

# Fieldnotes



Government of Western Australia  
Department of Mines and Petroleum

Geological Survey of  
Western Australia



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## GSWA releases entire Terra Search WA geochemical database

As part of the WA Government's Exploration Incentive Scheme (EIS), GSWA has purchased the entire Terra Search surface and downhole geochemical database for WA at a cost of \$400,000.

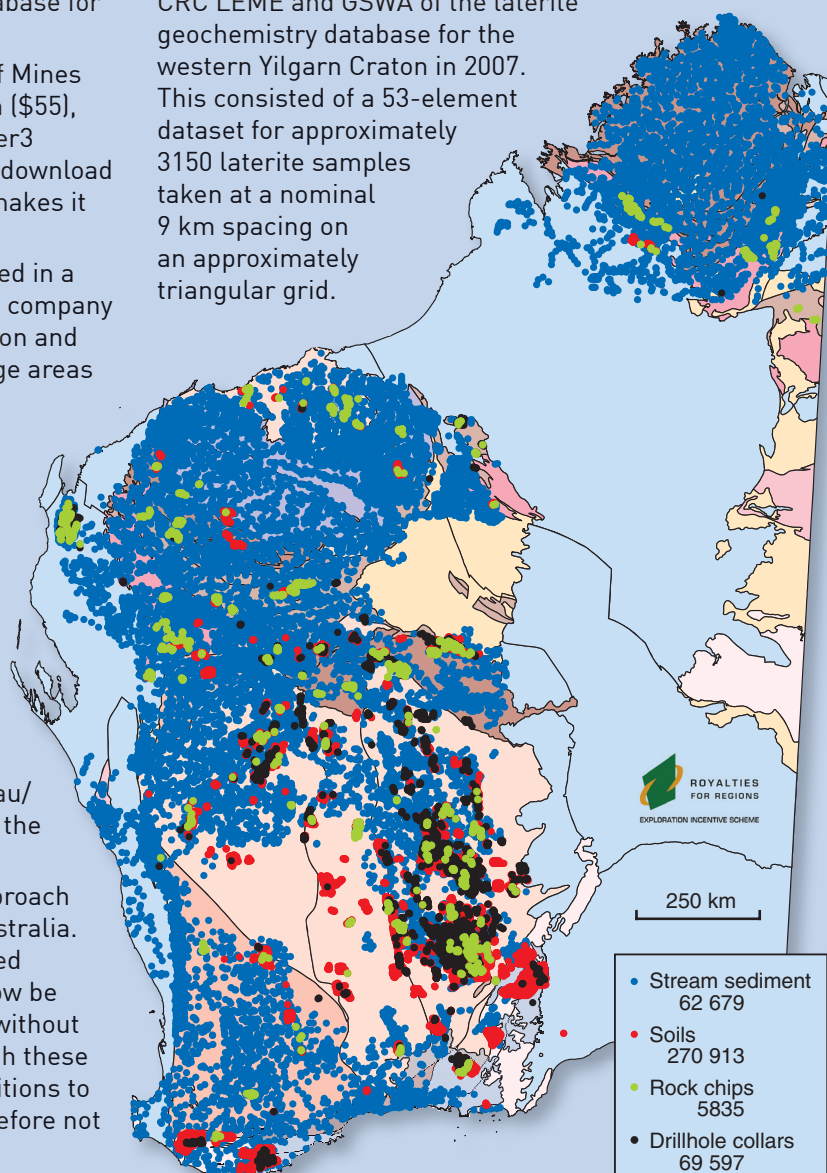
The dataset is available from the Department of Mines and Petroleum on DVD for the cost of extraction (\$55), and includes a version of Terra Search's Explorer3 software, which can be used to interrogate and download the data in a variety of formats. This low price makes it available to all explorers.

The exploration geochemistry data were captured in a standard format by Terra Search from open-file company reports, and validated in terms of sample location and data quality according to strict procedures. Large areas of the State are included in the dataset which consists of more than 1.1 million sample locations. Multi-element geochemistry from drillholes dominates the dataset, which includes capture of 69 597 drillhole collars, 596 448 drillhole assays, and 136 343 drillhole geology observations.

