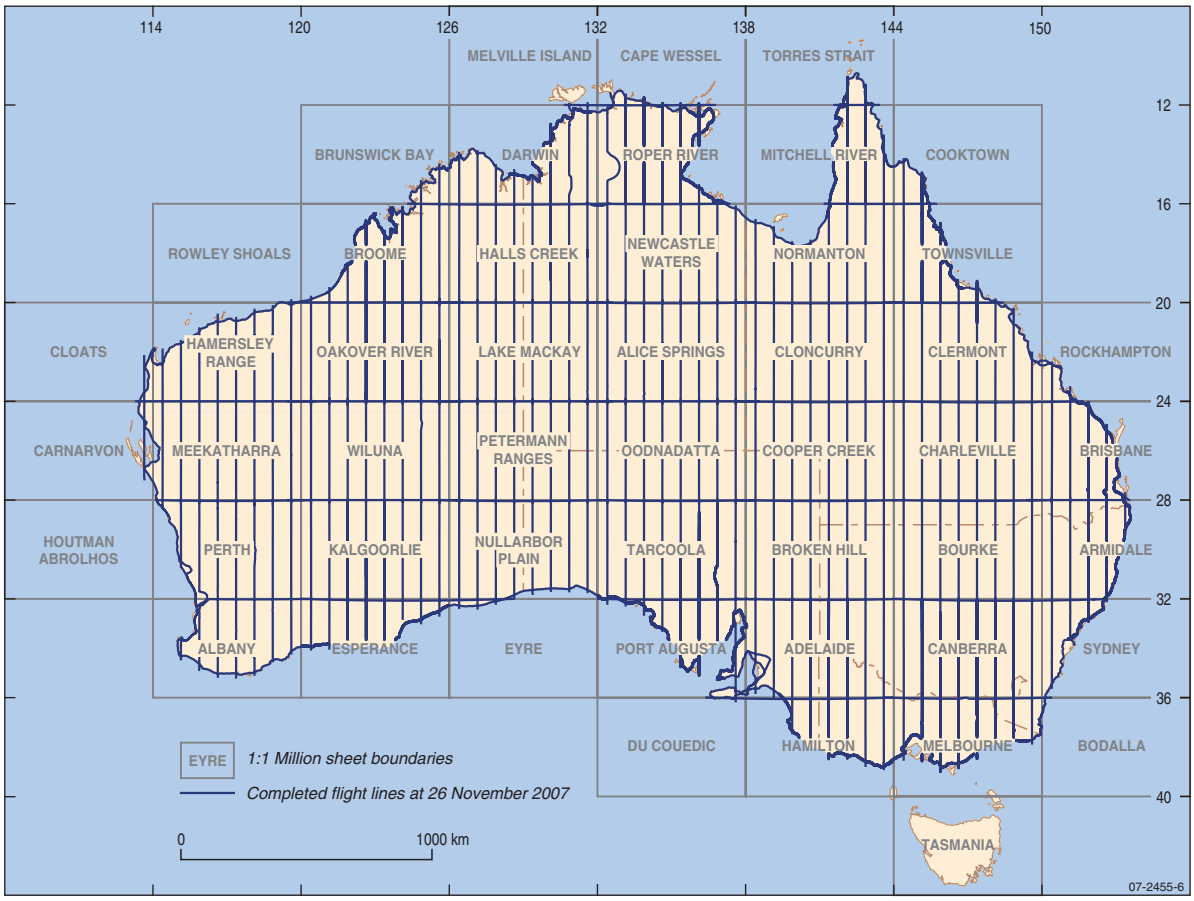


**Figure 1.** Flight-line pattern for the AWAGS 2 magnetics and radiometrics survey to back-calibrate the national radiometric database.


**Figure 2.** UTS' highly modified Fletcher aircraft, purpose-built for the slow, low level survey flying required by AWAGS 2.

With completion of the survey the contractor will process the acquired data and expects to supply the final processed data to Geoscience Australia by March 2008. The processed radiometric data from AWAGS 2 will form the Australian radioelement datum and be used to adjust data in the national radiometric database (all Commonwealth and state public-domain data) to the standard. The survey will also be the datum for airborne radiometric data acquired in the future.

The processed magnetic data will increase the resolution of the Australian magnetic anomaly map and will be incorporated into continental-scale datasets. These will fill the gap between wavelengths of about 100 kilometres from airborne surveys and those exceeding 400 kilometres from satellites.

## Regional surveys update

Other OESP work involved the acquisition of gravity, airborne electromagnetic (AEM) and seismic data in Queensland.

Geoscience Australia released new gravity data, acquired over parts of the Cooper Basin in the state's southwest, through the Geophysical Archive Data Delivery System in October 2007. The data are an important component of the OESP and will help in the assessment of hydrocarbon potential in the region, and in the identification of granites with possible geothermal energy potential in areas beneath the basin.

The first AEM survey to be conducted under the OESP started in the Paterson Province of Western Australia in September 2007. The survey is scheduled to be completed in mid-2008, with results to be released later that year. As outlined in *AusGeo News 86*, the results of the work are keenly awaited: they will give hints on the region's uranium potential.

The next AEM survey, planned for the Pine Creek Province in the Northern Territory, is expected to start in the second half of 2008. The province is prospective for several styles of uranium deposits. AEM data should make it possible to construct a 3D model of the basin architecture, map graphitic conductors in the basement, regolith thickness, and locate major structures and possible mineralising fluid pathways. Other AEM surveys are being scoped to target uranium and thorium systems elsewhere across the continent. In some areas, AEM data may also help in land and water management.

In September 2007, Geoscience Australia completed a major program of deep seismic data acquisition transecting northeast from the Mt Isa – Cloncurry region in Queensland towards Georgetown and then southeast to about 100 kilometres south of Charters Towers (figure 3). In total, 1175 kilometres of reflection data were acquired. The results of the survey will be released progressively from early 2008, The survey will help in the assessment of uranium, geothermal energy and hydrocarbon resource potential in the state's northwest.

The next seismic survey under the OESP is scheduled to start in mid-2008 in the Rankin Springs and Yathong troughs of the Darling Basin in western New South Wales. There is virtually no

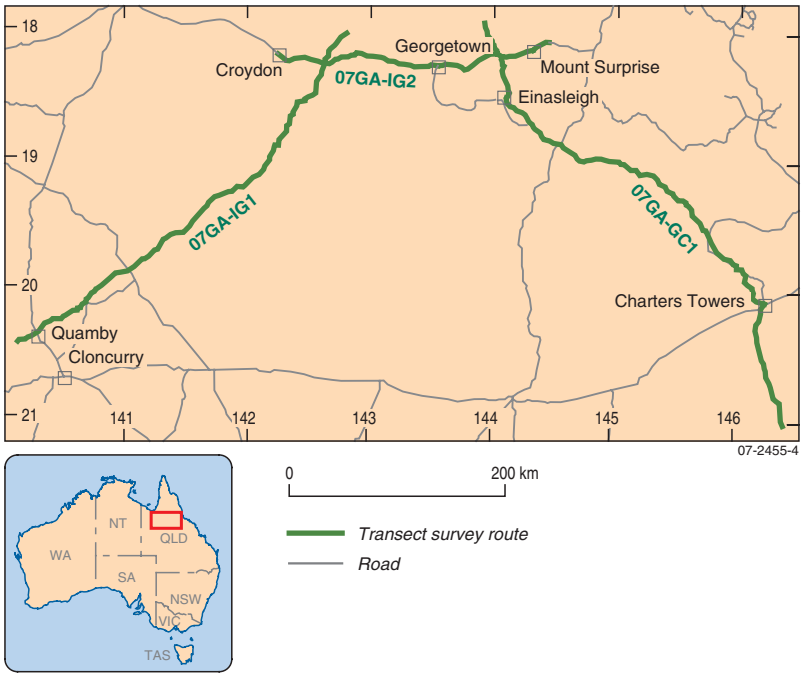


**Figure 3.** Completed transect routes for deep seismic reflection survey in Cloncurry – Georgetown – Charters Towers regions, Queensland.

seismic coverage in the troughs, but they have been identified as one of the regions with the highest petroleum prospectivity in the basin. Geoscience Australia wants to assess the petroleum potential of the area by identifying potential source rocks in the troughs, along with structures and stratigraphy significant for hydrocarbon migration and entrapment. Seismic data acquisition projects will follow in South Australia in 2009 and northern Western Australia in 2010.

## National projects underway

Meanwhile, planning and early work under the national projects (uranium, petroleum and geothermal energy) began in mid-2007:

- The uranium systems project aims to map the distribution of known uranium-enriched and related rocks, get insights into the processes that control where and how uranium mineral systems develop, and assess potential for undiscovered uranium mineralisation at regional to national scales.
- The petroleum project is a staged program of dataset acquisition involving the collection of airborne magnetics and radiometrics, magnetotellurics and, where appropriate, gravity and then seismic reflection data. It will focus on selected areas in the Cooper and Pedirka basins, and the Lander Trough and Kidson Sub-basin in South Australia, Western Australia and the Northern Territory.
- The geothermal energy project aims to shed light on the type and location of geothermal resources on a national scale, and is designed to encourage exploration and investment in this renewable energy sector. The project will integrate existing data and acquire new data to map temperature in the continent's upper crust. Geoscience Australia expects to release results towards the end of the OESP.

