

New map provides exploration pointers for nickel and platinum-group elements

Most of the world's very large economic deposits of nickel and platinum-group elements are found in mafic igneous rocks which are Proterozoic in age and part of exceptional Large Igneous Provinces (LIPs). To date, only one such major deposit has been discovered in Australia: the Nebo-Babel magmatic nickel sulphide deposit in the Musgrave region of central Australia, which contains more than one million tonnes of nickel metal. The discovery of other large deposits will require the identification, below cover, of the crustal-scale feeder systems of the most voluminous mafic-ultramafic magmatic events.

To encourage understanding of these very large magmatic systems, Geoscience Australia has released two new web-based map sheets that show the development of Australia's Large Igneous Provinces during the Proterozoic Eon 2500 to 542 Ma (million years).

Sheet 1 of the Australian Proterozoic Large Igneous Provinces map shows the solid geology and continent-wide distribution of the five major Proterozoic LIPs identified in Australia:

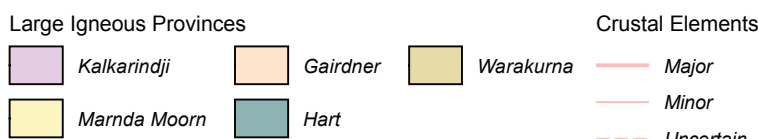
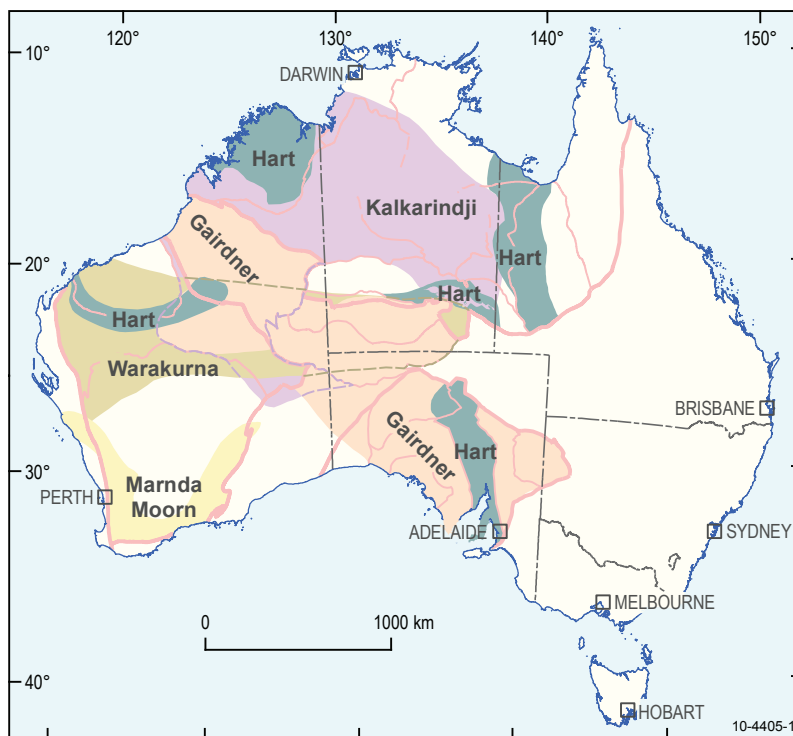


Figure 1. Collectively, the five major Proterozoic Large Igneous Provinces encompass more than half of the Australian continent. Their distributions are related to the Major Crustal Elements and reflect primary lithospheric structures.

- Hart (~1780 Ma), which extends from the Kimberley province in Western Australia to include large magmatic belts preserved across the west, north and south Australian Crustal Elements
- Marnda Moorn (~1210 Ma), which is preserved as a zone of dolerite dykes around the margins of the Yilgarn Craton
- Warakurna (~1070 Ma), which hosts the Nebo-Babel nickel discovery, and includes several large mafic intrusions in a belt across western and central Australia
- Gairdner (~825 Ma), which is preserved as lavas and subvolcanic intrusions in a northwesterly belt that transects the continent
- Kalkarindji (~510 Ma), which is the youngest, largest and best preserved of the LIPs, extending as lavas and intrusions across much of northern and central Australia.

