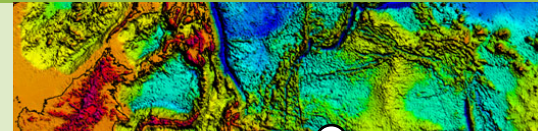




A chronicle of change

AusGeo News celebrates 20 years



Stephen Ross

AusGeo News, Geoscience Australia's quarterly online magazine, commenced publication in December 1990 as a bimonthly newsletter. It was designed to keep the clients of the then Bureau of Mineral Resources, Geology and Geophysics (BMR) in the minerals and petroleum exploration industries, government, education and conservation informed. Content included 'research results, program changes, staff movements, new publications and data releases' or the three 'Ps' (people, programs and products). Since then *AusGeo News* has informed readers about the progress of the agency's programs and products and significant structural changes (including two name changes). It has also chronicled the adoption of a greater range of functions serving a wider range of clients and stakeholders in government, industry and the community.

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'A New Approach'

The newsletter was inaugurated following the Woods Review of the BMR in 1989. The Review recommended that BMR move towards a stronger survey and mapping role which reflected industry's needs and priorities. There was also a clear recognition that geoscience was relevant to the consequences of resource development and use as well as environmental issues. In accordance with a major recommendation of the Review, the early issues of *AusGeo News* had a major focus on outputs of the National Geoscience Mapping Accord (NGMA).

The newsletter promoted the agency's first name change in 1992 when BMR became the Australian Geological Survey Organisation (AGSO). Subsequently the magazine's content was expanded to

include details of presentations by AGSO staff at major industry and professional conferences (the fourth 'P'). An external earnings target of 30 per cent of the agency's 1994/95 Budget allocation led to the inclusion of *AusGeo International* as an insert. It reported on geoscientific services AGSO provided for foreign government agencies (Argentina, Fiji and Oman) and projects funded by the Australian International Aid and Development Agency. The latter included an assessment of groundwater pollution in Nepal, earthquake mapping in Fiji and the establishment of an earthquake monitoring network in Papua New Guinea.

More than a newsletter

The newsletter began to move beyond its original format following the introduction of full colour in 1997 and increased graphic design input. It also included brief articles explaining the new technologies and techniques being used to undertake major projects. The magazine format introduced in 2000 soon evolved so that each issue had several main articles. Each issue also included separate

Year	Feature article
2010	2010 - Australian Energy Resource Assessment
	2009 - Australian Tsunami Warning System
	2008 - Australia's marine jurisdiction confirmed
	2007 - Geophysical tie-line survey
	2006 - Energy Security Programs funded
2005	2005 - Perth Cities Project
	2004 - Indian Ocean Tsunami
	2003 - 'Big New Oil' program
	2002 - Greenhouse gas storage potential
2000	2001 - Organisation renamed Geoscience Australia Merger with AUSLIG
	2000 - Salinity mapping Education Centre opens
	1999 - Resource assessment functions return
	1998 - National digital datasets
	1997 - South Tasman Rise seafloor mapping
	1996 - Cities Project launched Pine Creek GIS
1995	1995 - Murray Basin hydrogeological maps
	1994 - Law of the Sea project begins
	1993 - Magnetic Anomaly Map of Australia Mt Isa GIS
	1992 - AGSO formed Richards Review
	1991 - Environmental geoscience projects
1990	1990 - National Geoscience Mapping Accord

sections for In brief and product news reports as well as an Events calendar. The readership target was broadened beyond industry and stakeholders to include the 'interested reader' with a science or technical background but not necessarily in the same discipline as the writer.

The reporting of 'research results' increased after the AGSO Research Newsletter ceased publication in 2001 and *AusGeo News* became a quarterly publication. Reporting on the broad work program which saw geoscience as fundamental to mitigating the effects of natural hazards in urban areas, land management in rural and coastal areas, and management of the marine environment was included. This broader role was reflected in the change of name to Geoscience Australia in August 2001. It was followed by the merger with AUSLIG (Australian Surveying and Land Information Group) which brought together two organisations with large spatial data holdings. Consequently the magazine's content further expanded as *AusGeo News* reported on programs and products related to topographic mapping and satellite imagery and the application of spatial and other data more broadly.

Figure 1. Front covers and Contents pages showing the transformation of *AusGeo News* from a newsletter to online magazine between 1990 and 2010. The column at right includes some of the memorable items and articles during this period.



An online version of *AusGeo News* in HTML and pdf versions was introduced in 2005. This opened up the publication to a much wider readership since readers could download specific articles and external organisations or collaborating agencies could link directly to individual articles of interest to their readers. Authors could also include links to earlier articles to provide background or explanation for their articles.

In many respects *AusGeo News* has chronicled the changes in the activities of the agency as it expanded beyond its original mapping and surveying role (figure 1). BMR had provided much of the geoscientific information that had underpinned petroleum and mineral resource exploration and development in Australia. However by 1991 geoscience was becoming a fundamental input into a wide range of national priorities such as mitigation of natural hazards and environmental problems such as land degradation.

In addition to providing high-quality pre-competitive data and information to identify and promote new potential hydrocarbon areas to the international oil industry, the petroleum and marine program has:

- contributed to Australia's submission to the United Nations Commission on the Limits of the Continental Shelf
- acquired offshore geoscience information to increase our knowledge of seabed environments and marine habitats.

