

Fieldnotes



Department of
Industry and Resources

Geological Survey of
Western Australia



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The search for petroleum sources and seeps

Geologist Peter Haines of GSWA's Petroleum Geology Team joined the survey in Port Lincoln as an invited State representative.

During late February and the first half of March 2007, Geoscience Australia (GA) conducted a geoscientific survey along the offshore margin of eastern Western Australia and western South Australia, using the CSIRO research vessel **Southern Surveyor**. The survey, led onboard by Chief Scientist Cameron Mitchell of GA's Petroleum and Marine Division, was aimed at improving our knowledge of

the geological history and petroleum prospectivity of a poorly explored region, the Bight Basin. A similar survey of the Bremer Sub-basin was undertaken in 2004 with GSWA representative Roger Hocking onboard (see March 2004 Fieldnotes). The 2007 survey concentrated specifically on the central and western Ceduna Sub-basin and the southern edge of the Eyre Sub-basin.

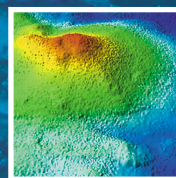
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Freshly dredged rocks get a hosing off before the geologists move in, GSWA's Peter Haines at left (Photograph courtesy Cameron Mitchell)

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DigitalPaper™ user tip #8

Sorted search results

GSWA is pleased to announce an important enhancement to our DigitalPaper document server: sorted search results for our *Geoscience Publications* cabinet.

Previously, the search results returned by DigitalPaper were not listed in any meaningful order. This made it difficult to locate the right document quickly within large result sets.

Now, search results are listed in a meaningful way (by publication date) making it faster and easier to find the documents you need. The new order for search results is:

- by Publication Year (descending)
- then by Series Name (ascending)
- then by Series Number (descending)

As an example, try this: visit our *Geoscience Products* search page (go to <<http://www.doir.wa.gov.au/GSWA/publications>> then click on the *Maps and Books* button). Perform a search for documents with *fieldnotes* in the Title. The results show all publications in GSWA's Fieldnotes series, ordered from most recent to oldest.

Should you have any difficulties using our DigitalPaper document server, please contact our Online Services Officer on 08 9222 3629.

WA Conference/Seminar Calendar 2007/2008

AUGUST 2007

August 6 – 8 Diggers & Dealers

Kalgoorlie, Western Australia
Web: www.diggersnddealers.com.au

August 13

Report Writing – Professional Development Course

Perth, Western Australia
Web: www.snowdengroup.com

August 20 – 22 Iron Ore 2007

Perth, Western Australia
Web: www.ausimm.com

SEPTEMBER 2007

September 4 – 5 Good Oil Conference

Esplanade Hotel Fremantle, Western Australia
Web: www.riuconferences.com.au/conferences/tgoc/

September 25 – 27

Kalgoorlie '07 Old Ground. New Knowledge.

Kalgoorlie, Western Australia
Web: www.kalgoorlie07.org

MAY 2008

May 19 – 24

ALTA 2008 Nickel/Cobalt, Copper and Uranium International Conference

Perth, Western Australia
Web: www.altamet.com.au

JULY 2008

July 20 – 25

Australian Earth Sciences Convention 2008

Perth, Western Australia
Web: www.gsa.org.au

August 17 – 20

Inaugural Global Geotourism Conference, Australia 2008

Esplanade Hotel, Fremantle, Western Australia
Web: www.promaco.com.au/2008/geotm/

Ocean drilling research available online

Publications detailing nearly 40 years of scientific discoveries from ocean drilling research will soon be available online.

These publications provide valuable data for geoscientists and represent the results of an important global science endeavour that had a major impact on our understanding of the Earth's processes.

The second phase of the digitization project will bring the Initial Reports of the Deep Sea Drilling Project series (Volumes 1–96) and other printed ODP and Deep Sea Drilling Project (DSDP) reports online.

The DSDP publications will be available at <<http://www.deepseadrilling.org>>.

ODP first began publishing its Proceedings online in 1997. Every chapter in both the Proceedings of the Ocean Drilling Program and the Initial Reports of the Deep Sea Drilling Project will contain a digital object identifier (DOI). Publishers create links between reference lists and the online content of cited papers using DOIs. With the newly digitized ODP data now readily available, organizers of the program are confident that scientists and engineers will ultimately make new discoveries, develop new technologies and contribute further to scientific knowledge.

For more information, contact Jon Corsiglia [jcorsiglia@joiscience.org] or see the website at <<http://www.iodp.org>>.