The overlay of the five LIPs shows that they share important Crustal Element controls on their distribution. These provide indicators to possible locations of the crustal-scale feeder zones that have repeatedly channelled huge volumes of mafic-ultramafic magma, and could be targeted for magmatic ore deposit exploration.

Sheet 2 of the new map is an innovative Time Series that



plots the secular movement of mafic-ultramafic magmatic activity during the Proterozoic development of the Australian continent. The context of many smaller magmatic events shows the five LIPs sharing, and defining, Crustal Element controls that changed with time. This is another indicator of the prospectively mineralised magmatic feeder zones in the crust. Some other Proterozoic magmatic events which have the size that could indicate LIP status, but are not yet recognised as LIPs, have also been highlighted.

The new map should be studied together with the *Map of Australian Archean Mafic-Ultramafic Magmatic Events* and the *Map of Australian Proterozoic Mafic-Ultramafic Magmatic Events*. This comprehensive series of whole-of-continent maps provides a national framework for investigating under-explored and potentially mineralised environments to support the search for world-class nickel and platinum-group element deposits.

For further information

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Related websites/articles

Map of Australian Proterozoic Large Igneous Provinces (Sheets 1 and 2)

www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=69213

AusGeo News 96: Revealing Archean mafic-ultramafic magmatism and mineral prospectivity across Australia

www.ga.gov.au/ausgeonews/ausgeonews200912/productnews.jsp#product2

AusGeo News 91: Revealing Proterozoic mafic-ultramafic magmatism in Australia.

www.ga.gov.au/ausgeonews/ausgeonews200809/productnews.jsp#product2

Maps available for download through the Geoscience Australia website

www.ga.gov.au/map/index.jsp

South Australian Seismic & MT Workshop 2010

Adelaide, 6 May 2010

NEW RESULTS TO BE RELEASED

This one-day workshop will present the results of new seismic and magnetotelluric data collected during 2008 and 2009 in the southern Gawler Craton & Curnamona Province of South Australia by Geoscience Australia and the Department of Primary Industries and Resources, South Australia.

When: Thursday 6 May 2010
Where: Hilton Hotel, Adelaide, South Australia
Costs: Free - but registration is required by Friday 16 April 2010
Contact: Narelle Neumann p: (02) 6249 9429 or e: Narelle.Neumann@ga.gov.au



Government of South Australia
Primary Industries and Resources SA



Australian Government
Geoscience Australia

New geophysical datasets released

Datasets from twelve new geophysical surveys which include the Canning and Eucla basins and Windimurra region in Western Australia, Cape York in Queensland, the Pine Creek Orogen and the Barkly region in the Northern Territory and the Jerilderie–Oaklands Basin in New South Wales have been released since October 2009.

These new airborne magnetic/radiometric, electromagnetic and gravity surveys provide basic geophysical data which can be interpreted to reveal the sub-surface geology of the survey area. The datasets will be a valuable tool in assessing the mineral potential of the respective survey areas and should stimulate mineral exploration.

The Seemore, Yampi–Derby, Broome, Central Canning, Mount Anderson–McLarty Hills and Cornish–Helena airborne magnetic and radiometric surveys and Windimurra gravity survey were managed by Geoscience Australia on behalf of the Geological Survey of Western Australia. The airborne magnetic and radiometric surveys were conducted under the Western Australian Government's *Exploration Incentive Scheme*.

The Cape York airborne magnetic and radiometric survey and gravity survey were managed by Geoscience Australia on behalf of the Geological Survey of Queensland and conducted under the Queensland Government's *Smart Mining–Future Prosperity* Program.

The Barkly gravity survey was managed by Geoscience Australia on behalf of the Northern Territory Geological Survey and conducted under the Northern Territory Government's *Bringing Forward Discovery* Initiative.

The Jerilderie–Oaklands Basin gravity survey was managed entirely by the Geological Survey of New South Wales and conducted under the New South Wales Government's *New Frontiers* Initiative.