National geoscience agreements under the National Geochemistry Survey of Australia project are now in place with all states and the Northern Territory. The training of field teams is complete in most places, and more than 130 catchments (about 10% of the total) have been sampled.

Updates on the OESP will continue in *AusGeo News*, in Geoscience Australia's monthly *Minerals Alert*, and on the program's website.

### For more information

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### Related websites/articles

Onshore Energy Security Program

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

*AusGeo News 86*: Onshore Energy Security Program takes off
www.ga.gov.au/ausgeonews/ausgeonews200706/onshore.jsp

*AusGeo News 87*: Energy Security Initiative updates
www.ga.gov.au/ausgeonews/ausgeonews200709/security.jsp

*AusGeo News 87*: In search of the next hotspot
www.ga.gov.au/ausgeonews/ausgeonews200709/geothermal.jsp

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# Survey maps north Queensland in depth

## *Project throws light on architecture, energy potential*

*Bruce Goleby, Ian Withnall, Jenny Maher and the Geoscience Australia Seismic Acquisition and Processing Group*

The first results are in from a major project to assess the potential of north Queensland for new onshore petroleum and mineral energy resources.

Geoscience Australia launched the geophysical data acquisition program as part of the Onshore Energy Security Program. The project will also assess the potential for geothermal energy from high-heat producing terrains and from under blankets of sedimentary cover.

The project was extended in scope and size when Geoscience Australia joined forces with the Queensland Department of Mines and Energy through the Geological Survey of Queensland. The Geological Survey was working under the state's Smart Mining—Future Prosperity Program.

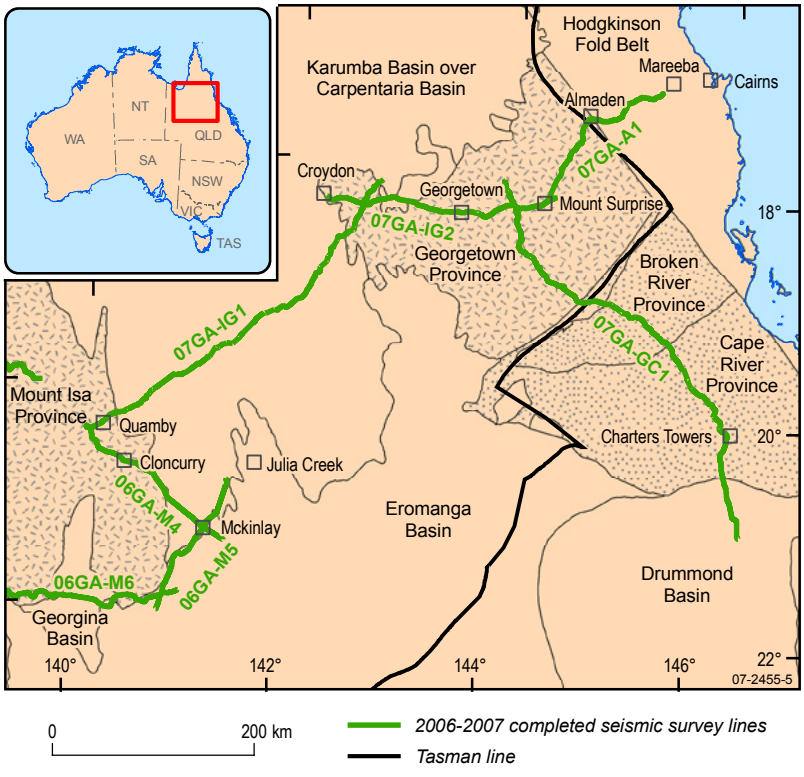


**Figure 1.** The positions of the 2007 Isa–Georgetown–Charters Towers survey (07GA-IG1, 07GA-IG2, 07GA-GC1) and the 2007 Far North Queensland AuScope (07GA-A1) traverses.

The project involved the collection of deep seismic reflection, gravity and magnetotelluric data along a series of traverses from the eastern edge of the Mt Isa Province, across the Georgetown Province, and south-east through the Charters Towers region and into the Drummond Basin.

Meanwhile, AuScope, the National Collaborative Research Infrastructure Scheme's 'Organisation for a National Earth Science Infrastructure Program—2007–2011', funded a seismic reflection transect that crossed the Palmerville Fault – Tasman Line. Figure 1 shows the location of the traverses.

## The Isa – Georgetown – Charters Towers region survey

The Isa – Georgetown – Charters Towers (IGCT) region survey consisted of three regional deep seismic reflection traverses (07GA-IG1, 07GA-IG2 and 07GA-GC1) covering 1187 kilometres (figure 1). The objectives were to map the three-dimensional geology between the Mt Isa Province, the Georgetown Province and the Drummond

Basin region to image whole-of-crust architecture (surface to 60 kilometres depth) and the geological structure within the upper 5 kilometres. The survey also collected gravity readings and high-frequency magnetotelluric data along each traverse.

The project investigated:

- the eastern margin of the Mt Isa Province
- the western margin of the Georgetown Province
- the relationship between the Georgetown, Cape River and Broken River provinces and northern margin of the Drummond Basin
- the geodynamic setting of the Mt Isa, Georgetown, Cape River and Broken River provinces and the Drummond Basin
- the internal structure of the Georgetown, Cape River and Broken River provinces
- relationships between crustal architecture, geodynamic setting, mineral and energy systems and geothermal systems.

For each traverse, specific research questions were identified.

Traverse 07GA-IG1 focused on helping to assess the geodynamic setting along a line from the Mt Isa Province into the Georgetown Province, including the characteristics of the postulated 1680 Ma northeast-oriented extension direction; the geometry of the eastern margin of Mt Isa Province and possible rift setting; and the geometry of the western margin of the Georgetown Province.

The results will provide insights into the potential for minerals deposition, including metasomatic uranium in Mt Isa Province and evidence for the occurrence of undercover IOCG-U (iron oxide – copper – gold – uranium) deposits. Within the eastern Mt Isa Province, the survey will help to identify potential geothermal sources, including hot granites in the Mt Isa Province and high-heat producing Proterozoic and Carboniferous granites in Georgetown Province. Buried mineralisation potential is also addressed by investigating the potential for undercover deposits, including zinc–lead–gold and copper–gold. The traverse runs near the Ernest Henry Mine and through the Croydon (gold) and Esmeralda (mesothermal gold) areas.

The seismic survey will reveal the thickness of the Carpentaria Basin (a potential petroleum basin and possible cover sequence for hot granites) and of any underlying basins, shedding light on the shape of those basins at depth—information that will aid our understanding of the petroleum potential of the region.

Traverse 07GA-IG2 focused on providing insights into the geodynamic setting of the Georgetown Province, including its internal structure. The results will reveal the structure within and beneath the Proterozoic Croydon volcanics near Croydon, the structure within and beneath the Carboniferous Newcastle Range volcanics to the east of Georgetown, and the geometry of the western margin of the Georgetown Province.

**Figure 2.** IVI Hemi60 Vibroseis trucks working along traverse 01GA-IG1. The trucks generated seismic waves by sending small vibrations into the ground The vibrations are reflected off changes in rock.

The seismic results will be used to investigate the potential for uranium mineralisation associated with high-heat producing Carboniferous magmatism that is now hosted by Carboniferous sediments and volcanics in the Newcastle Range, provide evidence for the occurrence of high-heat producing Proterozoic and Carboniferous hot granites in the Georgetown area, and map the depth to the top of those granites.

The seismic results will also provide information on possible controls on the mineralisation potential of the Croydon–Georgetown region. The seismic reflection data will image the deeper structure, which might indicate the source of the alluvial diamonds known from the Mt Surprise gem fields.

Traverse 07GA-GC1 was oriented to cross the grain of the main provinces in the area. It intersected a series of northeast–southwest major fault systems, including the Tasman Line (the major structure that marks the boundary between the Proterozoic craton margin

**Figure 3.** Terrex seismic crew laying out the geophones to record the reflected seismic waves along traverse 01GA-IG1.

to the northwest and the Early Palaeozoic rocks to the southeast) and Balcooma, Burdekin and Clarke River structures. The traverse data will shed light on the location and geometry of the Tasman Line and the internal structure of, and relationships between, the Georgetown, Cape River and Broken River provinces and the northern margin of the Drummond Basin. It will image the stratigraphy of the northern part of the Drummond Basin.

The data will identify relationships between crustal architecture and energy and geothermal systems. The traverse crossed the northern margin of the Drummond Basin and will provide information on the nature and petroleum prospectivity of that area.

The traverse also crossed the eastern Georgetown region, an area known for uranium mineralisation associated with high-heat producing Proterozoic S type granites. It crossed the Burdekin Basin (with potential for uranium mineralisation) and several gold provinces, including the Kidston, Charters Towers (mesothermal Au, veined Au), Mt Leyshon (breccia-hosted Au) and Pajingo (epithermal Au) provinces, as well as VMS (volcanic massive sulfide) base metal deposits at Balcooma and the Highway Mine south of Charters Towers.

