Fieldnotes

Government of Western Australia
Department of Mines and Petroleum

Geological Survey of Western Australia

Visit our Home Page at www.dmp.wa.gov.au/GSWA

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Successful applicants —2009-10 Exploration Incentive Scheme Co-funded Drilling Program

Exactly three months after the launch of the $80 million Exploration Incentive Scheme, agreements were handed to the owners of the 35 exploration projects which were successful in gaining financial support in the $3 million 2009/10 round of the Co-funded Drilling Program.

The Co-Funded Drilling Program, which is funded out of the Government's Royalties for Regions Initiative, attracted 168 applications requesting funding in excess of $15 million.

In 2009/10, the program offered funding of up to 50% of direct drilling costs capped at $150 000.

Applications for co-funded drilling proposals closed on 15 May 2009. The applications were reviewed by a small geological team with significant exploration industry experience. The criteria used to review the applications were listed in guidelines published on DMP's website. All applications were assessed against the criteria and were then ranked according to their total score, with 35 applications accounting for the $3 million available in 2009/10.

A short reserve list of applications was established in case any of the successful applicants did not take up the offer of funding or are unable to complete their projects.

The process and the subsequent rankings were endorsed by an Advisory Committee representing AMEC, the Chamber of Minerals and Energy WA, APPEA and APLA as well as the research sector.

The review process, and the subsequent ranking of applications, was reviewed by an independent probity auditor who endorsed the integrity of the process.

Successful applications were well distributed across the state and covered most commodities.

Unsurprisingly, gold was the target with the greatest number of successful applications, but base metals were a close second in popularity. Other target commodities included uranium, iron ore, manganese, nickel and platinum group elements.

The top-ranked applications demonstrated a high level of geoscientifically based exploration targeting and committed to making available to the public results of specialist analyses resulting from the drill holes.

The core obtained from drill holes funded by the program must be submitted to one of the Department's core libraries and will be made available to the public shortly thereafter.

Most successful applicants were small exploration companies.

DMP funding for successful projects ranges from $16 000 to $150 000. Further co-funding will be available in future years with about $6 million on offer for the 2010/11 program which will be advertised in early 2010.

Keep an eye on our website ‹www.dmp.wa.gov.au/EIS› for all the latest news.

For further information, contact Margaret Ellis (margaret.ellis@dmp.wa.gov.au) or see DMP's website ‹http://www.dmp.wa.gov.au/eis›.

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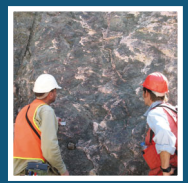
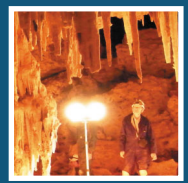


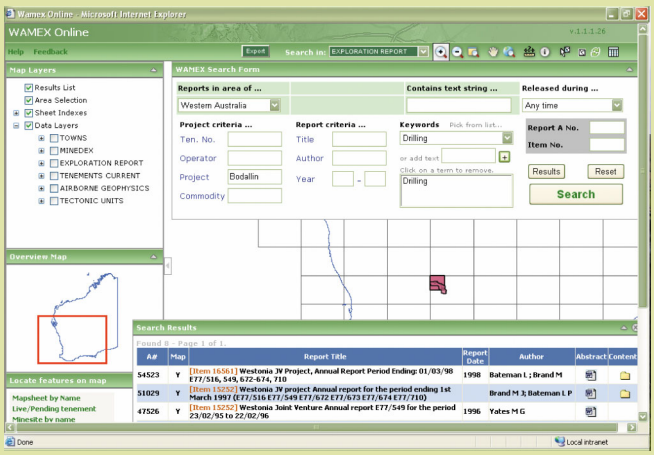


T-BREAK
GSWA TECHNOLOGY BREAK

T-BREAK takes a look at the latest information technology GSWA is using to better serve customers from industry, the public, and other government departments.
For more information, see (‹http://dmp.wa.gov.au/GSWA›Related Links› GeoVIEW.WA›Access to GeoVIEW.WA).