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@doir.wa.gov.au
arthur.mory@doir.wa.gov.au or peter.haines@doir.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
Ph: (08) 9222 3335
Fax: (08) 9222 3633
alan.thorne@doir.wa.gov.au

Gascoyne Complex project:

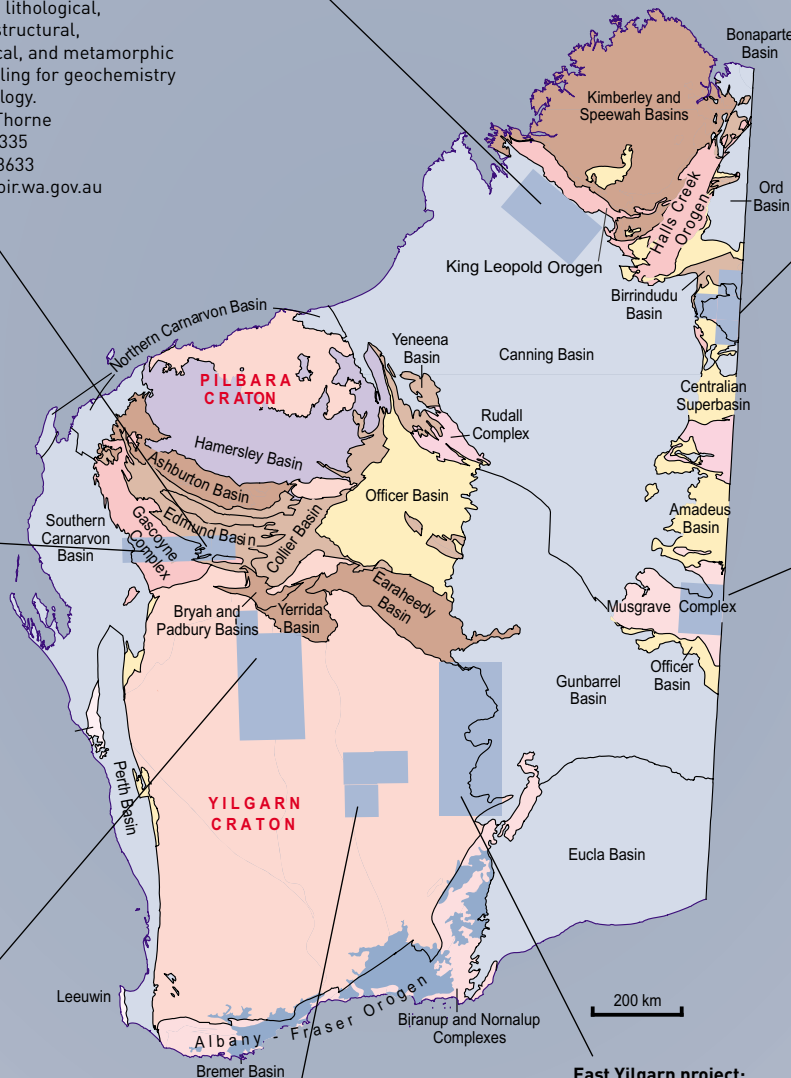
Field mapping; lithological, stratigraphic, structural, and metamorphic analysis; sampling for geochemistry and geochronology.
Contact: Steve Sheppard
Ph: (08) 9222 3566
Fax: (08) 9222 3633
steve.sheppard@doir.wa.gov.au

Western Tanami project:

Field mapping; lithological, structural, and metamorphic analysis; sampling for geochemistry and geochronology.
Contact: Leon Bagas
Ph: (08) 9222 3221
Fax: (08) 9222 3633
leon.bagas@doir.wa.gov.au

West Musgrave Complex 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@doir.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@doir.wa.gov.au

Inventory of abandoned mine sites:

Data collection, including the location and characteristics of historical mining activity in the Laverton–Mount Ida–Davyhurst areas.
Contact: Colin Strickland
Ph: (08) 9222 3139
Fax: (08) 9222 3633
colin.strickland@doir.wa.gov.au

East Yilgarn project:

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



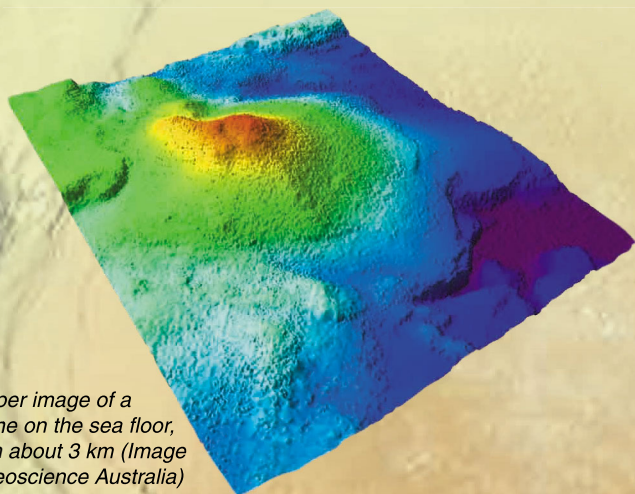
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Geologist Peter Haines of GSWA's Petroleum Geology Team joined the survey in Port Lincoln as an invited State representative. Coincidentally, as a student Peter participated in an earlier shipboard survey of the same area, conducted in November – December 1986 by GA's predecessor, the Bureau of Mineral Resources, using their survey vessel the **Rig Seismic**. Having worked entirely onshore for the rest of his career, Peter was intrigued to see the changes to shipboard surveys over the intervening 20 years. While the actual dredge and coring devices are essentially unchanged, the ability to target sites of interest accurately has improved immensely. This is due in part to continuous GPS operation (several fixes per day interspersed with long periods of operation on dead reckoning were the norm in 1986), and the ability to use swath mapping to produce a high-resolution digital elevation map of the sea

floor prior to picking sample sites. Many sites were also investigated with a sub-bottom profiler, which allows near-surface seismic-like imaging of the sea floor.

The Bight Basin extends for 2100 km along the southern margin of Australia from south of Cape Leeuwin in WA to south of Kangaroo Island in SA. It formed during rifting between Australia and Antarctica, and by definition is restricted to rocks of Middle Jurassic to Late Cretaceous (about 165 to 65 million years) age. The basin lies offshore apart from relatively thin sections hidden beneath younger cover of parts of the Eucla Basin, onshore. A number of thick sub-basins, typically located on or just inboard of the continental slope, are recognized, specifically the Denmark and Bremer Sub-basins off southwest WA, the Eyre Sub-basin off far eastern WA, the Ceduna Sub-basin, extending the length of the SA Bight Basin and into WA, and the Duntroon Sub-basin south of Eyre Peninsula and Kangaroo Island in SA.

A significant improvement in seismic coverage in recent years has allowed GA to undertake a major reassessment of the stratigraphic and structural framework of the Ceduna and Eyre Sub-basins. Unfortunately, the very limited drilling has concentrated in areas with thin and incomplete stratigraphic sections, so the stratigraphic and regional distribution, and quality, of the all-important hydrocarbon source rocks is poorly known. Hence a dredging program, targeting parts of the stratigraphy expected to harbour source rocks, was one of the main aims



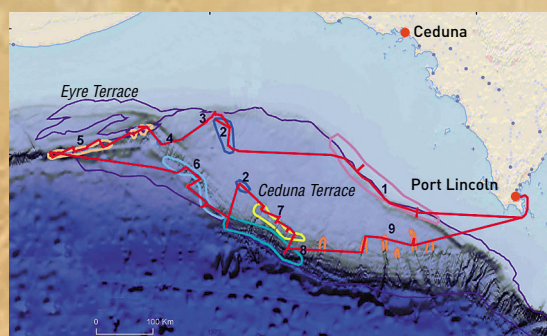
Swath mapper image of a volcanic cone on the sea floor, image width about 3 km (Image courtesy Geoscience Australia)



A successful dredge brings up a haul of rocks from the deep



Background image: Topography of the southern margin (Image courtesy Geoscience Australia)



The ship's track (red) and main survey areas (Image courtesy Geoscience Australia)



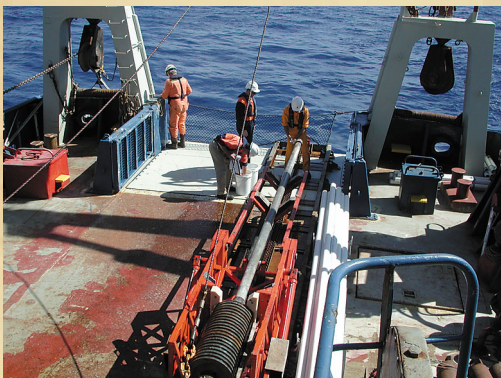
Petroleum sources and seeps in the Bight Basin