GSWA is currently developing a minerals drillhole database as part of the EIS initiative, into which parts of the Terra Search data will be migrated. Further developments include an expansion of GSWA's geochemistry database, GeochemExtract ([www.dmp.wa.gov.au/geochem](http://www.dmp.wa.gov.au/geochem)), to house non-GSWA data, including the Terra Search information.

Terra Search has employed its data capture approach in various States and Territories throughout Australia. The addition of the WA data component, captured in the same way, means that exploration can now be focused across State and Territory boundaries without the need for further data manipulation. Although these data are already available under open-file conditions to the public, most are in hardcopy form, and therefore not amenable to rapid evaluation and use.

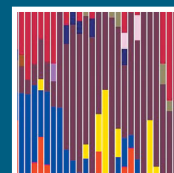
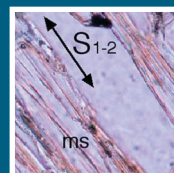
GSWA's release of the Terra Search database for WA follows the joint release by CSIRO, CRC LEME and GSWA of the laterite geochemistry database for the western Yilgarn Craton in 2007. This consisted of a 53-element dataset for approximately 3150 laterite samples taken at a nominal 9 km spacing on an approximately triangular grid.



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## Download open-file reports

An external disk drive containing more than 48 000 open-file mineral exploration reports is now available for use in both the Mineral House library, and the Kalgoorlie office of GSWA.

The disk drives will be updated on a monthly basis. Reports released within the last month will only be available online.

Clients wishing to download many reports should make a booking.

For Perth bookings, please phone Mineral House library on 9222 3330; for Kalgoorlie bookings, please phone 9022 0400.

## Bibliographic data sheet for mineral exploration reports (Mining Act Section 115A)

Since the release of the 'Guidelines for Mineral Exploration reports on Mining Tenements' in December 2006, mineral exploration reports should contain a bibliographic data sheet (see right) as one of the first pages of the report.

## Remember, when compiling exploration reports

- For surface and drilling geochemistry data, metadata headers need to be included at the top of the data file and should be completed in full, including laboratory details, and batch or job numbers.
- Aeromagnetic survey registration numbers need to be quoted in future reports.

For more information, contact Ann Fitton ([ann.fitton@dmp.wa.gov.au](mailto:ann.fitton@dmp.wa.gov.au)).

## MINERAL EXPLORATION REPORTS— required title page and bibliographic data sheet (example)

Project Name	Kryptonite
Combined Reporting Number	C1999/999
Tenement Numbers	E77/2500–E77/2509, M77/120–M77/134, P77/1234–P77/1240,
Tenement Operator	Small Time Minerals NL
Tenement Holder	Big Time Minerals Ltd
Report Type	Annual
Report Title	Annual report for the period 1 January 2005 to 31 December 2005, Kryptonite Project, E77/2500–E77/2509, M77/120–M77/134, P77/1234–P77/1240,
Report Period	1 January 2005 – 31 December 2005
Author	CH Jones
Date of report	25 January 2006
1:250 000 map sheet	Cue SG 50–15
1:100 000 map sheet	Cue 2443
Target Commodity	Au, Ni
Keywords	Geological mapping, aeromagnetic interpretation, soil and rock-chip sampling, RAB drilling
Prospects drilled	Finch, Swallow
List of Assays	As, Au, Co, Cr, Cu, Ni, Pb, Zn, Cr2O3, P2O5. (Alphabetical)
<b>ABSTRACT</b>	
Location	The Kryptonite project was 100 km south of the town of Cue in the Murchison Goldfield on the Cue 1:250 000 and 1:100 000 map sheets.
Geology	The project covered part of the Meekatharra – Mt Magnet greenstone belt. The main rock types in the area comprised banded iron-formation, basalt, komatiite, dolerite, and andesite.
Work done	Exploration in 2005 comprised geological mapping, aeromagnetic interpretation, soil (96 samples) and rock-chip (18 samples) sampling, and RAB drilling (35 holes – 650 m).
Results	The RAB drilling tested two anomalous areas, Finch and Swallow, where the best intersections were 2 m @ 1.4 g/t Au from 18 m in hole F018, and 3 m @ 1.2 g/t Au from 25 m in hole SW025.
Conclusions	The results were encouraging, and further drilling was planned.

continued from page 1

Each sample comprised about 1 kg of ferruginous nodules and pisoliths from lateritic residuum, lag formed from lateritic residuum, or of ferruginous gravel contained in locally derived colluvium. The success of regional geochemical datasets can be gauged by the effect on tenement uptake following release of this product. In the month prior to data release, tenements covering 5136 km<sup>2</sup> were pegged over the survey area. However, in the month following data release, almost three times the area of tenements were pegged, totalling 15 102 km<sup>2</sup>, representing a three-fold increase in tenement uptake following data release. The report of this work, Record 2007/9, can be downloaded from DMP's website at [www.dmp.wa.gov.au/gswapublications](http://www.dmp.wa.gov.au/gswapublications).