“In many respects *AusGeo News* has chronicled the changes in the activities of the agency as it expanded beyond its original mapping and surveying role.”

The agency has developed new geological mapping to stimulate investment in minerals exploration in cooperation with the states and the Northern Territory through the National Geoscience Mapping Accord. This collaboration has seen the development of continent-wide maps, such as the magnetic anomaly map, the gravity anomaly map and the recently-completed radiometric map (figure 4), as well as the first digital seamless surface geology dataset covering Australia. The agency has provided a three-dimensional framework to facilitate more effective exploration beneath regolith and sedimentary cover.

Other major changes over the last twenty years include:

- Geoscience has become an essential input to natural resource mitigation strategies and natural resource management. The agency is also involved in several projects to better understand and manage Australia's groundwater resources.

- The agency has developed a new approach to the assessment of risk and community vulnerability to natural hazards such as earthquakes, volcanism, landslides, and coastal/river erosion. It has also become a major contributor to tsunami science and warning systems in the Australasian region through the agency's contribution to the Australian Tsunami Warning System.
- Support for natural disaster management through providing timely information on the location of bushfires and floods as well as monitoring the effects of climate change.
- Provision of geographic information for government purposes, including emergency management, defence, marine zone management, public access and industry development, through the national mapping program.

Offshore petroleum and marine geoscience

The main functions of the agency's petroleum and marine programs in the 1990s were to identify and promote new potential hydrocarbon areas to the international petroleum industry. This work resulted in major regional syntheses of the Browse and Bonaparte basins on the North West Shelf. The regional knowledge generated during these projects still underpins

acreage release in these areas. At the same time there was research into the geological and geochemical processes affecting the marine environment, climate change and sea-level change and the establishment of Australia's seabed jurisdiction (*AusGeo News 2*). Consequently the agency became a major contributor to Australia's submission to define the outer limits of its jurisdiction under the UN Convention on the Law of the Sea. Australia is the first country to be in a position to proclaim the full outer limit of its continental shelf. Basic offshore geoscience information acquired by the agency is also contributing to seabed mapping and the identification of seabed habitats to support regional marine planning and the establishment of a national representative system of marine protected areas.

During the period 1985 to 1998 the agency chartered a research vessel *Rig Seismic* which carried out 68 surveys in support of AGSO's marine geoscience program (*AusGeo News 46*). Almost all of these surveys (64) acquired seismic data while 21 acquired geological samples (including cores up to 10 metres long) as well as geochemical samples of both the water column and seafloor sediment (7 surveys).

The search for a new oil province

Since 2000 the focus for petroleum exploration opportunities has shifted to areas outside currently active producing areas to 'frontier' basins. At the same time the Program changed from a survey mode of operation to targeting particular issues. The Australian Government's 2003 Budget allocated \$61 million over four years (2004 to 2007) to provide pre-competitive information to support industry's search for a new oil province. This funding initiated a new phase of offshore data acquisition and the preservation of the