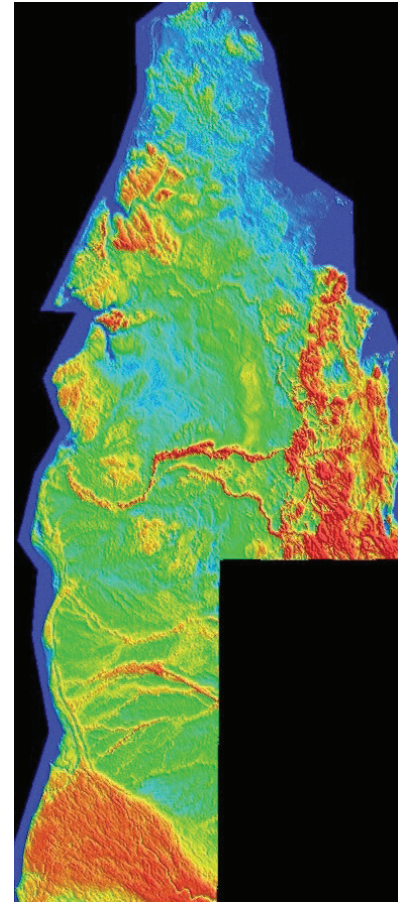
The Pine Creek–Kombolgie airborne electromagnetic survey in the Northern Territory was conducted as part of the Pine Creek Orogen component of Geoscience Australia's Onshore Energy Security Program. The Kombolgie data can be obtained free online by visiting the Free Data Downloads facility on Geoscience Australia's website or purchased on DVD for \$99.00 from the Geoscience Australia Sales Centre.

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

For more information

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Related websites

Geophysical Archive Data
Delivery System (GADDS)

www.geoscience.gov.au/gadds

Free Data Downloads facility
(Geoscience Australia)

www.ga.gov.au/products

Geological Survey of Western
Australia

www.dmp.wa.gov.au

Geological Survey of New South
Wales

www.dpi.nsw.gov.au/minerals/geological

Geological Survey of Queensland

www.dme.qld.gov.au

Northern Territory Geological
Survey

[www.nt.gov.au/d/Minerals_Energy/
Geoscience/](http://www.nt.gov.au/d/Minerals_Energy/Geoscience/)

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

Survey	Date	1:250 000 map sheets	Line spacing/ terrain clearance/ orientation	Line km	Contractor
Seemore (Eucla Basin 1) WA	June–September 2009	Seemore (pt), Loongana (pt).	200 m 50 m east–west	89 906	Thomson Aviation Pty Ltd
Yampi–Derby (North Canning 2) WA	June–September 2009	Yampi (pt), Derby (pt).	400 m 60 m north–south	66 700	GPX Surveys Pty Ltd
Broome (North Canning 1) WA	June–September 2009	Pender (pt), Yampi (pt), Broome (pt), Derby (pt).	400 m 60 m north–south	76 000	UTS Aeroquest Pty Ltd
Central Canning WA	June–September 2009	Anketell (pt), Joanna Spring (pt), Paterson Range (pt), Sahara (pt), Tabletop (pt), Percival (pt), Ural (pt).	800 m 60 m north–south	91 700	Fugro Airborne Surveys Pty Ltd
Mount Anderson–McLarty Hills (North Canning 3) WA	June–September 2009	Mount Anderson, McLarty Hills.	400 m 60 m north–south	98 200	UTS Aeroquest Pty Ltd
Cornish–Helena (East Canning 2) WA	June–October 2009	Mount Bannerman (pt), Cornish, Helena.	400 m 60 m north–south	123 910	Thomson Aviation Pty Ltd
Cape York Qld	April–October 2009	Thursday Island (pt), Cape York (pt), Jardine River (pt), Orford Bay (pt), Weipa (pt), Cape Weymouth (pt), Aurukun (pt), Coen (pt), Holroyd (pt), Rutland Plains (pt).	400 m 80 m east–west	238 900	GPX Surveys Pty Ltd

Table 2. Details of Pine Creek Orogen electromagnetic survey.