New developments in WAMEX online

The Department of Mines and Petroleum's (DMP's) WAMEX online web application enables more extensive searching of the mineral exploration report database (WAMEX) and has some new features. These include:

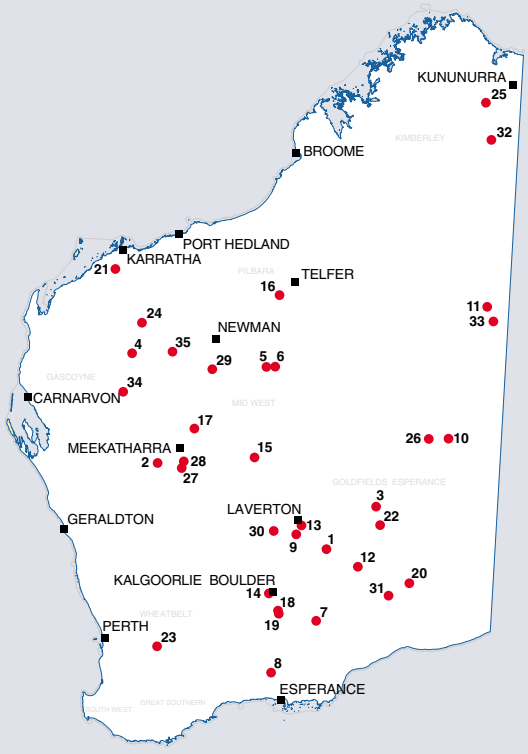


1. More extensive criteria on which to do a text search.
   Under the heading 'Reports in area of', the dropdown list includes 'Live/Pending Tenement'. Entering a current tenement and then searching will produce a list of historical reports that touch the current tenement. This list can be exported.
2. Results of a search can be seen on a map in relation to other features.
   In the example shown, project 'Bodallin' and keyword 'Drilling', the search produced eight reports and the area covered by the reports is shown on the map.
3. By selecting the Contents icon in the list of reports, it is possible to view and or download the whole report and any associated digital data such as surface geochemistry, drilling or geophysics.

For more information contact Ann Fitton (ann.fitton@dmp.wa.gov.au).

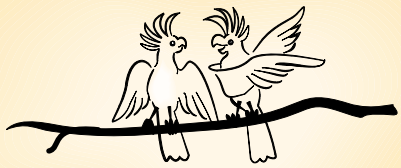
continued from page 1

1 A1 Minerals Ltd
2 Alchemy Resources
3 Aura Energy Ltd
4 Aurora Resources Pty Ltd
5 AusQuest Ltd
6 AusQuest Ltd
7 Triton Gold Ltd (Australian Mineral Fields Pty Ltd)
8 Triton Gold Ltd (Australian Mineral Fields Pty Ltd)
9 Barrick Gold Australia Ltd
10 Beadell Resources Ltd
11 Beadell Resources Ltd
12 Corvette Resources Ltd
13 Crescent Gold Ltd
14 David Reed Syndicate
15 Echo Resources Ltd
16 Encounter Resources Ltd
17 Enterprise Metals Ltd
18 Goldfields Ltd St Ives Gold Mine Pty Ltd
19 Goldfields Ltd St Ives Gold Mine Pty Ltd
20 Gunson Resources Ltd
21 Helix Resources Ltd
22 Iluka Resources Ltd
23 Magnetic Resources NL
24 Murchison Metals Ltd
25 NiPlats Australia Ltd
26 Rubicon Resources Ltd
27 Silver Swan Group Ltd
28 Silver Swan Group Ltd
29 Sipa Resources Ltd
30 St Barbara Ltd
31 Teck Australia Pty Ltd
32 Thundelarra Exploration Ltd
33 Toro Energy
34 U3O8 Ltd
35 U3O8 Ltd