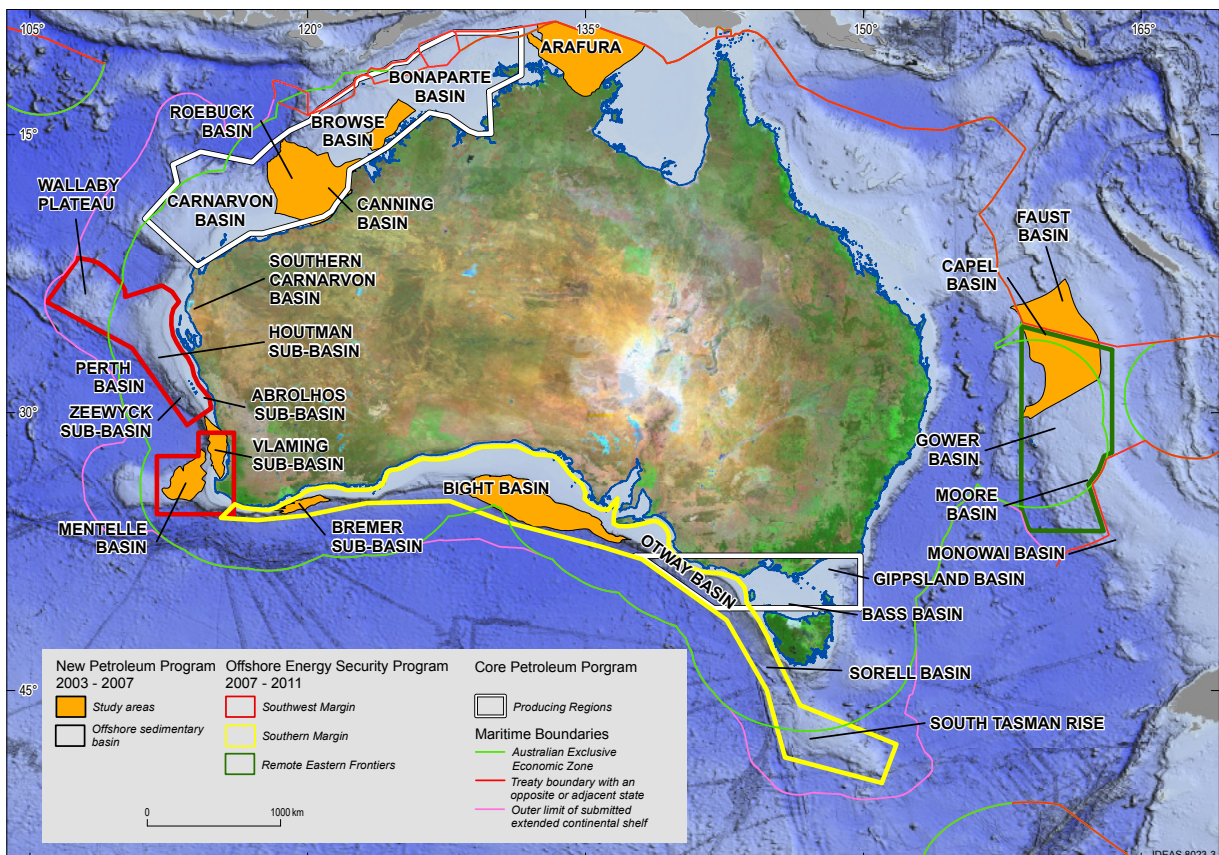


Figure 2. Offshore frontier basins targeted for geophysical and geological data acquisition under the New Petroleum Program ('Big New Oil') between 2003 and 2007 and the Offshore Energy Security Program from 2007 to 2011.



agency's extensive petroleum data archive (*AusGeo News* 77) as well as maintaining the core petroleum program.

The first frontier basins to be assessed were the Southwest frontiers, which included the Mentelle Basin and the Bremer and Vlaming sub-basins off southern Western Australia, and the shallow-water northern Arafura Basin off the Northern Territory (*AusGeo News* 81). Seismic data acquired in the first two areas marked the first seismic surveys in those areas in almost 30 years. The agency also investigated potential natural hydrocarbon seepage around Australia using a combination of approaches including remote sensing (*AusGeo News* 75). A marine reconnaissance survey of the Bight Basin in early 2007 targeted the collection of potential source rocks interpreted from 2D seismic lines. Dredge samples recovered a world-class Cenomanian–Turonian source rock with total organic carbon (TOC) values up to 6.9 per cent (*AusGeo News* 87).

The Offshore Energy Security Program was allocated \$75 million in new program funding for the period 2007 to 2011 to continue the offshore frontier basin research (figure 2). The Program focussed on the Remote Eastern Frontiers (including the Capel and Faust basins), the Southwest Margin (including the Mentelle Basin and sub-basins of the North Perth Basin and southern Carnarvon Basin) and the Southern Margin including the Bass, Sorrell, and deepwater Otway basins. The resulting data packages will enable explorers to assess the petroleum potential of these areas, provide the base data for future acreage releases and support the assessment and management of marine habitats. The Program also included the development of petroleum systems models for the 'Producing regions' of the North West Shelf.

The Southwest Margins Project in 2009 included a seismic survey, which acquired over 7000 line kilometres of seismic data and a marine reconnaissance survey which acquired new geophysical data as well as geological samples over a vast area. The marine reconnaissance survey collected more than 200 000 square kilometres of multibeam bathymetry – an area almost the size of the state of Victoria (*AusGeo News* 94). The survey included several frontier areas including the Wallaby Plateau, Zeewyck Sub-basin and Mentelle Basin as well as poorly explored areas of the southern Carnarvon Basin and northern Perth Basin (figure 2).

Recent petroleum prospectivity assessments

Geoscience Australia scientists have recently released assessments of the geological evolution and petroleum prospectivity of the Capel and Faust basins (*AusGeo News* 99) and the frontier Mentelle Basin (*AusGeo News* 98). These assessments will guide future scientific and resource exploration in these areas.

A regular feature of *AusGeo News* since 2005 has been details of the areas offered for release as part of the annual release of Offshore Acreage for petroleum exploration.

Last year also saw the first release of offshore areas designated specifically for the assessment of their greenhouse gas storage potential (*AusGeo News* 94).

Australia's marine jurisdiction

Geoscience Australia played a major role in preparing Australia's submission to the United Nations Commission on the Limits of the Continental Shelf in 2008. The Commission confirmed the location of the outer limit of Australia's continental shelf in nine distinct marine regions, which entitles Australia to large areas of continental shelf beyond 200 nautical miles (see *AusGeo News* 90). This means Australia now has jurisdiction over an additional 2.56 million square kilometres of the seabed (approximately the same size as Western Australia). In these areas, Australia has exclusive rights to what exists on the seabed, including oil, gas and biological resources (*AusGeo News* 93).

The submission was the result of a close partnership between Geoscience Australia, the Attorney General's Department and the Department of Foreign Affairs and Trade.