Survey	Date	1:250 000 map sheets	Line spacing/ terrain clearance/ orientation	Line km	Contractor
Pine Creek – Kombolgie (VTEM®) NT	August–November 2008; April 2009	Cobourg Peninsula (pt), Junction Bay (pt), Alligator River (pt), Millingimbi (pt), Mount Evelyn (pt), Katherine (pt).	1600 m and 5000 m, 80 m (aircraft), 45 m (sensor), east–west.	8780	Geotech Airborne Pty Ltd

Table 3. Details of gravity surveys.

Survey	Date	1:250 000 map sheets	Station spacing, orientation	Stations	Contractor
Windimurra WA (Release of Infill Stations)	August–September 2008	Cue (pt), Sandstone (pt), Kirkalocka (pt), Youanmi (pt), Ninghan (pt).	2500 m east–west; Positioned centrally between the stations spaced 2500 m apart; collected for GSWA.	852 (Infill Stations)	Atlas Geophysics Pty Ltd
Barkly NT	June–October 2009	Daly Waters (pt), Tanumbirini (pt), Bauhinia Downs (pt), Robinson River (pt), Newcastle Waters (pt), Beetaloo (pt), Wallhallow, Calvert Hills, Helen Springs (pt), Brunette Downs, Mount Drummond (pt), Alroy, Ranken (pt), Frew River (pt), Avon Downs (pt).	4000 m east–west	9732	Atlas Geophysics Pty Ltd
Cape York Qld	May–September 2009	Thursday Island (pt), Cape York (pt), Jardine River (pt), Orford Bay (pt), Weipa (pt), Cape Weymouth (pt), Aurukun (pt), Coen (pt), Holroyd (pt), Ebagoola (pt), Cape Melville (pt), Rutland Plains (pt), Hann River, Cooktown (pt), Mossman (pt), Atherton	4000m east–west	10 315	Daishsat Pty Ltd
Jerilderie–Oaklands Basin NSW	June 2009	Hay (pt), Narrandera, Deniliquin (pt), Jerilderie, Bendigo (pt), Wangaratta (pt).	4000 m with some 2000 m infill, east–west	2350	Daishsat Pty Ltd

Hydrocarbon and geothermal prospectivity of central Australian basins

Geoscience Australia has recently released a report on the hydrocarbon and geothermal prospectivity of the basins of the central Australian region. The study examines the region, nominally constrained by 22.5°S 134°E and 31.5°S 144°E, where several systems of stacked basins lie beneath the extensive Mesozoic Eromanga Basin. These basins include: the Warburton, Cooper, Perdirk, Galilee, Simpson and Eromanga basins.

The Mesozoic Eromanga Basin, which blankets the entire region, has deep depocentres overlying and offset from the underlying Carboniferous–Triassic basins. The Eromanga Basin sequence is the



main oil producer of the couplet, with the dominant source being the underlying Cooper sequences.

This region, the most productive onshore petroleum province of Australia, has produced 5.5 Tcf (trillion cubic feet) of gas and 255 million barrels of oil since the 1970s. It also features world-class geothermal resources associated with underlying high heat producing (HHP) granites. These resources are currently being evaluated by Geodynamics at their Innamincka project where they have reached 'proof of concept' for extracting energy from hot fractured rock. Collectively, the geothermal and sustained petroleum potential of the Cooper–Eromanga Basin points to it continuing as one of Australia's energy production centres.

This report documents the context and characteristics of all related basins in this region and their petroleum potential to identify information gaps which remain as critical uncertainties that have suppressed exploration in these areas.

The report outlines the exploration history of the Cooper–Eromanga fields as a guide to future exploration, the basement and structural context, and the spatially-separate stacked basin systems.

Eastern Yilgarn Craton metamorphism study

Geoscience Australia has recently released a new report and map on the metamorphic evolution of the eastern Yilgarn Craton. This study will make a significant contribution to our understanding of the world-class gold mineral systems of the region.

The spatial and temporal patterns of the craton's metamorphic rocks provide fundamental insights into the history and likely tectonic setting of the region. They also outline the fluid history of the crust and associated mineralisation events. The study was initiated because metamorphic rocks:

- preserve a long and near-continuous record of orogenic history
- are the only source of information on crustal depths and paths of individual particles through the crustal column which recognise lithospheric thinning and thickening events
- are the sole source of information that tracks the long-term thermal evolution of the crust.