Co-Funded drilling projects – 2009/10

Where we are working in the field

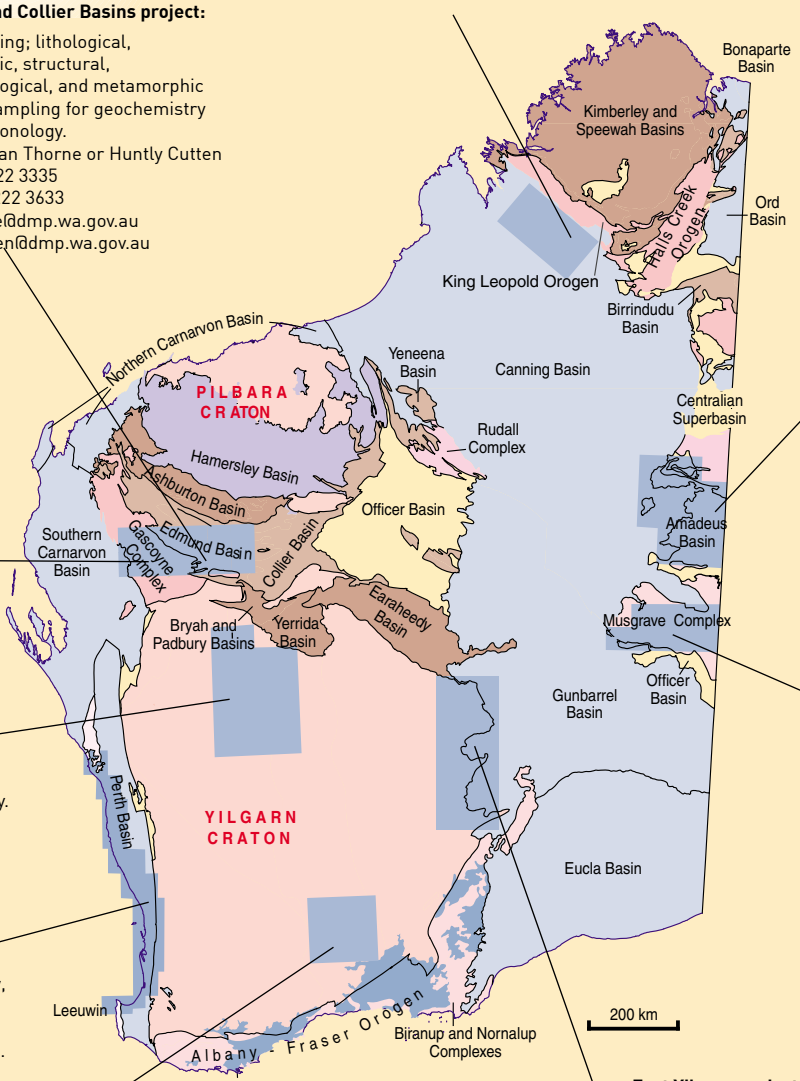


Canning Basin project:

Field studies of the Permian and Devonian succession.
Contact: Roger Hocking, Arthur Mory or Peter Haines
Ph: (08) 9222 3590, (08) 9222 3327 or (08) 9222 3667
Fax: (08) 9222 3633
roger.hocking@dmp.wa.gov.au
arthur.mory@dmp.wa.gov.au or
peter.haines@dmp.wa.gov.au

Edmund and Collier Basins project:

Field mapping; lithological, stratigraphic, structural, sedimentological, and metamorphic analysis; sampling for geochemistry and geochronology.
Contact: Alan Thorne or Huntly Cutten
Ph: (08) 9222 3335
Fax: (08) 9222 3633
alan.thorne@dmp.wa.gov.au
huntly.cutten@dmp.wa.gov.au



Western Amadeus Basin project:

Field studies of Neoproterozoic and Paleozoic successions.
Contact: Peter Haines
Ph: (08) 9222 3667
Fax: (08) 9222 3633
peter.haines@dmp.wa.gov.au

Gascoyne Province project:

Field mapping; lithological, stratigraphic, structural, and metamorphic analysis; sampling for geochemistry and geochronology.
Contact: Steve Sheppard or Simon Johnson
Ph: (08) 9222 3566
Fax: (08) 9222 3633
steve.sheppard@dmp.wa.gov.au
simon.johnson@dmp.wa.gov.au

West Musgrave Province project:

Field mapping; lithological, structural, and metamorphic analysis; sampling for geochemistry and geochronology.
Contact: Hugh Smithies
Ph: (08) 9222 3611
Fax: (08) 9222 3633
hugh.smithies@dmp.wa.gov.au