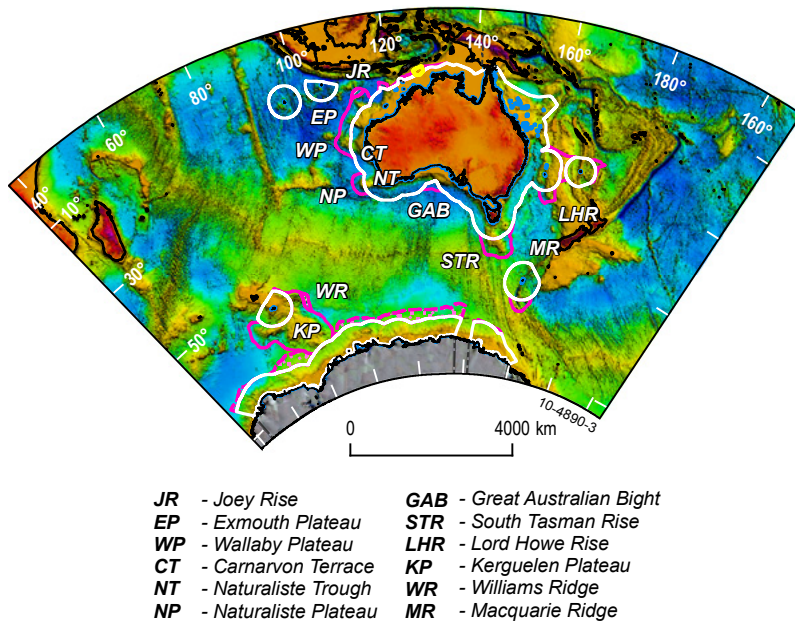


Figure 3. Australia's marine jurisdiction and associated seafloor morphology. Australia is the first country to be in a position to proclaim the outer limit of its continental shelf. This image indicates the form of the submarine features that lie within the jurisdiction.

It marked the culmination of 15 years of cutting-edge work, carried out under Geoscience Australia's Law of the Sea and Maritime Boundaries Advice project. The project involved analysis of new data gathered on 17 marine surveys conducted over eight years in some of the most remote and inhospitable parts of the world's oceans (figure 3).

The Law of the Sea surveys commenced in 1994 and by mid-1998 had collected about 30 000 kilometres of deep-seismic data and surveyed five of the seven areas requiring new data (*AusGeo News 44*). Later surveys included Australia's eastern limits to the east of Norfolk Island (*AusGeo News 57*), Macquarie Ridge, southeast of Tasmania (*AusGeo News 58*), and off the Australian Antarctic Territory. In total about 70 000 line kilometres of data were acquired.

Seabed mapping

The agency has been acquiring and collating bathymetric data for the Australian marine jurisdiction since 1963. Geoscience Australia became national co-custodian, with the Royal Australian Navy, for all Australian bathymetry data (*AusGeo News 80*). Geoscience Australia generated a 250 metre spatial resolution bathymetric grid (0.0025 decimal degree) in 2005 to meet client requests and has utilised data from subsequent surveys and from external sources to produce a new version in 2009 (*AusGeo News 95*).

Geoscience Australia is making a major contribution to marine research to help characterise and protect Australia's valuable marine environment. Australia is at the forefront of research to develop methodologies to predict marine biodiversity using geoscience information on the nature of the seabed (*AusGeo News 84*). A range of physical properties such as bathymetry, sediment grain size and seabed temperature are being used to define and map regional 'seascapes'. Appropriate biological data are also being incorporated with these physical data to improve their accuracy (*AusGeo News 93*).

Geoscience information for mineral resources

National datasets

Airborne geophysical surveys have become increasingly important for exploration as it provides credible insights into the subsurface geological architecture at both the regional and specific area scales. Geophysical data provides a cost effective means of visualising aspects of the Earth's subsurface over a large area through the inversion of geophysical data which is combined with known geological features to produce a 3D model (*AusGeo News 96*).

Data from 600 000 gravity stations (or reference points) was used for compilation of the first gravity anomaly map of Australia released in June 1992. By comparison, the third

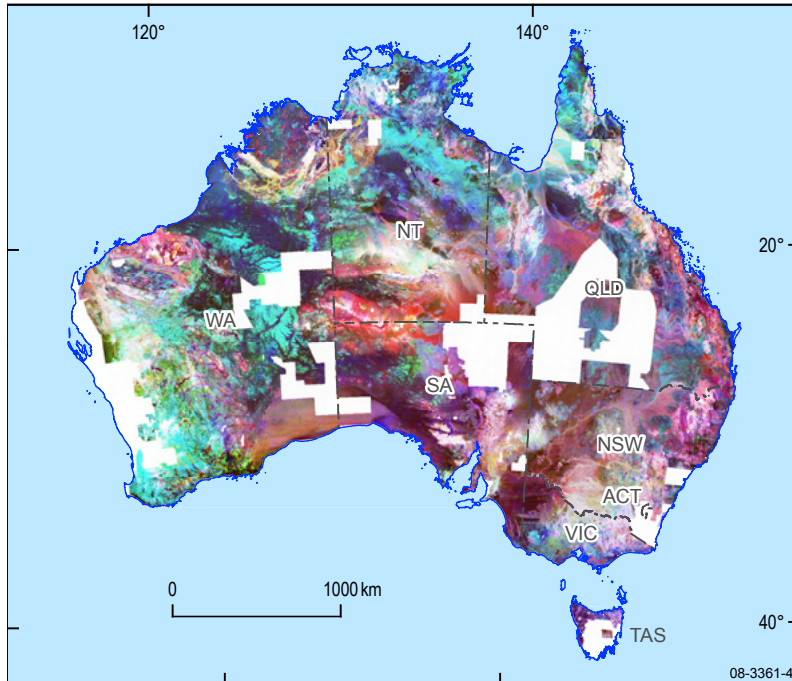


Figure 4. The Radiometric Map of Australia, released in early 2009, provides new insights into uranium prospectivity. The database is derived from levelled and merged composite potassium (red), uranium (blue) and thorium (green) grids. It will directly assist energy, geothermal and mineral resources exploration as well as assist environmental mapping.

edition, released in 2009, was produced from 1.4 million gravity stations (*AusGeo News* 91). The first edition of the magnetic anomaly map of Australia was released in 1993. This map was based on 5.4 million line kilometres of data which had been gathered since 1951. The fifth edition released in 2010 included an estimated 27 million line-kilometres of survey data which is eight million line kilometres more than the previous edition released in 2004 (*AusGeo News* 99). This edition also included results from the Australia-wide Airborne Geophysical Survey, a major output from Geoscience Australia's Onshore Energy Security Program.