## AuScope seismic survey

The AuScope seismic survey consisted of one regional traverse (07GA-A1) covering 205 kilometres. Traverse 07GA-A1 aimed to provide a dataset that will image the Tasman Line. The resulting interpretations on the geodynamic setting of the region will reveal the processes of Australian continental growth. The seismic results will also be used to determine the internal structure of both provinces by linking the surface structure and rock units with deep structure. The seismic results will be used to tie the internal structure to geodynamic evolution and mineralisation events.

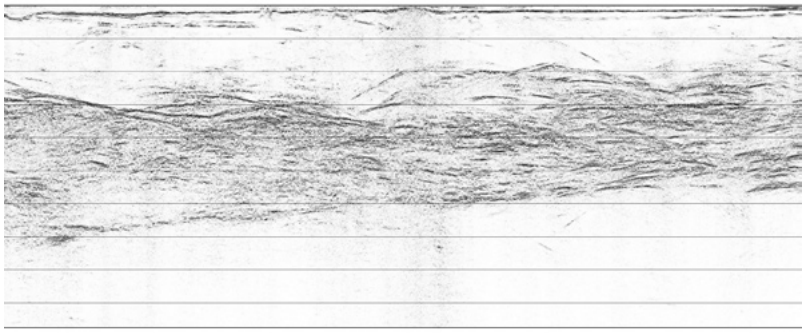

**Figure 4.** Raw field processed section from part of traverse 01GA-IG.

## IGCT seismic acquisition

The IGCT seismic acquisition will provide images of the crust at high resolution. It promises to reveal the crustal architecture and the region's energy and mineral resource potential close to the surface.

Terrex Seismic did the survey (figures 2 and 3), which ran for three months from May 2007, under the supervision of ANSIR staff at Geoscience Australia. The survey's objectives and timing were discussed with local shires, Aboriginal groups, property owners and mining companies.

Table 1 shows the acquisition parameters, which were designed to provide high resolution through the entire crust and images of the top five kilometres.

## IGCT gravity and magnetotelluric acquisition

Gravity and magnetotelluric datasets complemented the seismic reflection dataset for the IGCT traverses. The gravity readings were acquired at a

**Table 1.** Project survey parameters

| | |
|---|---|
| Geophone group interval | 40 m |
| Number of channels | 240 for 07GA-IG1, 300 for 07GA-IG2, -GC1 and -A1 |
| Spread configuration (IG1) | Split spread, 4800 m – 0 – 4800 m (240 channels). |
| Spread configuration (IG2, GC1, A1) | Split spread, 6000 m – 0 – 6000 m (300 channels). |
| VP interval | 80 m nominal, 40 m where there is crooked line or near 'noisy' areas. |
| Source parameters | 3 x Hemi60 vibes (plus 1 spare). |
| Sweep parameters | 3 x 12 s sweeps, 6–64 Hz, 12–96 Hz and 8–72 Hz. |
| Correlated record length | 20 sec |
| Sample rate | 2 ms |
| Acquisition filters | Hi cut 200 Hz, Lo-Cut nil or 3 Hz. |
| Nominal fold | 60 fold (was increased to 120 fold around some bends or near 'seismically noisy' areas). |

400-metre station spacing along each traverse. High-frequency magnetotelluric data were collected along 07GA-IG1, 07GA-IG2 and 07GA-GC1 at 10-kilometre spacing.

Working to Geoscience Australia's specifications, Dynamic Satellite Surveys did the gravity work and Quantex Geosciences handled the magnetotelluric data acquisition from late June until early September.

The results from both surveys and existing aeromagnetic data will be integrated with the seismic reflection data to build a comprehensive image of the third dimension within the region.

## IGCT results

The initial field raw stacks show some remarkable and unexpected images of the regions' crustal-scale geology. Figure 4 shows a portion of the field-processed raw seismic section from traverse 01GA-IG. It is an image of the entire crust between the Mt Isa Province and the Georgetown Province. The Moho stands out as the base to the band of crustal reflectivity in the middle of the figure. It deepens from east to west from approximately 33 to 42 kilometres, indicating that the crust thickens towards the Mt Isa Province.

The middle and lower crust is very reflective. On this field-processed section, the upper crust is non-reflective; however, on the more detailed daily quality control sections, a lot more structure is visible. This detail will be greatly enhanced with further processing, but even in this section there is evidence of both dipping events and sub-horizontal reflectors.

The seismic image has also revealed a series of shallow, large-scale, east dipping structures within the middle crust. The reflection patterns above and below suggest that the structures underwent considerable extension and later contraction, indicating considerable crustal movement between the Georgetown Province and the Mt Isa Block. This raises the question of whether there has ever been a geological relationship between the two provinces, other than the coincidental temporal one.

### Acknowledgments

The seismic data were acquired by ANSIR, the National Research Facility for Earth Sounding, using the services of Terrex Seismic, Perth. We thank them both for their efforts and expertise. We thank the Geological Survey of Queensland for assistance during the field operations. Geoscience Australia is providing staff to process the seismic data.

### For more information

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### Related articles and websites

Onshore Energy Security Program
www.ga.gov.au/minerals/research/oesp/

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

*AusGeo News 86*: Onshore Energy Security Program takes off
www.ga.gov.au/ausgeonews/ausgeonews200706/onshore.jsp

*AusGeo News 87*: Energy Security Initiative Updates
www.ga.gov.au/ausgeonews/ausgeonews200709/security.jsp

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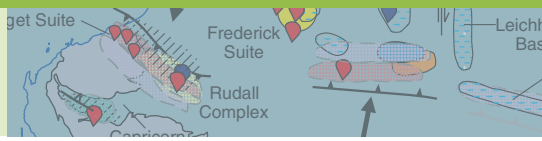
# Uncovering Proterozoic mineral wealth

## *Research points to mineral deposit prospects*




*Geoff Fraser, Narelle Neumann and David Huston*

A project synthesising geochronology, geodynamic analysis and tectonic modelling will give the mining industry hints on where to prospect for big, accessible economic mineral reserves.

Much of Australia's mineral wealth comes from deposits from the Proterozoic Eon, 2500 to 542 million years ago (Ma). About 90% of our uranium and lead, 85% of our zinc, and 70% of our copper reserves were deposited in the Proterozoic.

Most of our world-class deposits, such as Broken Hill, Hilton, Mt Isa, McArthur River HYC, Century and Olympic Dam, formed between 1870 Ma and 1550 Ma, a period spanning about a sixth of the Proterozoic. Apart from Olympic Dam, all these deposits were discovered at or near the surface. Between 30% and 50% of the continent contains rocks from this slice of the Proterozoic, but only a few per cent, at best, crops out. If about 5% outcrop has yielded five giant mineral deposits, 95 giant deposits could remain undiscovered in Proterozoic Australia. In most cases, the cover is only in the order of hundreds of metres at most. The challenge is to predict, at successively higher resolution, where undiscovered mineral wealth lies beneath this thin veneer.

"The challenge is to predict, at successively higher resolution, where undiscovered mineral wealth lies beneath this thin veneer."

## Continental scale

Over the past year, the Proterozoic Synthesis of Australia project has worked to tackle the problem on the continental scale.

We used an understanding of geodynamic processes to predict the location of potential deposits. For example, base metal deposits often occur in developing sedimentary basins, while porphyry copper deposits are often in magmatic arc settings. The project assessed the Proterozoic geodynamic evolution of Australia, and used this to predict regions of mineral prospectivity at the continental scale.

An important component of the project was to compile the evidence underpinning geodynamic interpretations. For the major Proterozoic regions, we compiled and assessed all the available geochronology, and plotted it in a consistent format and time scale to produce a series of time–space graphs (see figure 1 for an example). In contrast to many previously published time–space diagrams, these plots allow easy visual assessment of the quantity and consistency of the available data. The plots are available as thematic layers showing geochronological constraints on sedimentary deposition, magmatic activity, metamorphism and deformation, and mineralising events, along with explanatory notes, in Neumann and Fraser (2007).

Geochronological constraints are critical in comparing the geological history of different crustal fragments in the Australian Proterozoic puzzle. Our compilation highlights