Murchison project:

Field mapping and structural geology studies; sampling for geochronology and geochemistry.
Contact: Stephen Wyche
Ph: (08) 9222 3606
Fax: (08) 9222 3633
stephen.wyche@dmp.wa.gov.au

Swan Coastal Plain:

Field mapping; surficial geology, geomorphology, geohazards, coastal vulnerability, basic raw materials development potential.
Contact: Bob Gozzard
Ph: (08) 9222 3594
Fax: (08) 9222 3633
bob.gozzard@dmp.wa.gov.au

East Yilgarn project:

Geological mapping; structural studies; sampling for petrography, geochemistry and geochronology.
Contact: Stephen Wyche
Ph: (08) 9222 3606
Fax: (08) 9222 3633
stephen.wyche@dmp.wa.gov.au

South Yilgarn project:

Field mapping and structural geology studies; sampling for geochronology and geochemistry.
Contact: Stephen Wyche
Ph: (08) 9222 3606
Fax: (08) 9222 3633
stephen.wyche@dmp.wa.gov.au

Portable technology capturing attention

Multi-element geochemistry is an important part of GSWA's regional mapping program, where it is used as a correlation tool between spatially separate lithologies, to identify likely parent rock types of saprolite or saprock, or in evaluating the petrogenesis and tectonic setting of igneous rocks, and to determine the extent of mineralization. As a standalone dataset, geochemistry provides important information to mineral exploration companies, with measurable uptake of exploration tenements following data release. These data are usually generated by commercial laboratories using a variety of analytical techniques, including X-ray fluorescence (XRF), but improvements in technology have meant that capture of geochemistry in the field using a field-portable XRF (FPXRF) spectrometer is now possible.

Energy-dispersive XRF, or ED-XRF, is more suited to field applications as the simplicity of ED-XRF hardware means it can be miniaturised and made portable. Furthermore, advances in X-ray technology (particularly in X-ray tubes and detector crystals) mean that ED-XRF can equal and in some cases surpass the performance of wavelength-dispersive or WD-XRF. Thus, the lower levels of detection (LLD) for a variety of elements (e.g. Zr, Sr, Rb, Pb, Zn, Fe, Mn, Cr, V, Ti, Ca, and Ba), are similar to those found in crustal rocks, and for some of these elements (Zr, Sr, Ti) levels of detection are as low as those found in mid-ocean ridge basalts (N-MORB) and even primitive mantle (Sun and McDonough, 1989; Zr, Sr).

GSWA has acquired a Thermo Scientific Niton ® Xl3t 500 FPXRF, which can analyse for up to 32 elements. Analysis time is between 1 and 2 minutes, and data are displayed on a built in LCD screen, as well as being stored for later download.

Applications in GSWA

Screening for geochronology

The first step in GSWA's U–Pb ion microprobe dating program is selection of a suitable sample for dating—i.e. a sample with the largest amount of either zircon or baddeleyite. These two minerals account for most of the Zr in the rock, so it is fair to assume that rocks with the highest Zr content are the most prospective for dating. As each sample takes approximately four person days to process in the laboratory to extract the zircons, any method that can help in selecting the most zirconium-rich sample in the field is important. The Niton FPXRF can accurately measure Zr in rocks and soils to a lower level of detection of 15 ppm, over a concentration range from LLD to ›1000 ppm (Morris, 2009). An example of this screening is the dating of the Lunnon Basalt, which forms the lower part of the greenstone sequence at Kambalda. Laboratory XRF analysis showed this fine grained, sparsely porphyritic basalt to have a Zr concentration between 50 and 60 ppm, thus unlikely to have sufficient zircon or baddeleyite to warrant separation. However, some thin units at the top of the sequence have Zr concentrations up to 170 ppm. FPXRF testing was used to identify prospective ziron-bearing intervals, and thin section of drill core samples from these intervals revealed tiny clumps of zircons in a felsic mesostasis. In contrast, no zircons were identified in the Zr-poor lower parts of the succession.