Other major continent-wide datasets include:

- The new digital seamless surface geology map of Australia at 1:1 million scale released in late 2008 (*AusGeo News* 93)
- The first Radiometric Map of Australia (figure 4) which will directly assist exploration for uranium and thorium as well as supporting the assessment of geothermal resources (*AusGeo News* 92)
- The Proterozoic and Archean mafic-ultramafic maps which document the major magmatic events and associated mineral deposits across Australia (*AusGeo News* 96).

A new era of cooperation

Compilation of the geological and geophysical continent-wide maps was undertaken with the state and territory geoscience agencies

under the National Geoscience Agreement. Its predecessor, the National Geoscience Mapping Accord (NGMA), was developed in the early 1990s to produce a second generation of geological maps, in digital format, at 1:250 000 scale (and in places 1:100 000 scale) covering onshore Australia. Its objective was to stimulate investment in mineral exploration through collaboration between BMR (on behalf of the Australian Government) and the state and Northern Territory government geoscience agencies. The first major study inaugurated under the Accord was the North Queensland Project (1990 to 1996) which was reported in the first issue of *AusGeo News*.

Major features of the initial NGMA projects were: a collaborative, multi-disciplinary approach and the research could be used not only for the assessment of resource potential but also the development of conservation strategies. Other collaborators included Cooperative Research Centres, CSIRO, universities and mineral exploration companies. The multi-disciplinary approach has also become the hallmark of consequent studies by the agency.

Major NGMA projects have included:

- 'TASGO' was a joint project to characterise the large-scale geological structure of Tasmania to augment the detailed mapping undertaken by Mineral Resources Tasmania (*AusGeo News* 23).

- **Broken Hill Exploration Initiative** (1995 to 2003) was undertaken with the New South Wales and South Australian geological surveys to promote mineral exploration and further discovery in the Broken Hill mineral province (*AusGeo News 24*).
- **Northern Australian Basins Resource Evaluation** (1995 to 2000) focussed on the major petroleum and mineral systems operating between the Victoria River Basin (Northern Territory) and Mount Isa (Queensland: *AusGeo News 23*).
- **The Pilbara Project** (1995 to 2000) investigated the structural uniqueness of the Pilbara Craton in Western Australia to encourage exploration for stratabound base-metal deposits and attracting new interest in exploration for precious metals (*AusGeo News 56*).

- **The Gawler Craton Project** (2000 to 2003) was a research program to determine the regional-scale processes that formed ore and preserved economic-sized mineral deposits. It focussed on the Olympic Dam copper-gold-uranium province, the central Gawler and the area around the Challenger gold deposit in South Australia (*AusGeo News 61*).

- **The North Australia Project** (2002 to 2004) examined how its geological evolution influenced the mineral potential of the region particularly the gold deposits of the Tanami region (*AusGeo News 74*).

- **Tanami region gold mineral systems** (2004 to 2006) evolved from the North Australia Project and directly targeted controls on lode gold mineralisation (*AusGeo News 79*).

This close collaboration with the state and Northern Territory geological surveys has continued under Geoscience Australia's Onshore Energy Security Program which commenced in 2006. The Program involves the application of the latest geophysical imaging and mapping techniques to attract investment in exploration for onshore petroleum, geothermal and energy resources (such as uranium and thorium). The Program has demonstrated the large-scale application of the seismic method and inversion