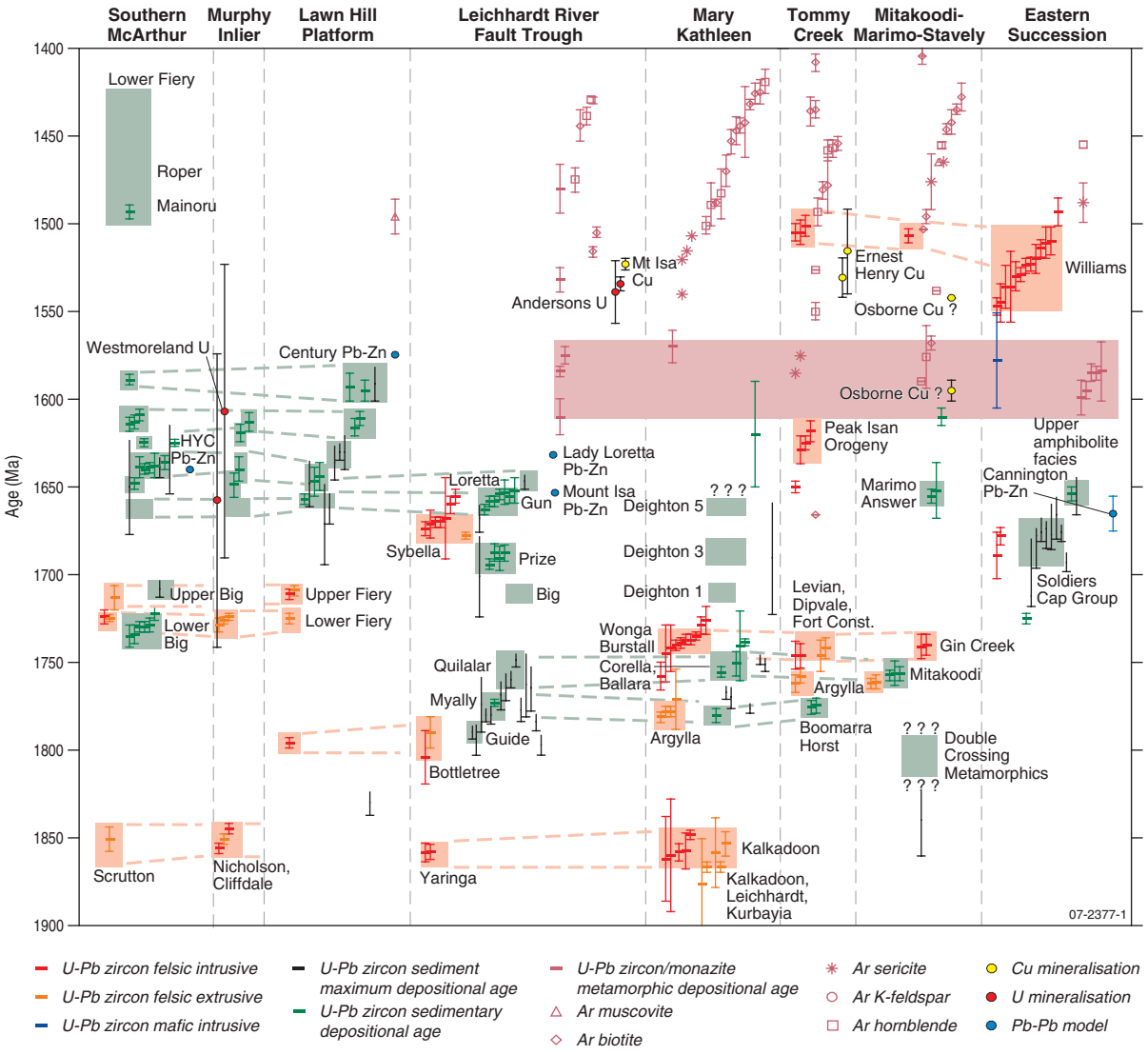



**Figure 1.** Time–space plot for the Mount Isa Inlier and southern McArthur Basin showing the abundance of geochronological data underpinning our understanding of the stratigraphic and magmatic evolution of the eastern margin of the North Australian Craton. All available radiometric ages and their uncertainties are plotted and coded by colour and symbol according to the geochronological method and geological interpretation. Coloured overlays highlight periods of geological activity, with green indicating sedimentation, red, magmatism and pink, metamorphism.

the wide variation in the quantity and quality of geochronological constraints for different Australian Proterozoic inliers, and for different aspects of their evolution. For example, the abundance of data for the Mt Isa region and Curnamona Province allows a relatively detailed stratigraphic framework to be erected, in contrast to the relatively few stratigraphic age constraints available for the Gawler Craton. As well as indicating levels of confidence that can be attached to age-based geological correlations, this information can also be used to guide future dating work, both within Geoscience Australia and by external researchers.

## Reviews of earlier models

As part of the project, we held a series of workshops in collaboration with colleagues from the state and Northern Territory geological surveys to review and summarise the geological evolution of particular Australian Proterozoic regions.

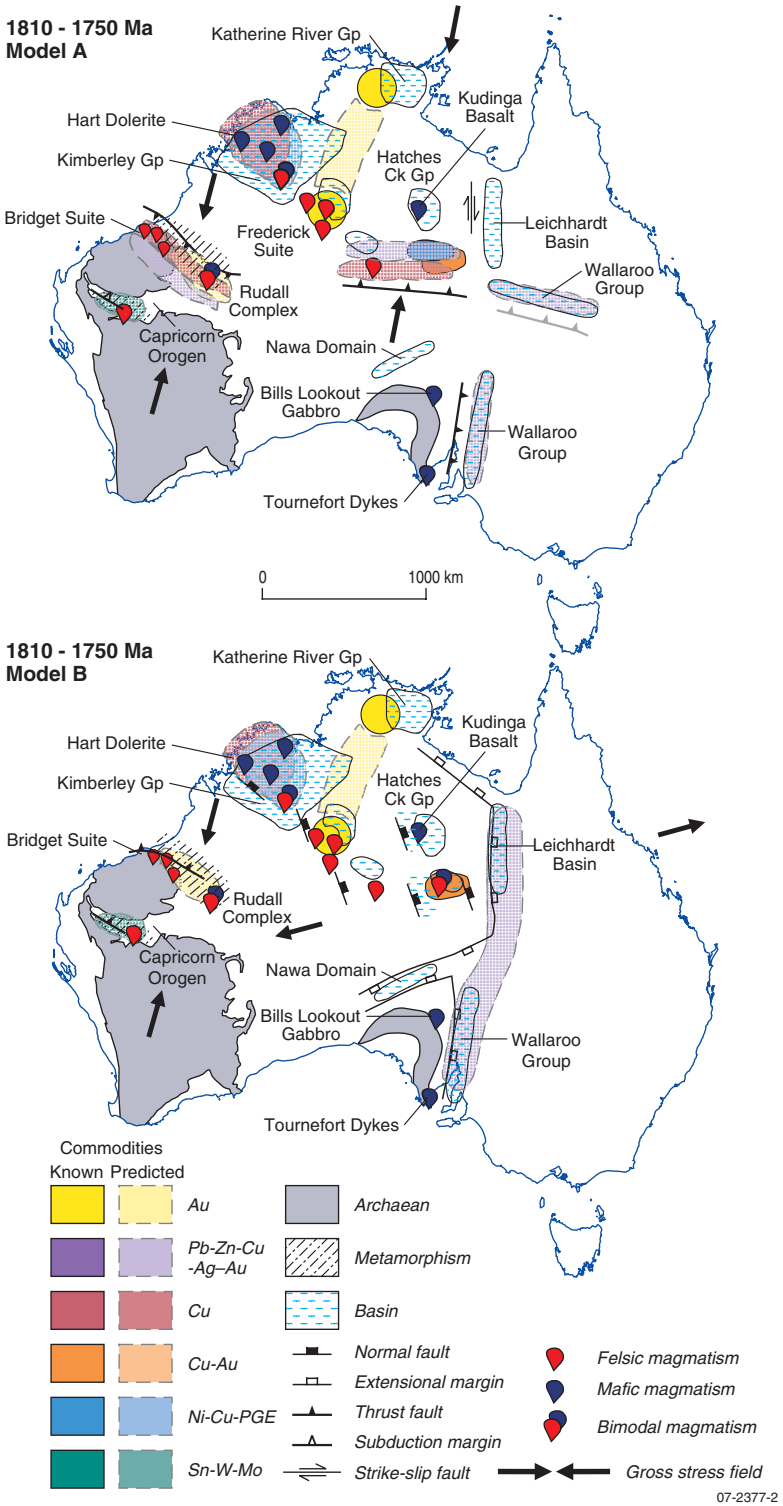



**Figure 2.** Alternative geodynamic models for Proterozoic Australia for 1810 Ma to 1750 Ma, with known and predicted mineral commodities shown as coloured overlays. Note the contrasting predictions of mineral prospectivity in the two models along the eastern margin of both the North Australian and South Australian cratons, along the southern margin of the North Australian Craton, and along the margin between the North Australian and West Australian cratons.

We also reviewed previously published tectonic models for Proterozoic Australia and the evidence on which they were based. The review traced the development of tectonic interpretations over the past 20 years, ranging from the 'ensialic' model of Etheridge et al (1987) invoking largely vertical addition to the crust, to a series of recently published models dominated by plate tectonic-style, horizontal accretionary tectonics.

There is an apparent inconsistency between recently published models that infer a long-lived, convergent, accretionary margin along the southern edge of the North Australian Craton (for example, Giles et al 2004, Betts and Giles 2006, Wade et al 2006) and others that infer a long-lived east-facing extensional margin along the eastern edges of the North Australian and South Australian cratons (Gibson et al, in press). The contradictions arise partly from workers having experience in different parts of Proterozoic Australia and partly from contrasting tectonic interpretations of the same geological evidence.

## Implications for explorers

Since the tectonics is open to interpretations with differing implications for minerals systems,

we have not presented a single model for the tectonic evolution of the Australian Proterozoic. Instead, we present two contrasting end-member models for five time intervals between 1870 and 1550 Ma. We present the models as a series of diagrams showing major geological features and inferred geodynamic setting, with coloured overlays depicting predicted mineral commodities based on associations between mineral systems and geodynamic processes.

Prediction of mineral prospectivity conducted at the continental scale provides a first-order guide to area selection for mineral exploration. Examples of these diagrams are shown in figures 2a and 2b. They illustrate how different end-member geodynamic models lead to significantly different predictions of mineral prospectivity in particular regions. See Fraser et al (2007) for the full series of the diagrams and explanatory notes, along with a review of published tectonic models and known metallogenic events for Proterozoic Australia.