Identification of parent rock from weathered lithology

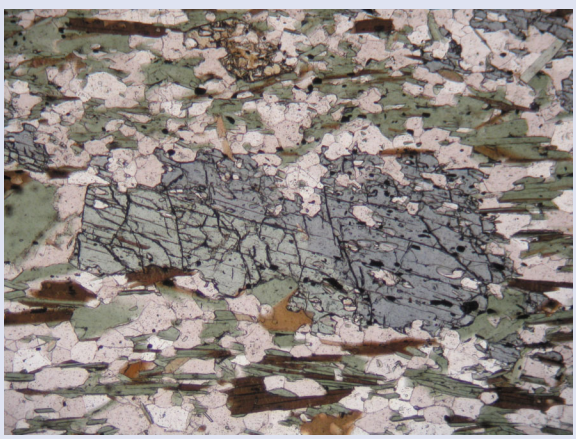
Due to metamorphism and subaerial weathering, Archean rocks of the Yilgarn Craton seldom preserve their original texture or mineralogy, meaning that it is commonly difficult to identify the parent lithology. During fieldwork in the southeast part of the craton, a 'micaceous sandstone' unit was analysed by FPXRF and shown to contain 381 ppm Ni, 331 ppm Cr, and 7641 ppm Fe (1.09 % Fe_2O_3). Subsequent laboratory analysis produced values of 795 ppm Ni, 1485 ppm Cr, 6 ppb Au, 32 800 ppm Fe (4.68 % Fe_2O_3), 10 ppb Pt + Pd, and 12.24 % MgO, indicating that this weathered material was most likely derived from an ultramafic parent. The poor agreement for Fe between FPXRF and laboratory analysis could be due to sample inhomogeneity — Ni and Cr values by FPXRF are also lower than laboratory values— suggesting that the single FPXRF analysis sampled a less ferruginous part of the outcrop. Despite this difference, the FPXRF results highlighted apparent compositional anomalies in the assumed 'micaceous sandstone' and demonstrated that further investigation was warranted.

For more information, contact Paul Morris (paul.morris@dmp.wa.gov.au).

New metamorphic study of the Yilgarn Craton

The GSWA is funding a component of an ongoing research project on the thermo-barometric evolution of the Yilgarn crust by Dr Ben Goscombe (Visiting Research Associate at Adelaide University). Ben is an international expert in metamorphic petrology with extensive experience in Australia, Africa, Asia, and Antarctica. This project is a follow-up to the highly regarded metamorphic study of the Eastern Goldfields Superterrane that he carried out in collaboration with the predictive mineral discovery Cooperative Research Centre (pmd*CRC).

As a result of the earlier study, the Yilgarn Craton is now known to have had a heterogeneous, partitioned metamorphic response, over a protracted history, with many thermal events. The extended study will build on the Eastern Goldfields work and result in documentation of fundamental, first-order metamorphic patterns and thermo-barometric evolutions across the entire Yilgarn Craton. The study will also result in documentation of second-order patterns and gradients across specific crustal structures and mineralization camps in an attempt to integrate metamorphism with deformation and fluid flow.



Choritoid porphyroblast in chlorite schist (x1.5ppl)

The recognition of five distinct metamorphic events in the pmd*CRC study clearly demonstrates the need for full commitment to accurate and robust direct dating of the different metamorphic parageneses. The well-constrained U–Pb series chronometers will be applied to the peak-metamorphic minerals zircon, titanite and monazite. Additional Lu–Hf garnet dating will document garnet growth in the same samples, and possibly result in constraints on the rates of thermal evolution. This full geochronology program will result in direct dating of different metamorphic events, both within terranes, and between different terranes.

This project will generate a large number of new datasets including mineral data, petrology, microphotos, garnet compositional maps, bulk composition and P–T calculations, P–T paths of evolution, geochronology, and field photographs. The new database will be used to constrain spatial metamorphic and deformation patterns, generating a series of time-slice and thematic metamorphic map products across the entire Yilgarn Craton. It will also document and constrain the chronology of thermal events across the craton. The result will be a new, comprehensive, spatial, relational GIS database that documents stratigraphic, lithologic, metamorphic, chronologic, fluid, structure, strain, kinematic, and bulk composition parameters that can be incorporated into GSWA products including maps and GIS databases.