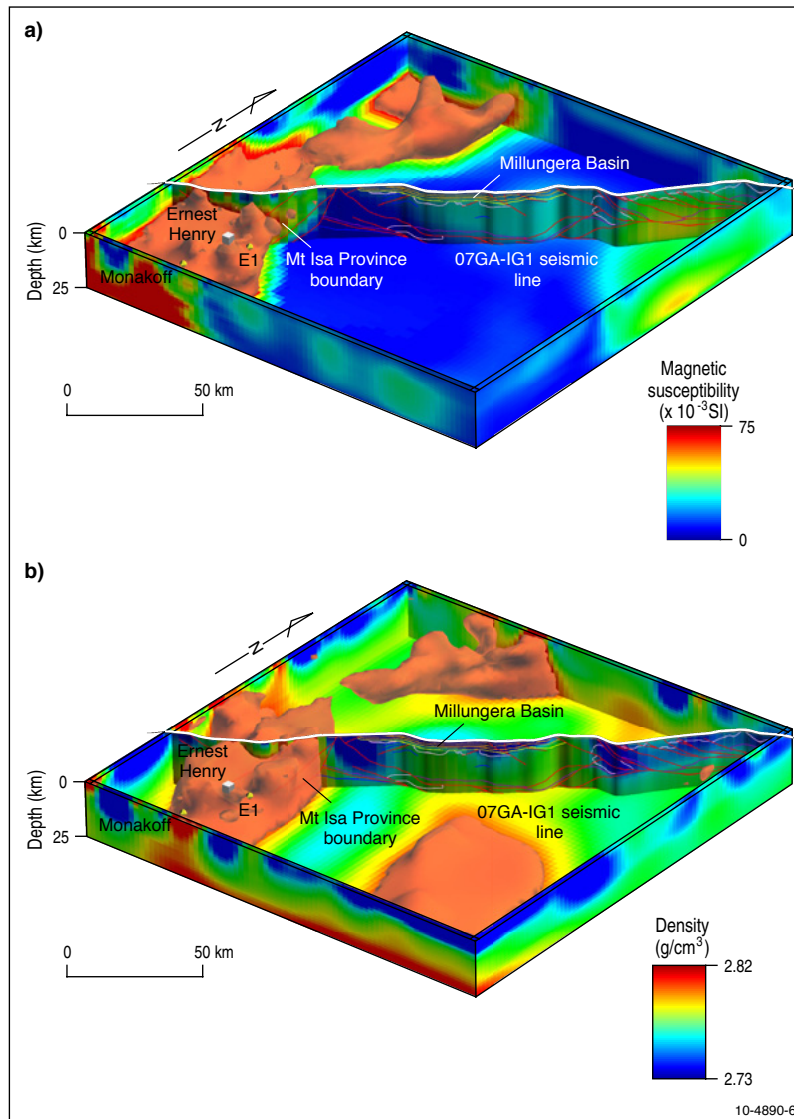


Figure 5. Geophysical inversion is a new method for generating a 3D physical property model capable of explaining observed geophysical data. The ability to visualise subsurface geological features and materials over a large area is a critical time and money saving tool for mineral explorers.

techniques (figure 5) to the unravelling of the three-dimensional geology of mineral-bearing rocks below the surface (*AusGeo News* 96).

The Program's projects include the Australia-wide airborne geophysical tie-line survey (AWAGS 2) and the National Geochemical Survey of Australia supported by targeted regional-scale projects in specific areas. These include:

- deep crustal reflection seismic surveys targeting prospective areas in South Australia, Northern Territory and Queensland such as the Gawler Craton, Georgina Basin and north Queensland
- airborne electromagnetic surveys targeting areas with potential for uranium mineralisation such as the Paterson Province in Western Australia, Pine Creek in the Northern Territory, and Frome region in South Australia
- national geothermal energy systems research
- interpretation of the geodynamic framework of major energy provinces such as the Gawler and Curnamona provinces in South Australia.

“Geoscience Australia is currently contributing to several research projects involving groundwater resources.”

The North Queensland Project (2006 to 2009) identified fundamental new crustal boundaries and provinces in North Queensland and pointed to areas of previously unknown potential for iron oxide-copper-gold, lode gold, uranium and geothermal energy (*AusGeo News* 96). Geoscience Australia has also contributed scientific expertise to exploration initiatives funded by individual states and territories.

Environmental management and risk mitigation

Natural resource management

The last twenty years have embedded geoscience as an essential input to natural resource mitigation strategies to help sustain the productive base of our agricultural industries. They have included managing problems such as land degradation caused by soil erosion and salinisation. The agency contributed to the Gilmore Project on the eastern margin of the Murray-Darling Basin in western New South Wales (*AusGeo News* 59).

Airborne electromagnetic data was used to provide information on likely areas for salt accumulation. This data when integrated with biophysical data (such as bedrock geology and regolith data) as well as hydrogeological and hydrogeochemical data provided the best information on rates of movement for groundwater and salt (*AusGeo News* 76). The regolith is the loose weathered material that sits between Earth's surface and bedrock. The project also utilised 3D computer modelling techniques to map and visualise the regolith in 3D. This data highlighted those areas in danger of salinisation if current practices were maintained.

The Hydrogeological-Landscape framework, which had been developed for addressing land and water quality issues, is currently being used for a broad range of land use, remedial re-vegetation intervention, and engineering strategies for salinity management and natural resource management applications (*AusGeo News* 97).

Groundwater resources

Geoscience Australia is currently contributing to several research projects involving groundwater resources. They include the Broken Hill Managed Aquifer Recharge Project which is mapping and characterising the groundwater aquifer (or underground storage) systems near Menindee Lakes in western New South Wales. It is part



of a government commitment to improve water efficiency at Menindee Lakes and secure Broken Hill's water supply. The project is acquiring new data to determine whether the use of groundwater resources is sustainable and aquifer storage is practicable. (*AusGeo News* 95). The agency is also leading the Water for Australia's Arid Zone (Palaeovalley Groundwater) Project which has been funded by the National Water Initiative which is funding projects that improve Australia's national capacity to measure, monitor, and manage our water resources. The project is undertaking detailed field studies to better understand the fundamental characteristics and behaviour of groundwater resources in Australia's arid zone. Palaeovalleys are geologically ancient river valleys which no longer function as active surface water systems (*AusGeo News* 93).

“The project's risk assessment methodology has been adapted to Australia's counter terrorism and critical infrastructure protection activities ...”

Community vulnerability

In 1995 the National Geohazards Vulnerability of Urban Communities (or Cities) Project was launched. Applied research would assess the risks posed to Australian communities by geohazards, such as earthquakes, landslides, floods, tsunami, and severe winds. The research identified appropriate applications to mitigate these risks such as engineering standards, building codes, planning constraints and the development of appropriate emergency management plans.