'These types of geochemical data have proved very popular with mineral explorers', said GSWA's EIS coordinator Margaret Ellis.

'We also receive comments from exploration companies that GSWA geochemistry has helped in prioritising exploration targets, and this is borne out by stock exchange releases which cite GSWA geochemical data as being instrumental in exploration successes,' added Margaret. 'The advantage of the Terra Search data is that it has all been captured in a rigidly controlled format, recording, where available, analytical techniques and laboratories, information about sample preparation, as well as locational data.'

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



# Pilbara and Kimberley in the spotlight

## GSWA authors showcase east Pilbara's hidden wonders



Martin Van Kranendonk and Jean Johnston from GSWA have recently published a guide to the Pilbara Region. *Discovery Trails to Early Earth* is a self-drive guide book that provides directions for five different trails all beginning from Marble Bar in the Pilbara region.

The trails each come with coordinates for easy global positioning system (GPS) navigation and uncover ancient volcanoes, the origin of the famed 'marble bar', and significant events that have shaped the Pilbara's landscape.

Throughout the travel guide, each stop on the map showcases some of the earth's ancient wonders seen in the rocks, allowing the reader to appreciate the formation of different landscapes and enjoy the ambience of this old, beautiful environment.

Martin Van Kranendonk and Jean Johnston have been working collaboratively on the publication for the last year. Van Kranendonk, who has worked in the Geoscience Mapping Branch for more than 12 years, much of it spent in the Pilbara, comments that the concept for the book started when he saw the potential for enhancing the local tourism industry by offering an insight into the wonders that are present in the rocks and landscapes of the Pilbara, around Marble Bar.

The town of Marble Bar is more commonly known for the hot weather, although he hopes to increase awareness of the internationally renowned geology and landforms present in the area.

The book attempts to tell the stories of the ancient rocks, by giving some background knowledge to the incredible lengths of time involved in formation and evolution of the planet, and the changes in landscape evolution that have shaped the places where we live. He also hopes the guide book will be useful for tourists, locals and school groups that may be visiting the area.

*Discovery Trails to Early Earth* can be purchased for \$25 including GST.

The guide is available from the DMP Information Centre by calling (08) 9222 3549, or online at [www.dmp.wa.gov.au/ebookshop](http://www.dmp.wa.gov.au/ebookshop).

## Reef complexes get centre stage

A publication featuring more than 50 years of research on one of the world's best preserved ancient barrier reef systems was launched recently at a DMP function attended by Minister Moore.

*Devonian reef complexes of the Canning Basin, Western Australia* provides an insight into a spectacular belt of rugged limestone ranges that extend for 350 kilometres along the northern edge of the State's Canning Basin, from near Derby to the east of Fitzroy Crossing. The publication was written by two GSWA geologists — principal author Phil Playford, and first co-author Roger Hocking — and ex-GSWA geologist Tony Cockbain.

At the launch DMP Director General, Richard Sellers, said the valuable publication captured some of Western Australia's most remarkable geology.

'These magnificently exposed reef complexes have yielded some significant economic discoveries, hosting five zinc-lead mines and one producing oilfield,' Mr Sellers said.

'They are now known as the Devonian Great Barrier Reef, and are also regarded as a model for similar reefs that host prolific oilfields elsewhere in the world.'

The book's authors collaborated in the mapping and associated research on the Devonian reef complexes. 'Principal author Phil Playford, has been studying the geology of these Devonian reef complexes periodically for more than half a century,' Mr Sellers said.

'The work of these authors and the rest of GSWA not only provides us with indepth knowledge on our State's geology, but encourages exploration investment by the world's mining and petroleum industries.'