of the survey. Seismic data show where potential source horizons have been exposed by submarine canyon erosion or slumping, typically at depths of a couple of kilometres along the continental slope. The challenge is then to get a metal dredge and chain mesh collecting bag, suspended at the end of several kilometres of wire cable, to drag across the target and return its haul to deck. More easily said than done, but the high success rate of bringing rocks to the surface is testament to the crew's experience in this type of work. The dredges brought up a wide variety of sedimentary rocks, including mudstone, sandstone, conglomerate, limestone and phosphate nodules. Many of the mudstones had a dark grey to black colour, indicating the presence of organic matter. Although conclusions must await geochemical analyses, this is an encouraging sign that such rocks may have source rock potential. Additional dredge bonuses included a basement granite, presumably of Proterozoic age, and volcanic rocks. The volcanic rocks were associated with distinct volcano-shaped cones on the upper continental slope near the WA-SA border, their well-preserved morphology implying that they may be quite young.

Remote sensing techniques can be good at spotting hydrocarbon slicks on the sea surface, potentially indicating hydrocarbon seepage from the sea floor, and hence the presence of an active hydrocarbon system beneath. Radar techniques are particularly useful because hydrocarbon slicks subtly change the radar texture of the sea surface. A combination

of Radarsat and ERS Synthetic Aperture Radar (SAR) data over the Great Australian Bight region has been analysed at GA, and suggests that active seepage may be occurring from the Bight Basin, particularly from restricted areas of the Ceduna Sub-basin. The common coincidence between these sites and areas of active or relatively recent faulting along the sub-basin margins enhances the probability that the slicks are related to natural hydrocarbon seepage rather than other causes. Seismic data over the same areas also show a variety of features that can be interpreted as signs of fluid migration up faults. As a follow-up on these potential seeps, another significant aim of the survey was to obtain sediment samples from shallow depths below the sea floor in these areas in the hope of 'ground truthing' the seep hypothesis. Here, accuracy is essential so swath mapping and sub-bottom profiling is first used to pin-point the target fault. Depending on the hardness of the substrate, a gravity coring device dropped to the sea floor typically extracts a core several metres in length. Samples were extracted from regular intervals of each core, quickly treated and frozen to minimize deterioration, and are now being analysed for traces of hydrocarbons.

Considering the Bight's reputation for rough conditions, and Peter's memory of the 1986 survey, the weather was remarkably kind and caused no significant hold-ups to planned operations. The large haul of rock and core samples are now being analysed at GA, and in several specialist laboratories. GSWA will also have some involvement, particularly with analyses of some of the 'hard rocks' collected. Participation in the survey ensures that GSWA shares in the investigation of this poorly known region between WA and SA. The final outcome should be a substantial improvement in our understanding of its geological history and prospectivity, the latter hopefully stimulating future exploration activity and eventual discoveries.



Extracting a sediment core from the gravity corer

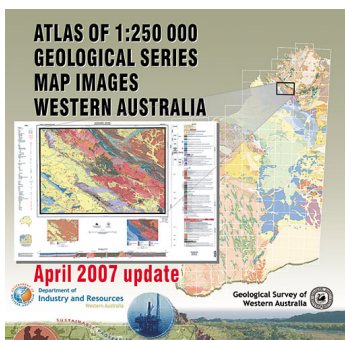


*Peter Haines (right) and GA geologists examine dredge samples
(Photograph courtesy Cameron Mitchell, GA)*



New digital Atlas

New digital Atlas has everything!



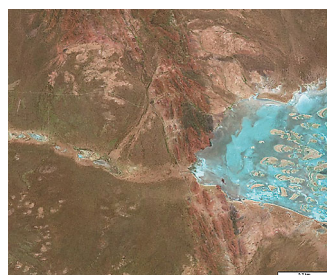
The release of all 163 of the 1:250 000 Geological Series maps of Western Australia on a single CD in January 2003 was so popular it was re-released with improvements in June 2003. It was re-released in January 2005 when the NATMAP mosaic of 1:250 000 topographic map images was included on the DVD. It has been released as the April 2007 update and in addition to the geology and topographic coverage, it also includes the magnetic anomaly image of WA (based on best available public domain aeromagnetic coverage) and a Landsat TM image covering the entire State. These datasets can be viewed with the included self-loading Atlas Viewer software and are suitable for printing to at least 1:250 000 scale.