Apart from the new insights that they will provide in constraining crustal processes and tectonic settings, the new fundamental datasets from this world-class mineral province will aid in the generation of mineral exploration models and explore the genetic links between thermo-barometric evolution and mineralization processes.

Besides being incorporated into GSWA publications, results of this project will be presented in conference forums such as the 5th International Archean Symposium (5IAS) to be held in Perth in September 2010, and in papers in academic journals.

Ben Goscombe (left) and Richard Blewett (Geoscience Australia) examine a fault surface in the Jupiter gold mine near Laverton

For more information, contact Stephen Wyche (stephen.wyche@dmp.wa.gov.au).

Treasure beneath the Nullarbor

Twenty metres straight down, through a narrow solution pipe in the Nullarbor limestone, there's an Aladdin's cave full of paleontological treasures. In April 2009, a large group of scientists, cavers, students, and media personnel descended beneath the Nullarbor Plain, to uncover ancient bones in the depths of a four-million-year-old cave. The expedition, led by paleontologist Dr Gavin Prideaux of Flinders University, aimed to excavate the infill sediments in Leaena's Breath Cave (LBC) – one of three famous 'Thylacoleo Caves' located northwest of Eucla. GSWA contributed logistical support and two field-equipped 4WD vehicles for the expedition.

Many spectacular finds from earlier trips were of megafauna fossils, including the marsupial lion, *Thylacoleo carniflex*, as well as giant wombats, kangaroos, and birds. The cave is laden with the bones of many marsupials, native rodents, lizards, and birds, including many previously unknown species. Prideaux and his team, including Professor Ernie Lundelius (pictured above) from the University of Texas, a pioneer of Australian cave paleontology, set out to increase the previous samples and to see how deep the fossil-bearing sediments are in LBC, i.e. how far back in time the deposit extends.

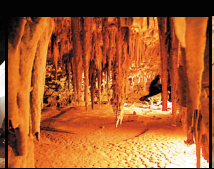
Prideaux and colleagues' earlier analyses of fossils from these caves, published in *Nature* in 2007, suggested that Australian megafauna were already adapted to an arid climate, hence climate change was not the reason for their extinction. It is thought now that bushfires, started by humans after their arrival in Australia about 50 000 years ago, altered the vegetation relied upon by large herbivores, and when they died, so did the giant carnivores that preyed on them.

From two large pits excavated in April, about 6 tonnes of sediment was removed for screening. The team has yet to sort through about 50 kg of small bones retrieved from sieving the sediment. This will occupy them for the next 12 months, and is likely to yield several new reptile, bird, and mammal species. Among the recent finds are a partial skull of one of the rarest short-faced kangaroos, several undescribed wallabies, and a partial skeleton of the giant kangaroo Protemnodon, draped across the rockpile beneath the sediment. The large number of bird fossils and bird skeletons make LBC one of the most important bird fossil sites in Australia, especially since little is known about the history of this region and the early Pleistocene bird fauna of Australia in general.

And then there is *the* frog, represented to date by a single hip bone identified by Professor Lundelius. No frogs live today on the Nullarbor Plain, and this one is thought to be hundreds of thousands of years old. Because frogs are sensitive to rainfall and temperature fluctuations, they act like a barometer for climate change and should reveal exactly when the Nullarbor became arid.

Another focus of the expedition was a return to Madura Cave after 45 years for Ernie Lundelius, who did the original cave palaeontology work on the Nullarbor in the 1950s and 1960s. The Madura cave deposits extend back to 40 000 years ago, and will help to test whether the timing and pattern of megafauna extinction on the Nullarbor was similar to that in the southeast and southwest of Australia.

For more information, contact Michael Wingate (michael.wingate@dmp.wa.gov.au).