The book can be purchased for \$77 including GST from the Department of Mines and Petroleum's Information Centre by calling (08) 9222 3549, or online by visiting [www.dmp.wa.gov.au/ebookshop](http://www.dmp.wa.gov.au/ebookshop).



Phil Playford signs book copies at the launch.



# New technology aids spectral scanning of drillcore

*GSWA is a participant in the National Collaborative Research Infrastructure Strategy (NCRIS) 'Structure and Evolution of the Australian Continent' project known as AuScope, and, in particular, the National Virtual Core Library (NVCL) component of this project (<http://www.auscope.org.au>). The NVCL project will deliver high-resolution pictures and mineral composition information for drillcore throughout Australia, thereby providing important information on the upper two kilometres of the Australian continent. The information will be generated using a new and innovative spectral scanning system developed by CSIRO, known as HyLogger. As the NVCL is web based, core images and information will be accessible worldwide.*

A common goal of the NVCL project is to improve the objectivity of drillcore logging, and increase the amount and quality (and thus the value) of information obtained from drilling. HyLogging is a new, highly automated method designed by CSIRO to determine core and chip mineralogy using rapid reflectance spectroscopy. The resulting data, coupled with simultaneous acquisition of high-resolution digital photographs of scanned core, can provide new insights into alteration mineral assemblages, vectors to mineralization, objective determination of lithostratigraphic units and their boundaries, and refined inputs to resource block modelling and mineral processing characteristics.

The resulting databases provide a valuable resource for the study of historic mining operations, and classic mineral deposit styles.

## Sample preparation

Little sample preparation is required, apart from ensuring that the core is dry, and any dust or mud is removed.

## How does it work?

The HyLogger consists of six components (see figure this page). Two spectrometers covering the electromagnetic spectrum from visible-near-infrared (VNIR) wavelengths (380–1000 nm) to shortwave-infrared (SWIR) wavelengths (1000–2500 nm) are used to scan the core and determine its mineralogy. Scanning is carried out using a computer controlled table which continuously moves the core in a zigzag path beneath the scanners at a rate of one metre every 30 seconds. At the same time, the core is photographed using a high-resolution digital linescan camera, with a resolution of 0.1 mm. A laser profilometer, that measures the

core height every 0.5 mm, is used to detect core breaks and fractures.

The HyLogger hyperspectrally samples the core every 8 mm and digitally images it. It can scan 300–500 m of core per day. Quality assurance is conducted by calibration of the reflected signal using a Teflon transfer standard at the beginning of each tray section. The Teflon standard is periodically calibrated to an absolute Spectralon plate of known reflectivity. In addition, a standard mineral set of ten pure minerals is analysed daily.



*The HyLogger 2-2 components:*

- |                           |                       |
|---------------------------|-----------------------|
| 1. control computer       | 4. laser profilometer |
| 2. linescan camera        | 5. calibration plate  |
| 3. spectrometer telescope | 6. robotic table      |

## Current target minerals

The spectrometers collect a reflectance spectrum between 380 and 2500 nm, which is suitable for the recognition of approximately 50 minerals. These consist of:

### Fe Oxide group

- hematite, goethite

### Al(OH) group

- paragonite, muscovite, phengite, illite, pyrophyllite, kaolinite, dickite, smectite varieties (montmorillonite, nontronite, saponite), gibbsite

### Mg(OH) group

- chlorites (Mg/Fe), biotite, phlogopite, actinolite, talc, tremolite, hornblende, brucite

### Carbonate group

- calcite, dolomite, magnesite, ankerite, siderite

## Sulfates

- alunite, jarosite, gypsum

## Selected OH-bearing silicates

- epidote, prehnite, tourmaline, topaz

## Si(OH) group

- opaline silica

## Ammonium-bearing minerals

- NH-alunite, buddingtonite

In mid-2010, the addition of a thermal infrared spectrometer (TIR: wavelengths from 7000 to 14000 nm) will increase the range of target minerals to include the feldspar, pyroxene, olivine, and garnet mineral groups, plus quartz.