## For more information

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## Related websites/articles

Proterozoic Synthesis Project
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Fraser G et al. 2007. Geodynamic and metallogenic evolution of Proterozoic Australia from 1870–1550 Ma: a discussion. Geoscience Australia Record 2007/16

Neumann N & Fraser G (eds). 2007. Geochronological synthesis and time-space plots for Proterozoic Australia. Geoscience Australia Record 2007/06

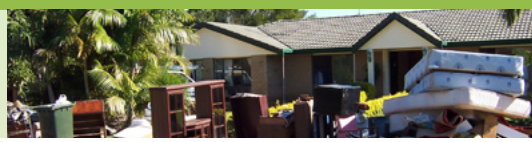
"Geochronological constraints are critical in comparing the geological history of different crustal fragments in the Australian Proterozoic puzzle"

Australian Government
Geoscience Australia

AUSGEO news
ISSUE 88 Dec 2007

# Safeguarding Australia

## *Exposure information aids disaster mitigation*



*Krishna Nadimpalli*

As Geoscience Australia continues its grand survey of the Australian continent down to the Moho, it is also undertaking a series of national risk assessments for several natural hazards in the urban landscape. Information defining the buildings, people, businesses, employment and infrastructure that would be affected by natural disasters underpins the project.

## A COAG research priority

The National Exposure Information System (NEXIS ) project was an initiative of Geoscience Australia in response to the Australian Government's research priority of safeguarding Australian communities from natural hazards, terrorism, invasive diseases and infrastructure failures. It follows a recommendation in the Council of Australian Governments Natural disasters in Australia report for a 'nationally consistent system of data collection, research and analysis to ensure a sound knowledge base on natural disasters and disaster mitigation'.

NEXIS aims to collect, collate and maintain nationally consistent and best available exposure information at the level of individual buildings. It requires detailed spatial analysis and the integration of available demographic, structural and statistical data.

The system integrates data from several national spatial databases, such as the Geocoded National Address File, the Property Cadastre, Australian Bureau of Statistics (ABS) census data, the ABS Business Registry, Reed–Cordell building cost factors, and Cityscope (commercial properties within CBDs). It also takes in post-disaster surveys and data from state agencies and local government bodies.


07-2485-2

**Figure 1.** Residential exposure information of the type contained in the NEXIS database.

## All building types covered

The generic version of residential exposure information is complete and provides information about location, building type, construction type, population and asset replacement cost (figure 1).

Business exposure information, which is harder to collect and maintain, covers CBDs, non-CBD commercial areas and industrial areas. The business information fields of this developing NEXIS capability include the business type (using Australian and New Zealand Land Information Council categories), business turnover and employee details, as well as the spatial and building information. Figure 2 shows a section of the residential, commercial and industrial buildings on the Gold Coast.

The exposure of ancillary buildings, including those of schools, essential services,

government agencies, museums, stadiums and ports, will also be included.

Eventually, NEXIS will commence the integration of critical infrastructure information, which includes the attributes required to predict the consequences of infrastructure failures. This information has been collated by the Engineering Vulnerability Project, which is leading the development of vulnerability models to assess the damage from various natural hazards and critical infrastructure failures. The exposure information and vulnerability models will underpin the development of critical infrastructure protection modelling and analysis (CIPMA) and natural hazard impacts capability at Geoscience Australia. The data integration process being developed will observe confidentiality agreements made during collection of the data.

"NEXIS aims to collect, collate and maintain nationally consistent and best available exposure information at the level of individual buildings."

NEXIS is undergoing quality assessment to identify and solve problems and fill gaps affecting the development of a more meaningful and realistic exposure definition. One example is the identification of the age and construction type of residential buildings. Geoscience Australia is sourcing several additional datasets, such as ABS historical databases and home approval information, to get a clearer picture of age and construction type.


**Figure 2.** Spatial locations of residential, commercial and industrial buildings on a section of the Gold Coast.

NEXIS is currently using a generic approach, but the information will become more specific over time. The development of strategic alliances with external stakeholders is enabling the capture of the more specific reference databases they hold.

Geoscience Australia will incorporate this specific exposure information on location, building and demographic profiles, business activity and associated infrastructure as the new datasets and other sources of information become available.

## Benefits for disaster recovery

This system is intended to provide a relative assessment of exposure to several hazards and map the distribution of exposure. This will help local, state and national government agencies identify communities at risk and prepare with impact mitigation strategies. The information will also help emergency managers. By integrating the information with the decision-support tools of early warning and alert systems, they will be able to forecast the impacts of various hazards and assess damage quickly. This will help them prioritise and manage response operations.

### *For more information*

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Australian Government
Geoscience Australia

AUSGEO news
ISSUE 88 Dec 2007

# Australian mineral exploration expenditure at record highs

## *Strong global demand underpins record expenditure*

*Lynton Jaques and Mike Huleatt*

## Record world mineral exploration

World mineral exploration is at record levels according to the latest survey by the Metals Economics Group (MEG) survey which showed that world non-ferrous mineral exploration budgets for 2007 reached an estimated US$10.5 billion, a 40% increase on 2006 figures (figure 1). This figure, based on a survey of 1 821 companies with mineral exploration budgets of US$100 000 or more, does not include iron ore, coal or uranium. However, MEG estimated uranium exploration budgets were an additional US$936 million based on responses from 363 companies. This was the first time that MEG included uranium in the survey and gives a combined estimate for world mineral exploration budgets for non-ferrous minerals (that is, excluding iron ore and coal but including uranium), of more than US$11.4 billion. Of this 42% was allocated for gold exploration and 36% for base metals (copper, nickel, lead and zinc) which was up strongly (55%) on 2006 budgets.

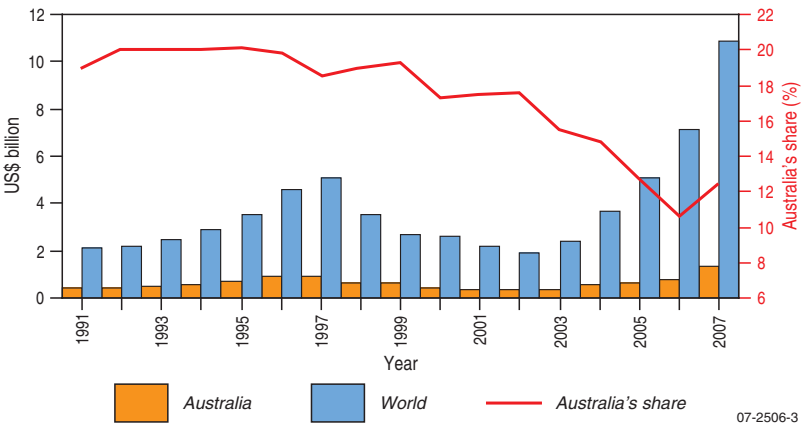


**Figure 1.** World and Australian non-ferrous mineral (excluding iron ore and coal) but including uranium exploration budgets in 2007 (Source: Metals Economics Group Corporate Exploration Strategies).

Exploration budgets increased in all regions of the world, and world mineral exploration budgets have risen by a factor of five since 2002, when mineral exploration was at the lowest level in recent years (figure 1). Canada continued to attract the largest share, as it has since 2002 when it overtook Australia, with 19% of world non-ferrous mineral exploration budgets, which is comparable to recent years. Australia attracted the second largest share with 11.9% of global non-ferrous mineral exploration budgets in 2007 in the MEG survey. This increased from 10.6% in 2006 and was the first increase in Australia's share since 2002 (figure 1). Canada and Australia also dominated world uranium exploration which is estimated to have risen tenfold since 2003, with approximately 43% and 19% of world uranium exploration budgets, respectively. As a consequence, Canada's share of world non-ferrous mineral exploration budgets, including uranium, in 2007 was 21.2 % and Australia's share was 12.4%.

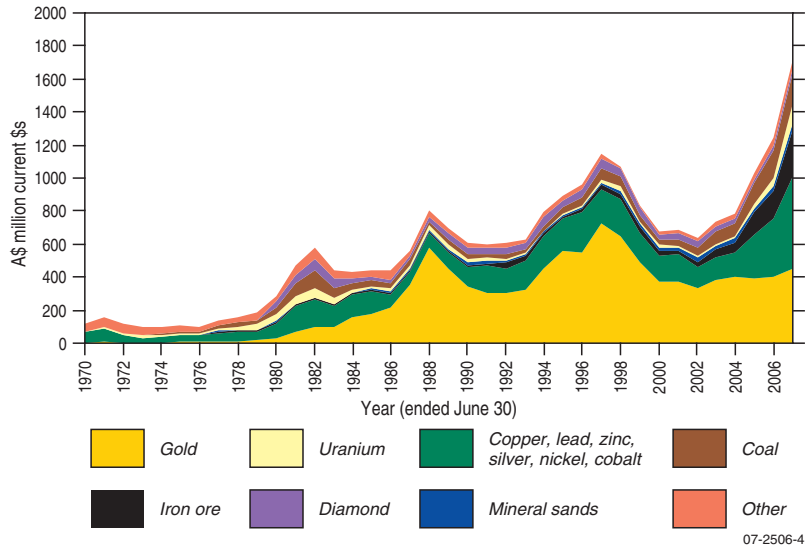


**Figure 2.** Australian mineral exploration expenditure 1970-2007 (current dollars, source: Australian Bureau of Statistics).