Early studies included multi-hazard risk assessments for a number of Queensland communities including Cairns, Mackay, and Gladstone as well as southeast Queensland. The Cairns study, for example, developed a multi-risk assessment which added risk of earthquake, flood, cyclone, wind and storm tide to produce 'community total risk maps' (*AusGeo News* 59). A major multi-hazard risk assessment study of Perth, undertaken in collaboration with federal, state and local government agencies, was released in 2005 (*AusGeo News* 80). These studies incorporated measures of vulnerability, resilience and probability of occurrence. This study has provided a valuable reference for the Western Australian Fire and Emergency Services Authority.

The project's risk assessment methodology has been adapted to Australia's counter terrorism and critical infrastructure protection activities. Safeguarding Australian communities from natural hazards was made a research priority following the Council of Australian Governments *Natural disasters in Australia* (2002) report. It called for

a 'nationally consistent system of data collection, research and analysis to ensure a sound knowledge base on natural disasters and disaster mitigation'.

A major Geoscience Australia output has been the National Exposure Information System (NEXIS) which collects, collates and maintains nationally consistent and best available exposure information. It requires detailed spatial analysis and the integration of available demographic, structural and statistical data (*AusGeo News* 88). Information from NEXIS has already been applied for a range of threats to communities and infrastructure along Australia's coast, including sea level rise and extreme weather.

Geoscience Australia is also now contributing significantly to Australia's international aid program through natural hazard risk assessments to identify areas and countries in the Asia Pacific region at high risk from one or more natural hazards (*AusGeo News* 90).

Tsunami warning system

An article in the September 2004 issue (*AusGeo News* 77) discussed how massive earthquakes in the subduction zone off Sumatra, where the Australian plate is subducted beneath the Eurasian plate, had the potential to cause tsunamis large enough to affect north-western Australia and the entire Indian Ocean basin (figure 6). The Indian Ocean tsunami of 26 December 2004 was the most devastating

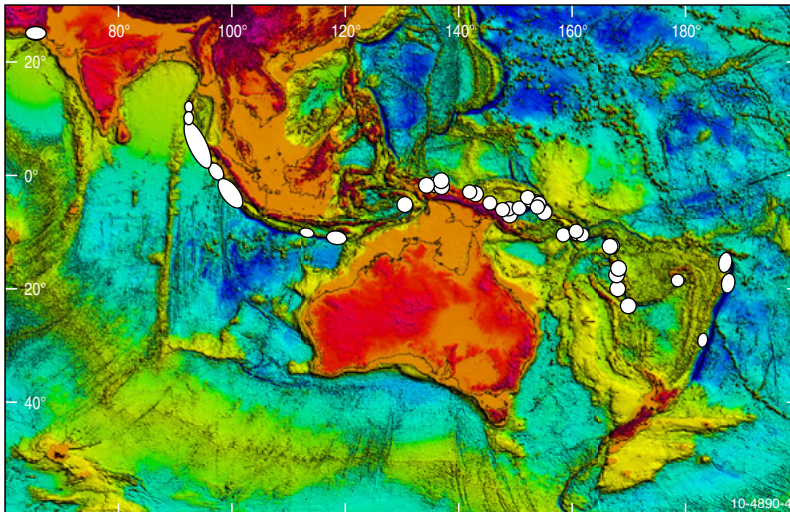


Figure 6. The map shows the major tectonic plate boundaries and location of historic tsunamigenic earthquakes in our region. The tsunami threat originates from the system of subduction zone plate boundaries (or ocean trenches) extending through Indonesia, New Guinea, Vanuatu, Fiji, and the trench systems to the north and south of New Zealand.

earthquake-tsunami event in recorded history. At the time of the tsunami Australia relied on the Australian Tsunami Alert System which provided a limited notification and warning capability. Consequently the Australian Government provided funding in its 2005-06 Budget for the development of an Australian Tsunami Warning System which would contribute to an Indian Ocean Tsunami Warning System.

The agency was allocated funding of \$21 million over four years to build on the existing domestic capabilities of Geoscience Australia's seismic monitoring and analysis systems. This included upgrading existing seismic stations, building new seismic stations and gaining access to real-time digital seismic data from new and existing international seismic networks. The system was developed using the scientific and technical expertise at Geoscience Australia, the Bureau of Meteorology and Emergency Management Australia. It became fully operational in June 2009 (*AusGeo News 96*).

The agency has become a major contributor to earthquake and tsunami science and warning systems in the region. It has also collaborated with Fire and Emergency Services Authority Western Australia to raise community awareness and provide the scientific knowledge upon which emergency managers can base their planning (*AusGeo News 93*).

Estuaries and coastal

From the early 1990s the agency carried out studies of sediments and nutrients that threaten coastal and marine ecosystems in waterways around Australia. Studies included Moreton Bay (Queensland), Wilson Inlet and Swan River estuary (Western Australia), Wallis Lake

and Myall Lakes (New South Wales) and, Fitzroy River estuary (Queensland). Research was funded by industry and state and regional governments and the data was being used to develop estuarine management plans.

In 2000 and 2001 the agency was involved in taking an inventory of Australian estuarine conditions for the National Land and Water Resources Audit (*AusGeo News 65*). This involved mapping the distribution of different sedimentary environments in 960 Australian estuaries. The results of the research were added to the OzEstuaries database which had information on every estuary and coastal waterway in Australia. The section also contributed to the Cooperative Research Centre for Coastal Zone, Estuary and Waterways Management which compiled the OzCoast component of the CRC website.