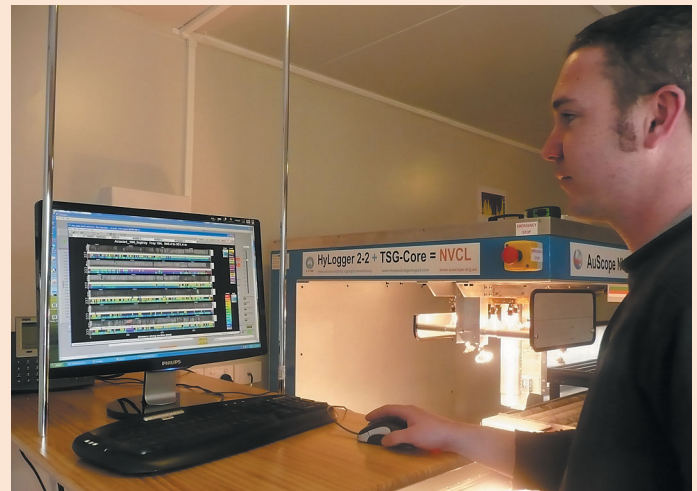
## Data processing

HyLogger data is reduced using a specialized version of the software package

'The Spectral Geologist' (TSG-Core:

<<http://www.thespectralgeologist.com>>).

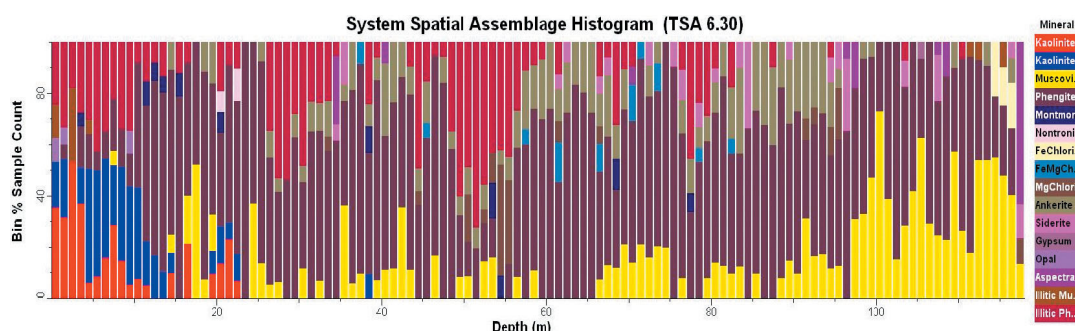
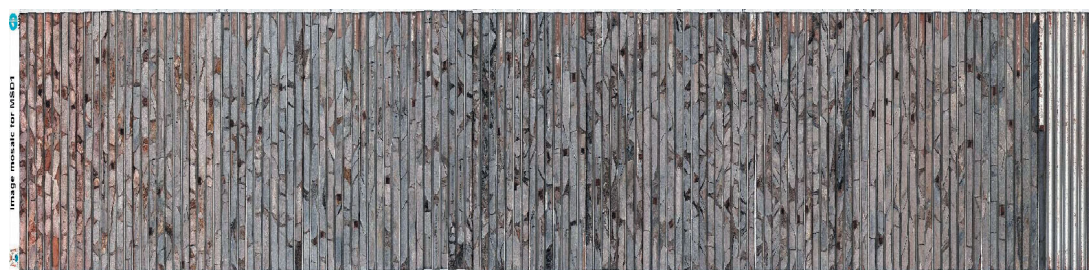
Data are pre-processed immediately after scanning, which also involves QA/QC of spectra and imagery. Importing all data into the TSG-Core package allows simultaneous viewing of the high-resolution core imagery, tray images, whole-of-hole mosaics, reflectance spectra, a possible mineralogical interpretation, a variety of spectral indices, and imported attributes, such as lithological codes and assays.



## GSWA HyLogger

In 2004–05 GSWA used the first generation of HyLogger for nine weeks at the Joe Lord Core Library in Kalgoorlie, during which more than 33 000 metres of core was scanned. In July 2009, the second generation HyLogger (2-2) was installed at the Carlisle Core Library. The HyLogger is located in a custom-built container which ensures a dust-free and temperature-controlled workspace. A shelter provides protection from the weather for core about to be scanned.

For more information, contact Lena Hancock (lena.hancock@dmp.wa.gov.au).



Example of TSG results: high-resolution image of core trays and minerals distribution with depth.