## Australian mineral exploration also at record levels

Australian mineral exploration is also at record levels as shown by the Australian Bureau of Statistics (ABS) survey figures that record actual Australian mineral exploration expenditure (including iron ore, coal, and uranium) reaching a record $1714.6 million in 2006-07, an increase of 38% from $1240.7 million in 2005-06 (figure 2). Underpinning the record global exploration budgets and Australian mineral exploration expenditure is the continuing minerals boom with record or near-record commodity prices largely driven by demand from China.

In Australia during 2006-07 spending increased in all states and the Northern Territory. Western Australia was the leading destination attracting $839.1 million (figure 3), an increase of 42%. However, the greatest percentage increase in exploration spending was recorded in South Australia which rose by 78% to $260.7 million. Other jurisdictions to record strong growth in mineral exploration expenditure included New South Wales (up 26% to $144.1 million), Queensland (up 24% to $272.3 million), and the Northern Territory (up 23% to $92.2 million). Modest increases were recorded by Victoria (up 11% to $82.5 million) and Tasmania which recorded a 5% increase to $23.7 million (figure 3).

"Exploration budgets increased in all regions of the world, and world mineral exploration budgets have risen by a factor of five since 2002"

Base metals dominated Australian exploration expenditure for the first time since 1983 and reached $555.0 million (figure 4), up 56% on 2005-06 figures. Exploration for silver-lead-zinc rose 96% to $139.4 million, copper by 68% to $234.5 million, and nickel by 24% to $181.9 million. The largest increase was in uranium exploration which doubled to $114.1 million. Iron ore exploration expenditure rose 77% to $285.3 million. Gold exploration spending, in comparison, rose by only a modest 14% on the previous year to $455.8 million and accounted for approximately 27% of total exploration (figure 4), its lowest share in nearly 25 years. Coal exploration was up 16% to $193.3 million, the highest in real terms since 1981-82.

The ABS survey data showed that, nationally, 36% of spending

was on exploration for new deposits, compared to 37% in 2005-06. Victoria (46%) had the highest proportion of its exploration directed to the search for new deposits while South Australia had the lowest at 24%. The national share of exploration for new deposits is slightly lower than that estimated by the MEG world survey of non-ferrous minerals exploration budgets for 2007 which found that 39% of exploration budgets in Australia was for grassroots exploration.

In 2006-07, ABS reported that exploration drilling for all mineral commodities totalled 8.455 million metres, an increase of 1.618 million metres from 2005-06. Increases were recorded in both the search for new mineralisation which rose by 0.62 million metres to 3.24 million metres and exploration of existing mineralisation which rose by 0.996 million metres to 5.215 million metres.

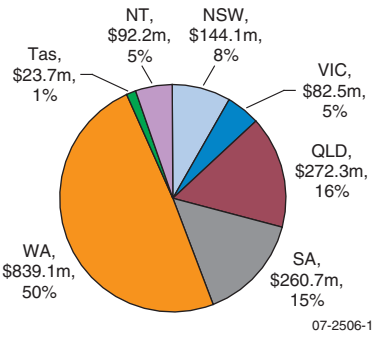


**Figure 3.** Australian mineral exploration expenditure 2006-07 by jurisdiction (Source: Australian Bureau of Statistics).

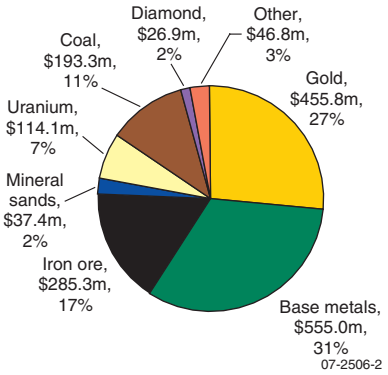


**Figure 4.** Australian mineral exploration expenditure 2006-07 by commodity (Source: Australian Bureau of Statistics).

## Outlook for 2008

Commodity prices remain relatively strong reflecting continuing global demand, primarily from China, although most metal prices have eased from their record highs reached over the past 18 months. Most are forecast to ease further in 2008 as a consequence of increased world supply. The record world and Australian mineral exploration budgets reported in the MEG 2007 survey, coupled with the high levels of capital raising on both Australian and global financial markets in 2007, suggest that mineral exploration will remain at high levels through 2008. The strong focus on brownfields exploration in Australia (and globally) in recent years is a consequence of the shortfall in mineral supply with companies seeking to prove up resources and increase or commence production to capitalise on the high prices. This is particularly true of the recent strong growth in iron ore exploration. A continued dominance of brownfields over greenfields exploration may well be a cause for concern in the longer term as new mineral deposits – and, particularly, new mineral provinces – are needed for the long term future of the industry.

### *For more information*

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in brief

## Groundwater funding flows to Geoscience Australia

Geoscience Australia will participate in a project funded under the National Water Commission's Raising National Water Standards Programme. The project, Water for Australia's Arid Zone – Identifying and Assessing Australia's Palaeovalley Groundwater Resources, will receive funding of $4.935 million over a five-year period (2008–2012). It will directly address the gaps in our fundamental knowledge and management practices which currently limit the use of palaeovalley aquifers, a potentially significant but poorly understood groundwater resource in many areas of Australia's arid interior. In particular, this project will:

- Enchance our knowledge of the groundwater resources of arid and semi-arid Australia
- Improve methodologies for determining the characteristics, volumes and sustainability of groundwater resources in palaeovalley aquifers
- Evaluate the application of non-conventional and conventional groundwater assessment methods to delineating palaeovalley groundwater resources. This will improve our understanding of groundwater resources for remote communities, such as indigenous townships, as well as potential future mining and agricultural developments
- Develop a conceptual and spatial framework of key palaeovalley system types and associated groundwater scenarios in arid and semi-arid regions
- Develop a national strategy to delineate and manage arid-zone palaeovalley resources in respective geologic provinces or regions
- Provide guidelines to state agencies, other water managers and remote communities for the sustainable management and use of palaeovalley resources and associated groundwater-dependant ecosystems.

This project is being led by Geoscience Australia in collaboration with various geological and water resource agencies from South Australia, Western Australia and the Northern Territory. The consortium also includes a mining and exploration industry partner, Newmont Australia.

The Water for Australia's Arid Zone project will also collaborate with, and build on research carried out by, Geoscience Australia's Onshore Energy Security Program.

***For more information***

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## International Year of Planet Earth

The General Assembly of the United Nations has proclaimed 2008 as the International Year of Planet Earth (IYPE). The IYPE is being preceded by a preparatory year in 2007 with a wrap-up year in 2009.

The aim of the IYPE is to demonstrate how the earth sciences can assist future generations meet the challenges involved in ensuring a safer, healthier and more prosperous world. The initiative seeks to raise awareness of the role and contribution of the earth sciences to society through science and outreach programs.

The IYPE science program is concentrating on 'big issues' and the complex interactions of Earth systems in determining its long-term sustainability. For example, Geoscience Australia is collaborating with similar organisations from more than 40 countries to embark on one of the most ambitious geological mapping programs ever undertaken: OneGeology is a major international initiative that is fast-tracking

planetearth® Earth Sciences for Society

moves towards international data exchange which will provide internet access to the most up-to-date geological data at a scale of 1:1 million.

IYPE will be a dominant theme at geoscience conferences throughout 2008. The 33rd International Geological Congress to be held in Oslo in 2008 includes themes

in brief

related to IYPE and will aim to showcase the earth sciences as the foundation for sustainable development. The Australian Earth Sciences Convention to be held in Perth in July 2008 will also focus on the key themes of IYPE. The Convention will be jointly hosted by the Geological Society of Australia and the Australian Institute of Geoscientists. The Inaugural Global Geotourism Conference, also to be held in Perth, will follow the Convention.

The IYPE outreach program includes educational activities at every level. The IYPE Global Launch Event on February 12 and 13 at the UNESCO Headquarters in Paris aims to bring together students from around the world. Up to 350 students will be invited to attend the event following their participation in the IYPE Student Contest. The creativity and perception of the selected students will provide new perspectives on the major themes of the IYPE. The National Committees in Australia and New Zealand will each select students to take part in the event.

Outreach activities in Australia include a special edition coin set to commemorate IYPE released by the Royal Australian Mint on 22 November 2007. The Australian Bureau of Statistics Year Book 2008, which will be launched as part of Australia Day 2008 celebrations, will also have an IYPE theme. The Australian Science Teachers Association has also chosen "Planet of Earth - Planet of Change" as the theme for their 2008 National Science Week Teacher Resource Book.

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Ms Janine Murphy, CEO Royal Australian Mint and Dr Ian Lambert, Geoscience Australia and Member of the Australian National IYPE Committee following the release of the 2008 Special Edition IYPE Coins at the Royal Australian Mint, Canberra.

## SPOT the changes in our data

To assist users of the Geoscience Australia website to find the best available data as well as minimise the amount of time required to find and access information, Geoscience Australia has developed a formal method of managing its geospatial and geoscientific data holdings. Known as Single Point of Truth (SPOT), the methodology will apply consistency to data, and enhance Geoscience Australia's reputation both as a source of high quality information and advocate of best practice information-management.