This research is underpinned by a comprehensive metamorphic database covering the entire eastern Yilgarn Craton, which was compiled from available mapping. The database includes: 14 500 sites with qualitative metamorphic information, and 470 new key sites with detailed quantitative metamorphic data, including pressure (P), temperature (T), temperature/depth ratio and pressure–temperature

Summaries of individual basins and their statistics are provided for reference as appendices.

For more information visit

www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=69150

Hydrocarbon and Geothermal Prospectivity of the Sedimentary Basins in Central Australia: Warburton, Cooper, Perdirka, Galilee, Simpson and Eromanga Basins (Geoscience Australia Record 2009/25)

www.ga.gov.au/image_cache/GA15314.pdf



paths. This is a unique compilation, and the authors are unaware of any other comparable study of a Precambrian terrane with this scope and magnitude. The continual evolution over time of fundamental metamorphic parameters has been constructed as evolution curves and integrated with the

deformation, magmatic, stratigraphic and mineralisation history of the craton.

This new study contrasts significantly with previous tectonic and metamorphic interpretations in the eastern Yilgarn Craton. In particular, there are large variations in peak metamorphic crustal depths (12 to 31 kilometres), and five metamorphic periods have been defined. Implicit in these metamorphic constraints are large displacement shear zones that juxtapose the different metamorphic domains, and provided the backbone architecture of the gold mineral system.

This research was undertaken between 2006 and 2008 as a project of the Predictive Mineral Discovery Cooperative Research Centre and is now available in the public domain.

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Groundwater sampling and analysis made easier

Groundwater resources support many urban, rural and remote communities across Australia. The groundwater is received and stored in aquifers (rock or soil formations) which are a source of water for drinking, irrigation, stock supply, bottling and many other uses. Groundwater accounts for more than 30 per cent of Australia's total water consumption.

In some parts of Australia, the current rate of groundwater extraction is depleting the resource faster than it is being replenished. Consequently, understanding the basic processes about groundwater as well as the factors affecting its quantity and quality is vital for sustainable groundwater management.

This new field guide has been compiled to provide a comprehensive set of sampling guidelines that focus on a range of groundwater quantity and quality issues. The comprehensive and practical guidelines cover the basic elements of effective groundwater sampling in the field. They also provide simple and effective methods for monitoring groundwater systems as well as outlining procedures for sampling from the bore site to the laboratory. A uniform, accurate, and reliable set of sampling procedures should ensure greater confidence in the interpretation of any field based-data.

The authors were also mindful of the need to provide a comprehensive set of guidelines which can be used across a range of geoscientific disciplines. In addition to groundwater resource assessment and management, they include mineral exploration, geothermal energy resources, and carbon capture and storage.

Related websites/articles

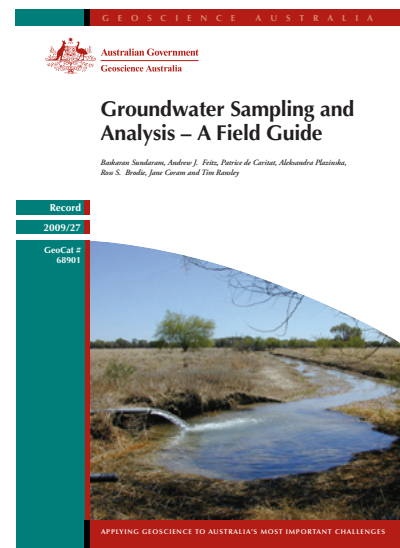
Predictive Mineral Discovery
Cooperative Research Centre
www.pmdcrc.com.au

Metamorphic Evolution and
Integrated Terrane Analysis of
the Eastern Yilgarn Craton:
Rationale, Methods, Outcomes
and Interpretation (Geoscience
Australia Record 2009/23)

[www.ga.gov.au/products/servlet/
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DETAILS&catno=68806](http://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=68806)

Eastern Yilgarn Craton
Metamorphism and Strain map

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Groundwater Sampling and
Analysis – A Field Guide
(Geoscience Australia Record
2009/27)

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GA15501.pdf](http://www.ga.gov.au/image_cache/GA15501.pdf)