## Phosphate geochronology to assist exploration

The Curtin University of Technology (Curtin), GSWA, and The University of Western Australia (UWA) were recently awarded an Australian Research Council (ARC) Linkage Grant to develop a new tectonothermal and mineralization history for the Gascoyne Province and Bangemall Supergroup. The project will be lead by Prof. Birger Rasmussen at Curtin, and will integrate his team's state-of-the-art SHRIMP phosphate geochronology with GSWA's on-the-ground experience in the Capricorn Orogen.

Although the magmatic and high-temperature metamorphic history of the Gascoyne Province is reasonably well defined, little is known about the very low- to moderate-temperature events in this province or the Bangemall Supergroup. These events include deposition and early diagenesis, regional metamorphism, and hydrothermal fluid flow and mineralization.

Dating these processes is crucial in establishing the reliable geochronological framework essential for successful exploration targeting. The absence of such a framework in many greenfields terrains significantly increases the risk to exploration companies owing to the greater inherent uncertainty in targeting.

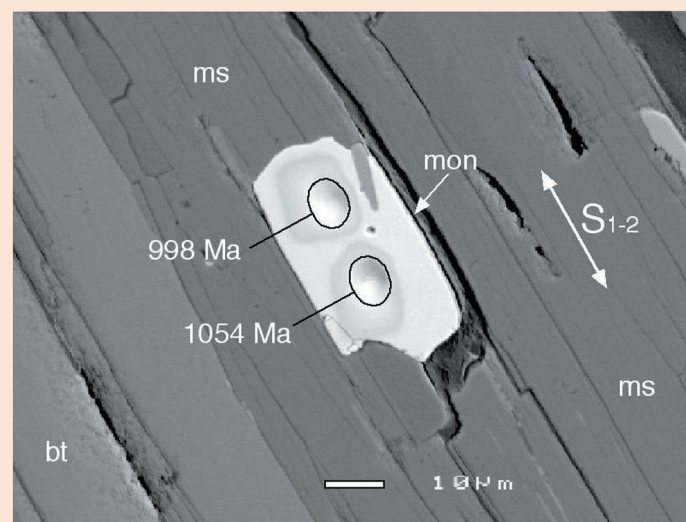
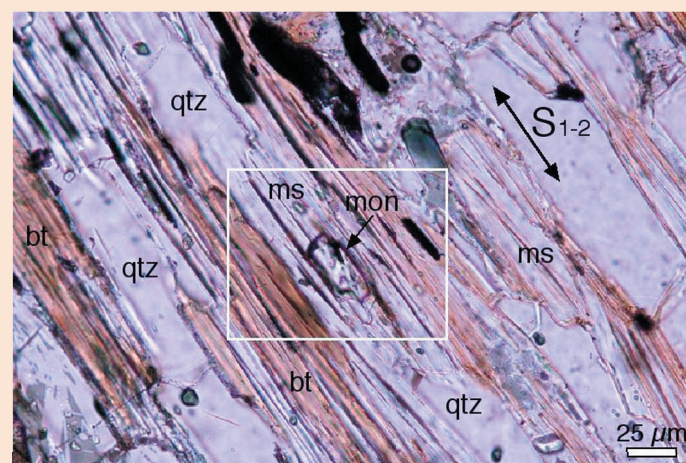
Low- to moderate-temperature events cannot be studied using standard SHRIMP U–Th–Pb zircon geochronology, and require the use of monazite and xenotime. Both these minerals are versatile and powerful U–Th–Pb chronometers that can record precise ages for a variety of low-temperature (<100°C to 550°C) geological processes. Monazite and xenotime do not readily undergo diffusive Pb loss during reheating, but may undergo dissolution and reprecipitation with the ability to record multiple events in a single crystal.

This project will apply advanced and innovative geochronology on a range of minerals, combined with regional- and deposit-scale field mapping, to formulate a new and improved stratigraphic and tectonic framework for a prospective greenfields region. Outcomes from this project will lead to more effective exploration targeting.

Research will address several outstanding problems in our understanding of the geological and mineralization history of the Capricorn Orogen:

- the age of the Bangemall Supergroup and its correlations with other basins
- the tectonothermal history of the Gascoyne Province and the Bangemall Supergroup
- the timing of crustal fluid flow, and base metal and other mineralization events
- the tectonic settings and geological controls on mineralization.

For more information, contact Steve Sheppard ([steve.sheppard@dmp.wa.gov.au](mailto:steve.sheppard@dmp.wa.gov.au)) or Prof. Birger Rasmussen ([B.Rasmussen@curtin.edu.au](mailto:B.Rasmussen@curtin.edu.au)).