Regional geophysics surveys funded by the Exploration Incentive Scheme

July 2009 update

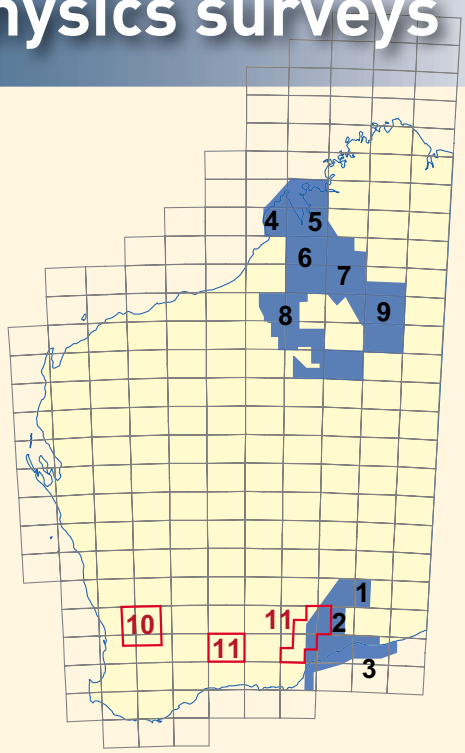
Data access

Download final data releases from the Geoscience Australia Data Delivery System at ‹http://www.ga.gov.au/gadds›.

Download preliminary and final grids and images from the GSWA website at ‹http://www.dmp.wa.gov.au regionalgeophysicalsurveys›.

Subscribe to the GSWA mailing list to keep informed of preliminary and final data release dates.

For more information, contact David Howard (david.howard@dmp.wa.gov.au).



* A Royalties for Regions project

Airborne magnetic and radiometric surveys

ID	Area/Name	Lines	Size (km)	Status	Start	End	Release
1	Seemore 2009	200 m; E/W	88 000	Survey	Jun–09	Sep–09	Dec–09*
2	Naretha 2009	200 m; E/W	123 000	Survey	Jun–09	Dec–09	Feb–10*
3	Eucla Coast 2009	200-400 m; N/S	108 000	Contract	Aug–09*	Jan–10*	Mar–09*
4	Broome 2009	400 m; N/S	76 000	Survey	Jul–09*	Oct–09*	Jan–10*
5	Yampi-Derby 2009	400 m; N/S	67 000	Survey	Jun–09*	Sep–09*	Dec–09*
6	Mt Anderson-McLarty Hills 2009	400 m; N/S	98 000	Survey	Jul–09*	Nov–09*	Feb–10*
7	Crossland-Noonkanbah 2009	400 m; N/S	117 000	Survey	Jul–09*	Nov–09*	Feb–10*
8	Central Canning 2009	800 m; N/S	92 000	Survey	Jun–09*	Sep–09*	Nov–09*
9	Cornish–Helena 2009	400 m; N/S	121 000	Survey	Jun–09*	Dec–09*	Feb–10*

Ground gravity surveys

ID	Area/Name	Spacing	Size (stns)	Status	Start	End	Release
10	Cunderdin 2009	2.0 km grid	6 000	Processing	Jan–09	Apr–09	Aug–09*
11	South Yilgarn Margin (2 parts)	2.5 km grid	6 500	Contract	Jul–09	Sep–09*	Nov–09*

Information current at: 16 July 2009 * Estimated date

AusGeo News

AusGeo News is Geoscience Australia's (GA's) quarterly news magazine. Each issue comprises geoscience-related features, brief articles about GA's research and initiatives, news about geoscience products and spatial data, and a calendar of coming seminars and conferences.

Issue No 94 is now available at http://www.ga.gov.au/ausgeonews/. Some articles related to Western Australia are listed below.

New opportunities for offshore petroleum exploration

2009 acreage release includes deep water frontiers

Southwest Margin surveys completed

Surveys investigate basin structure, hydrocarbon potential and marine habitat

The geology and deep marine terrains of Australia's western region

Preliminary results from major marine reconnaissance survey

Revealing the Wallaby Plateau

Recent survey delivers geophysical, geological and biophysical data

Product releases

All prices include 10% GST

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ISSN 1834-2272 ISBN 978-1-74168-220-5 (PDF)

RECENT RELEASES

GEOLOGICAL MAPS

Candolle 1:100 000 geological series map
by AM Thorne, DMcB Martin, and HN Cutten

Errabiddy 1:100 000 geological series map second edition
by SA Occhipinti, S Sheppard, HN Cutten, and AM Thorne