Individual 1:250 000 Geological Series map sheets are supplied as ECW images of the latest edition maps (to 31 December 2006), complete with reference, cross section and marginalia. The maps are georeferenced to GDA94 enabling accurate

MGA coordinates to be read in real time on screen with GIS software or ER VIEWER freeware. Legacy Imperial maps have a blue MGA grid overlay added to them. Maps can be selected from the State index map, or by sheet name or number, or even by a topographic feature that occurs within the map area. Geological maps are also provided as a State-wide mosaic which can be toggled between the topography, magnetic anomaly and satellite images. These images zoom in together to any selected area.

Data are provided as ESRI shapefiles, ECW images, and MS Access database formats.

Price is just \$22 for the DVD giving you everything you ever needed to find your way around WA's geology and wide-open spaces!









AusGeo News: for Western Australian readers

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.

AusGeo News June 2007 Issue No. 86

Some of the articles pertinent to Western Australia are:

-  **Offshore petroleum exploration set to increase**
Recent successes have significantly increased known oil and gas reserves.
-  **Onshore Energy Security Program takes off**
Search for new energy sources is underway.
-  **Regional geochemical study paves way for national survey**
Geochemistry of surface regolith points to new resources.
-  **High seas and marine protected areas**
GIS analysis of seafloor geomorphology exposes conservation concerns.
-  **Australian mineral exploration growing strongly**
Strong demand underpins higher spending.
-  **Gnangara geomagnetic observatory 50 years young**
Australian geomagnetic studies go back 167 years.

Click on <<http://www.ga.gov.au/ausgeonews>> to view AusGeo News and learn more about these stories.





Geophysics survey program

GSWA regional geophysics survey program April

Final data releases are available by download from the Geoscience Australia Data Delivery System at <http://www.ga.gov.au/gadds>. Releases of preliminary data, generally at about 50% and 100% of the data acquisition stage, are made on the GSWA website <http://www.doir.wa.gov.au/GSWA/> *Regional Geophysical Surveys* page. Subscribe to the GSWA newsletter to keep informed of preliminary and final data release dates by sending in an email to publications@doir.wa.gov.au.

ID	Name	Specifications	Status	Start	End	Release*
Airborne Mag/Rad Surveys						
1	Musgrave 2006	400 m x 60 m; E/W; N/S	Complete	Jun-06	Oct-06	13 Feb 07
2	Officer (Trainer) 2006	400 m x 60 m; N/S	Complete	Aug-06	Jan-07	28 Mar 07
3	Ashburton 2006	400 m x 60 m; N/S	Complete	Aug-06	Jan-07	4 Apr 07
6	South Kimberley 2007	400 m x 60 m; N/S	Contracted	(Jul-07)	(Dec-07)	(Apr-08)
Gravity Surveys						
4	Webb 2006	2.5 km regular	Complete	Aug-06	Sep-06	21 Dec 06
5	Murchison 2007	2.5 km regular	Complete	Feb-07	Mar-07	15 May 07
7	West Tanami 2007	2.5 km regular	Quotation Request	Dependent on Land Access		

*Information current at 27 April 2007

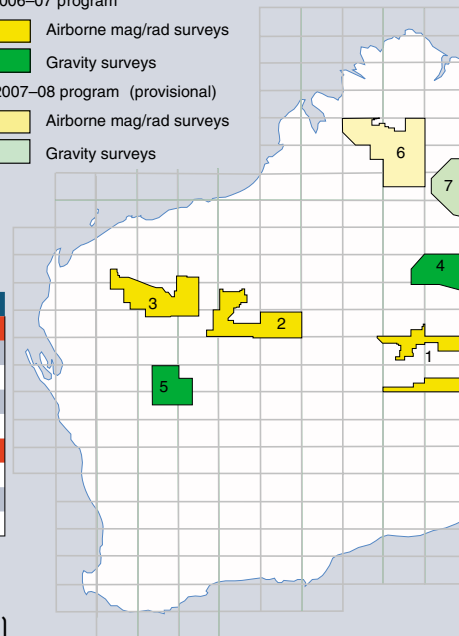
Dates shown are for release of final data; dates in parentheses are provisional.

2006-07 program

- Airborne mag/rad surveys
- Gravity surveys

2007-08 program (provisional)

- Airborne mag/rad surveys
- Gravity surveys



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

Geoscience Library catalogue now available online

GEOLIB is the online library catalogue of the DoIR Mineral House Library. It provides users with an easy-to-use search tool to readily search and locate library holdings in the subject areas of WA geology, mining, petroleum and the environment.

GEOLIB records the complete holdings of the library including books, journals, reprints, maps, published and unpublished GSWA and DoIR publications, aerial photography, field and sample note books, historical material, photograph collections and more.