Transmitted light image (top) of blocky monazite (mon) crystal aligned parallel to  $S_{1-2}$  in pelitic schist, and back-scattered electron (BSE) image (bottom) of inset showing the same monazite with two oval SHRIMP analytical pits and their corresponding  $^{207}\text{Pb}/^{206}\text{Pb}$  ages.



# Geophysics surveys

## Regional geophysics surveys funded by the Exploration Incentive Scheme

August 2009

### Data access

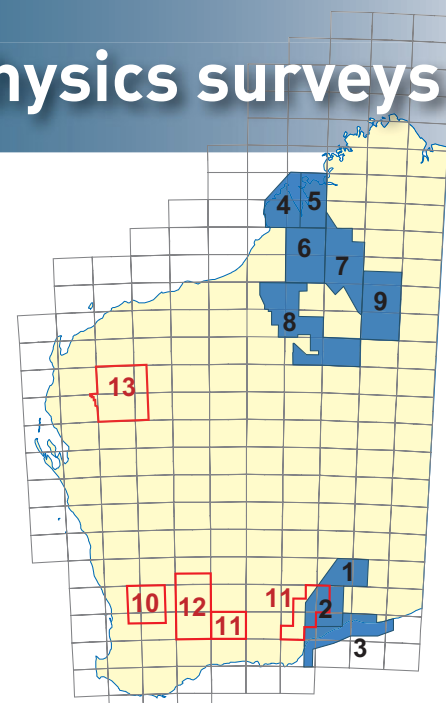
Final data releases can be downloaded from the Geoscience Australia Data Delivery System at <<http://www.ga.gov.au/gadds>>.

Preliminary and final grids and images can be downloaded from the GSWA website at <<http://www.dmp.wa.gov.au/geophysics>>.

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](mailto:david.howard@dmp.wa.gov.au)).

In progress



### Airborne magnetic and radiometric surveys

ID	Area/Name	Lines	Size (km)	Status	Start	End	Release
1	Seemore 2009	200 m; E/W	88 000	Processing	Jun-09	Sep-09	Nov-09*
2	Naretha 2009	200 m; E/W	123 000	Survey	Jun-09	Nov-09*	Feb-10*
3	Eucla Coast 2009	200-400 m; N/S	108 000	Survey	Sep-09*	Jan-10*	Mar-10*
4	Broome 2009	400 m; N/S	76 000	Processing	Jul-09	Sep-09	Dec-09*
5	Yampi-Derby 2009	400 m; N/S	67 000	Processing	Jun-09	Sep-09	Dec-09*
6	Mt Anderson - McLarty Hills 2009	400 m; N/S	98 000	Survey	Jul-09	Oct-09*	Jan-10*
7	Crossland-Noonkanbah 2009	400 m; N/S	117 000	Survey	Aug-09	Dec-09*	Feb-10*
8	Central Canning 2009	800 m; N/S	92 000	Processing	Jun-09	Aug-09	Nov-09*
9	Cornish-Helena 2009	400 m; N/S	121 000	Survey	Jun-09	Nov-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	Released	Jan-09	Apr-09	3 Sep-09
11	South Yilgarn Margin (two parts)	2.5 km grid	6 500	Survey	Jul-09	Oct-09*	Dec-09*
12	Southern Cross	2.5 km grid	7 000	Tender	Jan-10*	Apr-10*	Jun-10*
13	Gascoyne North 2010	2.5 km grid	7 400	Planning	Apr-10*	Jul-10*	Sep-10*

Information current at: 28 August 2009

\* Estimated date

## Goodbye to Gary Williams after 40 years of service



It was 1969. Man first walked on the moon. The number one record was Crimson and Clover; best picture was Midnight Cowboy. And Gary Williams started working at GSWA. This labour of love saw Gary take on various roles over the years from laboratory technician, collector of drill

core and rock samples, fundraiser, field assistant, bush mechanic, bush architect, OSH officer, expert witness, and finally, builder and manager of GSWA's Field Logistics and Core Library Services at both Kalgoorlie and Carlisle. Gary's vision for the design of a world-class core library in Western Australia was attained after the Government provided funding for the construction of the Perth and Kalgoorlie core libraries. The Perth core library is acknowledged as the second best core library in the world after Calgary, Canada.