Koonmarra 1:100 000 geological series map
by SF Chen and T Ivanic

Madoonga 1:100 000 geological series map
by T Ivanic

Marquis 1:100 000 geological series map second edition
by S Sheppard, CP Swager, SA Occhipinti, AM Thorne, and HN Cutten

Tieraco 1: 100 000 geological series map
by SF Chen and T Ivanic

PDFs available on website ..... free of charge

NON-SERIES MAPS

Iron ore deposits of the Yilgarn Craton 2009
by RW Cooper and DJ Flint

Industrial minerals in Western Australia 2008 Plate 1
by JM Fetherston

Iron ore deposits of the Pilbara region 2009
by RW Cooper and DJ Flint

PDFs available on website ..... free of charge

BULLETIN

145 Devonian reef complexes of the Canning Basin, Western Australia
by PE Playford, RM Hocking, and AE Cockbain

Available in hard copy only $77.00

REPORT

105 The Carribuddy Group and Worral Formation, Canning Basin, Western Australia: Stratigraphy, sedimentology, and petroleum potential
by P Haines

RECORDS

2009/2 GSWA 2009 extended abstracts: promoting the prospectivity of Western Australia

2009/4 The Magellan non-sulfide lead deposit, Yerrida and Earaheedy Basins, Western Australia
by F Pirajno

2009/5 Guidebook to the geology and geomorphology of Devonian Reef Complexes of the Canning Basin, Western Australia
by PE Playford

2009/6 Mineralogy and trace element chemistry of lode and alluvial gold from the western Capricorn Orogen
by EA Hancock, AM Thorne, PA Morris, RJ Watling, and HN Cutten

2009/7 Field-portable X-ray fluorescence analysis and its application in GSWA
by PA Morris

2009/8 An approach to digital map compilation using ArcGIS software
by AM Thorne SP Johnson, A Riganti, P Evins, T Ivanic, and R Maas

2009/9 Tips and tricks for map compilation using ArcGIS software and tablet PCs
by SP Johnson, AM Thorne T McDonald, T Ivanic, A Riganti, HN Cutten, P Evins, RW Page, and KAR Ghori

2009/10 Interpreted bedrock geology of the southern Yilgarn and central Albany-Fraser Orogen, Western Australia
by C Spaggiari S Bodorkos, IM Tyler, and MTD Wingate

2008/16 Industrial minerals in Western Australia: the situation in 2008
by JM Fetherston

2008/19 The west Musgrave Complex — new geological insights from recent mapping, geochronology, and geochemical studies
by RH Smithies, HM Howard, P Evins, CL Kirkland, S Bodorkos, and MTD Wingate

PDFs available on website ..... free of charge

MISCELLANEOUS PUBLICATIONS

Western Australia atlas of mineral deposits and petroleum fields 2009
by RW Cooper, PB Abeysinghe, and DJ Flint

Geology of James Price Point, Broome, Western Australia

PDFs available on website ..... free of charge

GEOLOGICAL INFORMATION PACKAGE (DVD)

West Musgrave 1:100 000 Geological Information Series 2009 update
by RH Smithies and H Howard $55.00

East Yilgarn Geological Information series update 2009
by S Wyche, and A Riganti $55.00

RESOURCE POTENTIAL FOR LAND USE PLANNING

Titanium-zircon mineralization, Bunbury second edition
by LY Hassan

Titanium-zircon mineralization, Busselton-Clairault second edition
by LY Hassan

Titanium-zircon mineralization, Donnelly-Meerup second edition
by LY Hassan

Titanium-zircon mineralization, Donnybrook second edition
by LY Hassan

Titanium-zircon mineralization, Fremantle–Jarrahdale second edition
by LY Hassan

Titanium-zircon mineralization, Leeuwin-Tooker second edition
by LY Hassan

Titanium-zircon mineralization, Pinjarra second edition
by LY Hassan

PDFs available on website ..... free of charge

MISCELLANEOUS DIGITAL PRODUCTS

Iron ore deposits of the Pilbara region 2009

Prospectivity of State acreage release areas L09–3 and L09–4
by KAR Ghori

DATA PACKAGE

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