Search the collections by Title, Author, Keyword, Subject, ISBN/ISSN, Series and more. Wildcard searching using either the percent (%) or asterisk (*) is available for searching for words anywhere in the Title. Use the 'GeoDocs' link in the Links section of the side bar menu to access the full text PDF of GSWA publications located in your catalogue search.

You can access GEOLIB from the 'Online databases' section of the DoIR home page at <http://www.doir.wa.gov.au> or directly at the URL address: <http://geolib.doir.wa.gov.au/cgi-bin/w2005.sh>.

External DoIR clients wishing to view the library collections may visit the library onsite from Monday to Friday 8.30 am – 4.30 pm on Level 1 at Mineral House in Perth. Photocopying facilities are available. Please note that external clients may not borrow items directly from the library. Inter-library loan requests from libraries only are accepted.

For further information on searching the library collections with GEOLIB, contact Brian Knyn (brian.knyn@doir.wa.gov.au).

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RELEASED

MISCELLANEOUS

Geology and landforms of the Perth Region

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Inventory of abandoned mine sites: progress 1999–2006

GIS dataset on DVD\$55

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EUDAMULLAH 1:100 000 geological map.....\$11

PDF available on website free of charge

WATTS 1:100 000 geological map\$11

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Western Australian mines —

operating and under development, 2007

1:2 500 000\$11

PDF available on website free of charge

Western Australia mineral deposits and petroleum fields 2007\$11

PDF available on website free of charge

North Gascoyne, W.A., Ternary Radiometric Image (part of sheets SF50-5, SF 50-6, SF 50-9, SF 50-10, SF 50-13, and SF 50-14; 1:500 000 scale)

PDF available on website free of charge

Digital data — available from Geoscience Australia

East Yilgarn, W.A., Ternary Radiometric Image (sheets SH 51-7, SH 51-11, and part sheets SH51-3, SH 51-4, SH 51-8, SH 51-12, and SH 51-15; 1:500 000 scale)

PDF available on website free of charge

Digital data — available from Geoscience Australia

Established and proposed aboriginal land, conservation estate, mineral and petroleum titles, and geology, Western Australia — 2007 (1:2 500 000)

PDF available on website free of charge

RECORDS

2006/18 Proterozoic geology of the western Capricorn Orogen — a field guide

PDF available on website free of charge

2007/3 Mineral occurrences and exploration potential of the Gascoyne area

GIS dataset on DVD\$55

2007/4 TerraneChron analysis of zircons from Western Australian samples

PDF available on website free of charge

2007/8 A classification system for regolith in Western Australia (March 2007 update)

PDF available on website free of charge

2007/9 Laterite sampling in the northwestern part of the Yilgarn Craton, Western Australia

PDF available on website free of charge

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NULLAGINE 3rd edition

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Kalgoorlie–Boulder town site

Non-series

Iron ore deposits of the Yilgarn craton, 2007

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Central Yilgarn (MONTAGU – YOUNG DOWNS) update

Geological Exploration Package

Southern Yilgarn

MISCELLANEOUS

Compilation of geochronology data, 2007 update

Tectonic units of WA 2007, GIS layer in GeoVIEW.WA

1:100 000 Geological Series Explanatory Notes

ERAYINIA, YILGALONG

RECORDS

2007/5 Copper–lead–zinc in WA: commodity review for 2005–06

2007/7 BLACKSTONE 1:100 000 map sheet gravity survey, technical summary

2007/10 Neoproterozoic reworking in the Paleoproterozoic Capricorn Orogen

2007/11 Stratigraphy and facies of the 3.43 Ga Strelley Pool Chert

2007/12 Nickel–cobalt in Western Australia: commodity review for 2005

REPORT

Geochemistry of volcanic rocks of the northern Pilbara Craton

BULLETIN

Dimension stone in Western Australia Volume 1

All publications published as PDF files can also be ordered from the Information Centre as laser-printed copies at the cost of printing and binding. Our printed publications are now also available free as PDF files on our website at <www.doir.wa.gov.au/GSWA/publications>. Further details of geological publications and maps produced by the Geological Survey of Western Australia can be obtained at <www.doir.wa.gov.au/GSWA>.

Hard copy publications including CDs and DVDs are available from the Information Centre, First Floor, Mineral House, 100 Plain St, East Perth, WA 6004, AUSTRALIA Phone: +61 8 9222 3459; Fax: +61 8 9222 3444 or can be purchased online from the bookshop at <www.doir.wa.gov.au>.