So far SPOT has been applied to the Gazetteer of Australia. The remaining major data themes will be receiving the SPOT treatment over the next three years. They will include Bathymetry, Elevation, Located Sample Data, Drillholes, Geochemistry, Geochronology, Exposure and Marine Surveys. These are scheduled to be completed during 2008.

If you wish to view the SPOT methodology, it is available through the Geoscience Australia Sales Centre or downloadable from the web as a pdf.

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### Geoscience Australia Sales Centre

**Freecall** 1800 800 173 (within Australia) or +61 2 6249 9966
**email** sales@ga.gov.au

### Related websites/articles

Single Point of Truth (SPOT) methodology
www.ga.gov.au/standards/spot.jsp

product news

# Offshore Canning Basin magnetic survey data

Geoscience Australia has acquired new high-resolution magnetic data across the 2007 Offshore Acreage Release areas (W07-12 to 15) in the offshore Canning Basin (figure 1). The survey, completed under a contract awarded to Fugro Airborne Surveys Pty Ltd, also covers adjacent State Water Acreage Release Areas (T07-1 to 3) and ties to and in-fills existing onshore and offshore magnetic data. Bids for the Commonwealth offshore release areas close on 17 April 2008.

The survey data improves our understanding of the geology and petroleum potential of the release areas by identifying structural and basement features, including the delineation of associated Devonian reef trends and Permian intrusive structures. No exploration activities have been undertaken in the offshore area since the 1980s, but several petroleum systems (Permo-Carboniferous, Devonian and Ordovician) in the adjacent onshore portion of the basin are proven to be prospective. Live oil shows have been recorded at multiple levels within the Permian-Devonian section intersected in the offshore Perindi-1 well (1983).

The Survey data covers an area of approximately 31 770 square kilometres and consists of a total of 56 504 line kilometres, comprising 44 633 line kilometres of new data (flying height of 60 metres above sea level) and 11 871 line kilometres of pre-existing data. Geoscience Australia has levelled and merged the new and older datasets to achieve a 750 metre line spacing and 3000 metre tie-line spacing grid across the release areas.

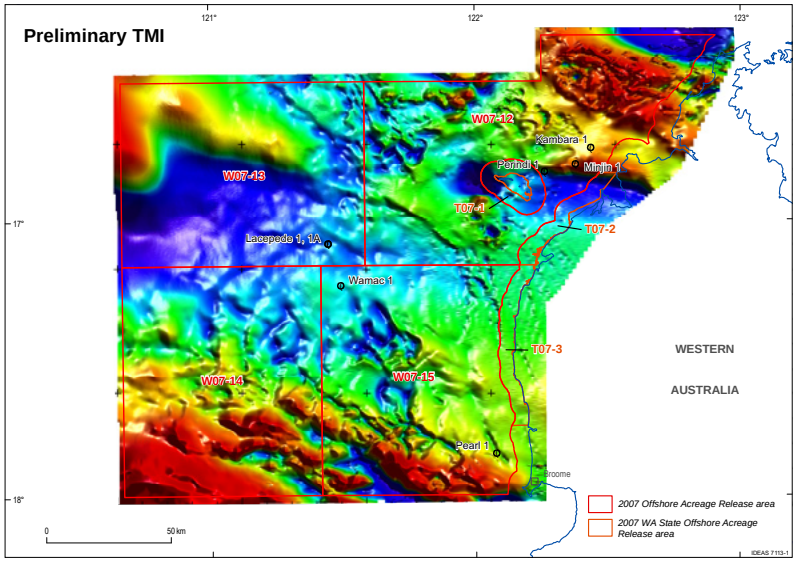


**Figure 1.** Preliminary total magnetic intensity map of newly acquired data in the Offshore Canning Basin, Western Australia, showing offshore acreage release areas.

Levelled and merged magnetic data were released on 30 October 2007 through Geoscience Australia's geophysical online data delivery system (GADDS).

Geoscience Australia has let a contract to Encom Technologies Pty Ltd to undertake an integrated geophysical and geological interpretation and hydrocarbon prospectivity assessment of the Offshore Canning Basin based on this newly available magnetic survey data. Results of this interpretation study will be released in February 2008.

## For more information regarding the magnetic data

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## For more information regarding the interpretation report

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## Related websites

Geophysical Archive Data Delivery System (GADDS)
www.geoscience.gov.au/gadds/

product news

## New geophysical datasets released

Datasets from five new geophysical surveys have been released since September 2007. They include four new airborne magnetic and radiometric surveys in the Onshore and Offshore Canning Basin as well as the Mount Isa region in Queensland. The new gravity data covers part of the Cooper Basin in southwest Queensland.

The Onshore Canning airborne survey and the Cooper Basin North gravity survey were conducted under Geoscience Australia's Onshore Energy Security Program (OESP). The Program provides funding over five years for the application of the latest geophysical imaging and mapping technologies to attract investment in exploration for onshore petroleum, geothermal and energy mineral sources.

**Table 1.** Details of the gravity surveys.

| Survey | Survey Type | Date of Acquisition | 1:250 000 Map Sheets | Station Spacing/ orientation | Stations | Contractor |
|---|---|---|---|---|---|---|
| Cooper Basin North (Qld) | Gravity | May – June 2007 | Maneroo, Longreach, Connemara, Jundah, Blackall | 4.0 x 4.0 km east – west | 3 537 | Daishsat Geodetic Surveyors |

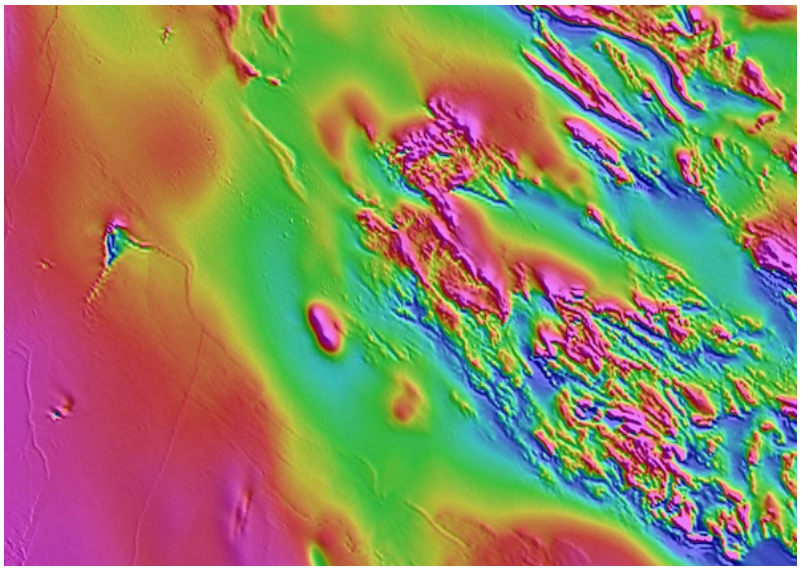
**Table 2.** Details of the airborne surveys.

| Survey | Survey Type | Date | 1:250 000 Map Sheets | Line Spacing/ terrain clearance/ orientation | Line km | Contractor |
|---|---|---|---|---|---|---|
| Onshore Canning Basin (WA) | Magnetic, Radiometric, Elevation | April – July 2007 | Anketell, Joanna Spring, Dummer, Paterson Range, Sahara, Percival, Tabletop, Rudall | 800 m 80 m north – south | 102 656 | Fugro Airborne Surveys |
| Offshore Canning Basin (WA) | Magnetic | June – August 2007 | SE51-01, Pender, SE51-05, Broome | 750 m 60 m north – south | 46 733 | Fugro Airborne Surveys |
| East Isa North (Qld) | Magnetic, Radiometric, Elevation | April – July 2007 | Richmond, Hughenden, McKinlay, Manuka, Tangorin | 400 m 80 m east – west | 113 195 | UTS Geophysics |
| East Isa South (Qld) | Magnetic, Radiometric, Elevation | Nov 2006 – July 2007 | McKinlay, Manuka, Mackunda, Winton, Brighton Downs, Maneroo | 400 m 80 m east – west | 146 900 | Fugro Airborne Surveys |

product news

The Offshore Canning Basin Survey data will assist explorers assess the resource potential of four areas in the Canning Basin which were included in the 2007 Offshore Acreage Release of offshore petroleum exploration areas. Bids for these areas are open until 17 April 2008.

For all surveys the data were acquired in surveys conducted in 2007 which were managed by Geoscience Australia. The East Isa North and East Isa South airborne magnetic and radiometric surveys were managed by Geoscience Australia on behalf of the Geological Survey of Queensland.



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

### For more information

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### Related websites

Geological Survey of Queensland
www.nrw.qld.gov.au/science/geoscience/

Geoscience Australia's Onshore Energy Security Program
www.ga.gov.au/minerals/research/oesp/index.jsp

Geoscience Australia's Acreage Release
www.ga.gov.au/oceans/ss_Acreage.jsp

## New maps of the Great Barrier Reef seabed

A new physical dataset of the Great Barrier Reef (GBR) seabed, which can be used by marine managers and planners, researchers and students, to better understand the nature and layout of seabed habitats, both at a regional scale and within the planning zones, has recently been released by Geoscience Australia.