OzCoast and OzEstuaries were merged to become part of the new OzCoasts website, the largest central source of coastal information and data in Australia, which was released in August 2008. The data and information available through the website supports natural resource management and the conservation of Australia's coastal zone, estuaries and near-shore environments (*AusGeo News 91*). Recent additions have included a beach database search capability and the Smartline system. The Smartline has many uses for environmental planning, climate change adaptation and hazard assessment.

Geoscience Australia also carried out research into the physical and chemical conditions and the ecological character of the Coorong to identify groundwater discharge and its possible impact on water quality. The Coorong and Lower Lakes are major interconnected coastal water bodies between the Murray River and the Southern Ocean in South Australia (*AusGeo News* 91).

Emergency response and Earth monitoring

Sentinel is an internet-based satellite mapping tool which provides timely information on the location of bushfires across Australia. The system was developed during bushfires in New South Wales and the Australian Capital Territory in early 2002 and operation of the system passed from CSIRO to Geoscience Australia in 2005.

Geoscience Australia acquires satellite data from satellites with thermal infra-red sensors to detect hotspots which indicate bushfires.

8 February (*AusGeo News* 94). Satellite imagery is also provided to complement local information available to emergency managers to determine the extent of flooding during major floods.

Satellites are also being used to capture environmental information across the entire Australian continent to assist dynamic land cover mapping. This will capture the pattern of change in the landscape and allow the land cover to be mapped, classified and studied as a dynamic system (*AusGeo News* 92).

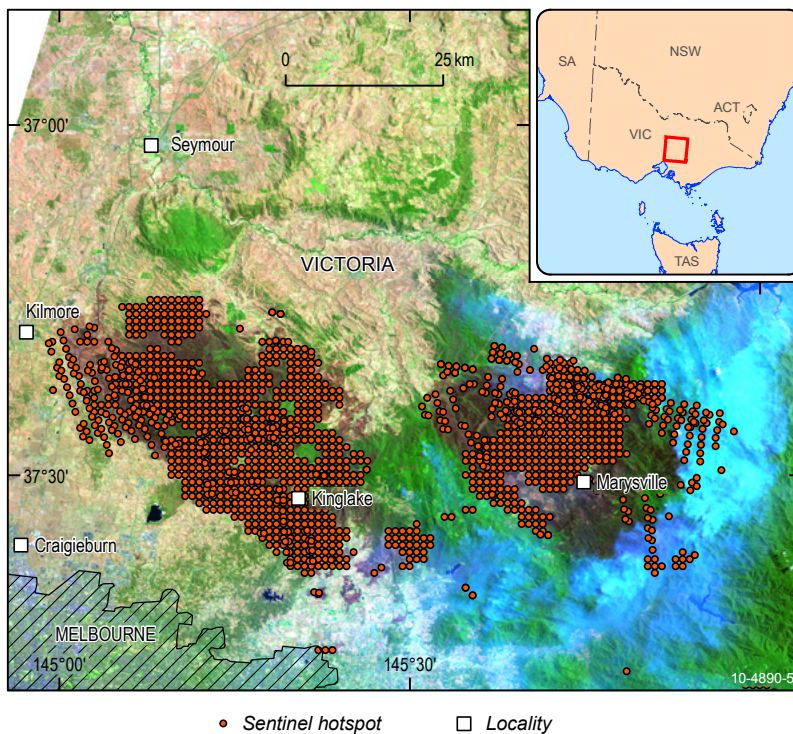


Figure 7. The Sentinel system uses satellites with thermal infra-red sensors to detect hotspots which indicate bushfires. This image depicts hotspots as red square dots overlaid on a satellite image of the Kinglake and Marysville fires in Victoria on 17 February 2009.

The satellites pass over the Australian continent each morning and afternoon and beam their information to Geoscience Australia's ground stations in Alice Springs. The images are analysed automatically by a computer to detect hotspots (figure 7). These satellite scenes are then used to produce maps showing the actual areas burnt, which are used by emergency managers, researchers and the media. During the Victorian bushfires in early 2009 over 5.2 million hits were recorded on Sunday

Spatially enabling government and the community

The revised topographic mapping of the whole of Australia at 1:250 000 scale (Series 2) was completed in 2003. This was the first national coverage of the whole continent at the standard 250 000 scale available in both paper and digital versions (*AusGeo News* 71). A number of versions of seamless digital maps covering Australia have been released for professional, emergency management, and recreational uses including real-time navigation with global positioning systems (GPS) and backdrops for geographic information systems (GIS).

This data has provided the foundation for more specialised mapping and Geoscience Australia has diversified into providing geographic information for government purposes including emergency



management, defence, marine zone management, public access and industry development (*AusGeo News* 76). Examples include a pilot mapping program to maintain fundamental information for emergency workers initiated in 2004 and maps covering National Parks in Australia's Red Centre for the National Landscapes initiative—a partnership between Tourism Australia and Parks Australia—which identifies and promotes distinctive and inspirational destinations to domestic and international visitors (*AusGeo News* 99). Close collaboration with Australian Government and state government agencies has been a major feature of these programs.

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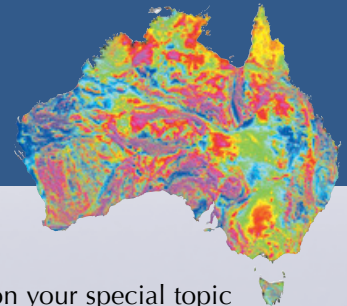
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