In the early 1950s, petroleum core was stored in Dianella but OSH issues necessitated moving to

another location. However, it was only in the mid-1990s, after many requests for the substantial funding required, Cabinet (in the late 1990s) approved construction of two core libraries to service the mineral and energy sectors.

Kalgoorlie was an obvious choice for a location as it is the service point for many exploration and mining operations. Eventually the Kalgoorlie and Perth (at Carlisle) libraries were built, with Carlisle three times the size of Kalgoorlie. Gary loved overseeing the construction and functional design of the facilities, and has consequently become a leading consultant in the development, construction, and efficient operation of core libraries.

After working with six GSWA Directors (Joe Lord, Alec Trendall, Phil Playford, Pietro Guj, David Blight and Tim Griffin), Gary may be saying goodbye to GSWA but he is far from retirement, as he takes on a consultancy role with the Malaysian company, Petronas, to set up a world-class core library in Kuala Lumpur.

We wish him well.

# Product releases

All prices include 10% GST

## RECORDS

**2009/12 A kinematic, metamorphic, geochemical, and geochronological framework for intracratonic reworking in the western Musgrave Block, central Australia**

by T Raimondo

**2009/13 Age constraints and deformation history of the Shag Hill mylonites, western Musgraves**

by M Belperio

**2009/14 Complex strain in mylonites from the western Musgraves, North of the Mann Fault, Western Australia**

by A Walker-Hallam

**2009/15 Using calculated pseudosections in the system NCKFMASHTO and SHRIMP II U-Pb zircon dating to constrain the metamorphic evolution of paragneisses in the Latitude Hills, West Musgrave Province, Western Australia**

by RJ King

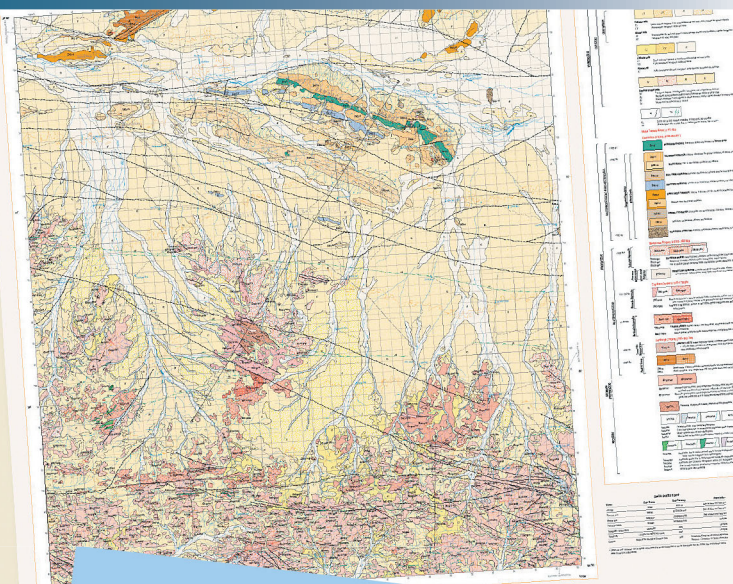
## DATA PACKAGE

**Western Australian petroleum acreage release**

September 2009

**Geothermal Acreage Release (Northern)**

September 2009



### DEVONIAN REEF COMPLEXES OF THE CANNING BASIN, WESTERN AUSTRALIA

Geological Survey of Western Australia  
Bulletin 145

Phillip E Playford, Roger M Hocking, and Anthony E Cockbain

### DISCOVERY TRAILS TO EARLY EARTH a traveller's guide to the east Pilbara of Western Australia

MARTIN VAN KRANENDONK  
and JEAN JOHNSTON

Hardcopies  
now  
available!

These two long-awaited premium publications on the Pilbara and the Kimberley can now be purchased.

*Please see page 3 for purchasing details.*

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. Almost all printed publications are now also available free as PDF files on our website at <http://www.dmp.wa.gov.au/GSWApublications>. Further details of geological publications and maps produced by the Geological Survey of Western Australia can be obtained at <http://www.dmp.wa.gov.au/GSWA>.

Hardcopy 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 <http://www.dmp.wa.gov.au/ebookshop>.