The report, *Inter-reefal seabed sediments and geomorphology of the Great Barrier Reef (GBR), a spatial analysis* includes quantitative sedimentary and geomorphic information as well as maps showing modern surface sediment patterns and geomorphic features within the GBR Marine Park (MP) and its planning zones. The sediment maps show local and regional trends in surface sediments, refining the existing facies model for the mixed carbonate-siliciclastic GBR margin. The report and maps are the first overview of the regional sedimentary characteristics of inter-reefal areas in the GBR since the pioneering research carried out in the 1970s and early 80s.

Many new sediment samples were collected as part of the CSIRO Seabed Biodiversity Project, which filled gaps in the existing sample coverage. Together with samples from previous work stored in Geoscience Australia's National Marine Samples Database (MARS), this dataset has substantially improved the coverage of surface sediment data in inter-reefal areas. This regional dataset contains over 3 000 sediment samples, many of which are available from MARS.

The maps show the spatial distribution of surface sediments and geomorphic features within the marine park area. Twenty four separate maps

product news

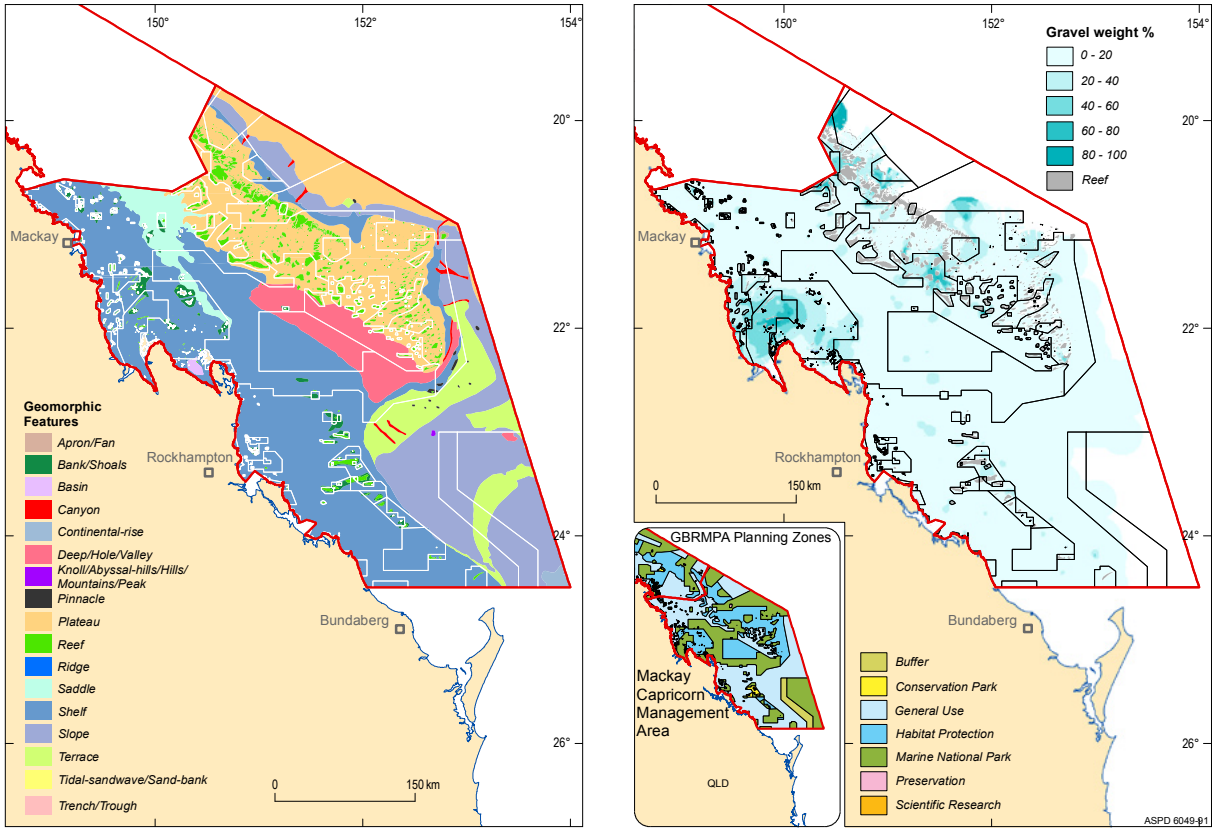


**Figure 1.** Maps of the seabed geomorphic features and percentage gravel sediments attribute in the Mackay-Capricorn Management Area.

show the spatial distribution, by percentage, of gravel, sand, mud, bulk carbonate, carbonate sand and carbonate mud attributes of surface sediments in the Management Areas that make up the Marine Park. Each of these sediment attributes are also represented in six poster size maps of the entire marine park. Another 24 maps show the relationship between geomorphology and surface sediments in characterising the seabed within each of the planning zone types (figure 1).

The new report and maps can be downloaded free in pdf format from the Geoscience Australia website.

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## To order the Record

**phone** Geoscience Australia Sales Centre Freecall 1800 800 173 (within Australia) or +61 2 6249 9966
**email** sales@ga.gov.au

## Related websites/articles

GBR sedimentology (Geoscience Australia Record and maps)
www.ga.gov.au/image_cache/GA10248.pdf

Geomorphic Features (Geoscience Australia Record)
www.ga.gov.au/image_cache/GA7950.pdf

AusGeo News 84: Great Barrier Reef Marine Park sedimentology revealed
www.ga.gov.au/ausgeonews/ausgeonews200612/reef.jsp

events

## Earth Science Week 2007 celebrations

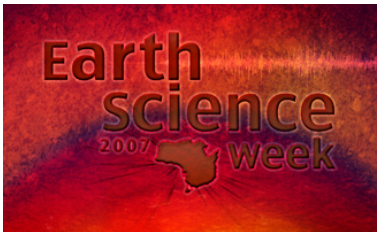
The highlight of the Earth Science Week 2007 celebrations at Geoscience Australia was an Award Ceremony following the screening of winning entries from the inaugural Geologi short film competition.

Over 200 students across Australia produced and submitted 56 short films for the competition which was hosted by Geoscience Australia and sponsored by the National Geographic Channel Website–Australia.

The competition entries featured a diversity of earth science themes. The Senior Gold award was won by 'Carbon Sinks' produced by students from St John Bosco College (NSW). The Junior Gold award was presented to students from Presbyterian Ladies College (WA) for their three-minute film 'Quicksand queries'.

Earth Science Week celebrated its tenth year with the theme 'The Pulse of Earth Science', which highlighted the significant contribution the earth sciences make to the world we live in, and the diversity of career opportunities available to earth science graduates. Earth Science Week activities were again held across Australia raising the profile of the earth sciences in local communities and schools.

In 2008, Earth Science Week will focus on 'International Year of Planet Earth' themes and will be celebrated between October 12 and 18.

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### Related websites

Earth Science Week, Geoscience Australia
www.ga.gov.au/about/event/eswhome.jsp

Earth Science Week, International
www.earthsciweek.org/

International Year of Planet Earth,Geoscience Australia
www.ga.gov.au/about/event/IYPEhome.jsp

International Year of Planet Earth
www.esfs.org/

events calendar

**NAPE Expo 2008**
American Association of Professional Landmen
*7 & 8 February*
Houston, Texas, USA
Contact: NAPE, 4100 Fossil Creek Boulevard, Fort Worth, Texas 76137 USA
p +1 817 847 7700
f +1 817 847 7703
e info@napeexpo.com
www.napeonline.com

**PDAC 2008 International Convention & Trade Show**
Prospectors and Developers Association of Canada
*2 to 5 March*
Metro Toronto Convention Centre, Toronto, Canada
Contact: PDAC, 34 King Street East Suite 900, Toronto, Ontario M5C 2X8
p +1 416 362 1969
f +1 416 362 0101
e info@pdac.ca info@pdac.ca
www.pdac.ca/

**Salinity, Water and Society – Global issues, local action**
2nd International Salinity Forum
*31 March to 3 April*
Adelaide Convention Centre
Contact: Conference Logistics, PO Box 201, Deakin West ACT 2600
p +61 2 6281 6624
f +61 2 6285 1336
e conference@conlog.com.au
www.internationalsalinityforum.org

**2008 APPEA Conference and Exhibition**
Australian Petroleum Production and Exploration Association
*6 to 9 April*
Perth Convention & Exhibition Centre
Contact: Julie Hood, APPEA Limited, GPO Box 2201, Canberra ACT 2601
p +61 2 6247 0906
f +61 2 6247 0548
e jhood@appea.com.au
www.appea.com.au

**AMEC National Mining Congress 2008**
Association of Mining and Exploration Companies
*22 to 24 May*
Perth Convention & Exhibition Centre
Contact: AMEC, PO Box 545, West Perth, WA 6872
p 1300 738 184 (within Australia)
f 1300 738 185 (within Australia)
e events@amec.org.au
www.ameccongress.com.au/

**Australian Earth Sciences Convention 2008**
Geological Society of Australia & Australian Institute of Geoscientists
*20 to 24 July*
Perth Convention & Exhibition Centre
Contact: International Conferences and Events Pty Ltd, Suite 4, 73 Hay Street, Subiaco, WA 6008
p +61 8 9381 9281
f 61 8 9381 9560
e aesc2008@iceaustralia.com
www.iceaustralia.com/aesc2008/