

# Fieldnotes



Government of Western Australia  
Department of Mines and Petroleum

Geological Survey of  
Western Australia



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ISSN 1325-9377  
ISSN 1834-2272

ISBN (PRINT) 978-1-74168-660-9  
ISBN (PDF) 978-1-74168-659-3

## Round 12 Co-funded Exploration Drilling results



The government continues to support the quest for new resource discoveries across Western Australia through the latest round of the Exploration Incentive Scheme (EIS) Co-funded Exploration Drilling program.

The Minister for Mines and Petroleum, Bill Marmion, announced that 48 applicants were offered \$5.17 million in Round 12 of the Co-funded Exploration Drilling program for projects to be drilled in 2016. Mr Marmion said the scheme was helping to underwrite Western Australia's continued prosperity.

'This is an important investment in the State's future, particularly in the challenging financial environment faced by exploration companies. Heading into its eighth year, this highly competitive drilling program has resulted in major discoveries, with more being made every year,' Mr Marmion said.

The successful projects are chosen via a transparent process which is subject to ongoing probity audits and ratified by a committee representing all the peak resource industry bodies in Western Australia.

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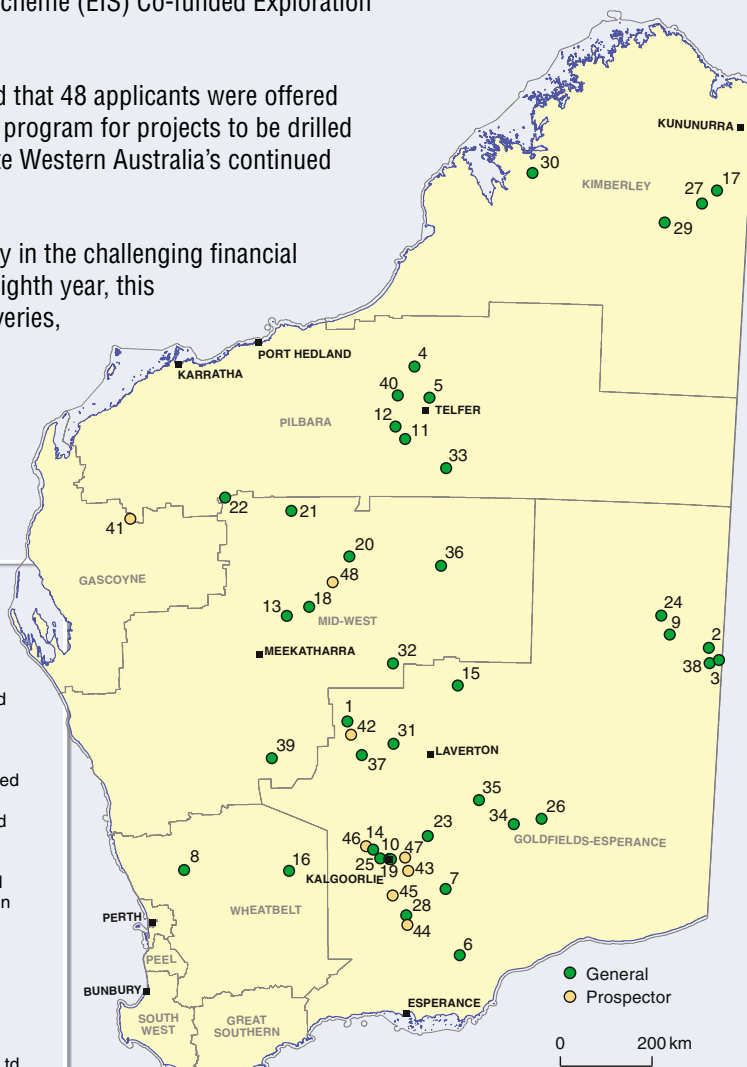


Figure 1. Location of projects

### General

- 1 Agnew Gold Mining Company
- 2 Anglo American - Traka Resources JV
- 3 Anglo American Exploration (Australia)
- 4 Antipa Minerals
- 5 Antipa Minerals
- 6 AusQuest Limited
- 7 Black Raven Mining
- 8 Caravel Minerals Limited
- 9 Cassini Resources Limited
- 10 David Reed
- 11 Encounter Resources
- 12 Encounter Resources
- 13 Enterprise Metals Limited
- 14 Evolution Mining
- 15 Goldphyre Resources Limited
- 16 Hanking Gold Mining Pty Ltd
- 17 IronRinger (Killarney) Pty Ltd
- 18 Kalamazoo Resources Pty Ltd
- 19 Kalgoorlie Consolidated Gold Mines
- 20 Kalium Lakes Potash Pty Ltd
- 21 Marindi Metals Pty Ltd
- 22 MRG Metals Ltd
- 23 Nexus Minerals
- 24 NiCul Minerals Limited
- 25 Northern Star Resources
- 26 Orion Gold NL

- 27 Panoramic Resources
- 28 Polar Metals Pty Ltd
- 29 Prenti Exploration Pty Ltd
- 30 Ram Resources Ltd
- 31 Redcliffe Resources Ltd
- 32 Rox Resources Limited
- 33 Rumble Resources Limited
- 34 Segue Resources Ltd
- 35 St George Mining Limited
- 36 Stirling Minerals Pty Ltd
- 37 Talisman Mining Ltd
- 38 Traka Resources Limited
- 39 Venus Metals Corporation Limited
- 40 Warriedar Pty Ltd

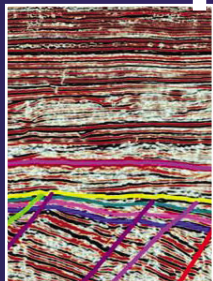
### Prospectors

- 41 Anthony Stehn
- 42 Brutus Constructions Pty Ltd
- 43 Christopher Potts
- 44 David Pascoe
- 45 Ladislav Stanko
- 46 Peter Kerley
- 47 Steven Kean
- 48 Vanguard Exploration Ltd

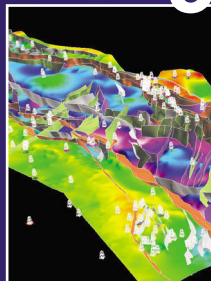
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## ENS digital repository hosts all stratigraphic units

The Explanatory Notes System (ENS) is a digital repository that integrates stratigraphic relationships with links to all tectonic units and events recognized in Western Australia. It replaces the previously published Explanatory Notes manuscripts that accompanied individual 1:100 000 and 1:250 000 series geological maps. The system allows incremental updates for new data and refined interpretations, providing a seamless, up-to-date summary of the geology of Western Australia. It is a virtual Explanatory Notes for Western Australian geology. The best way to learn its capabilities is to have a play with ENS in GeoVIEW.WA – point-and-shoot or via icons and text searches.

Reports are available in two formats (green boxes in figure):

- *Unit* — for a single unit; colour-coding indicates whether the description of the unit is complete (green tick) or only basic information is available (red tick)
- *Overview* — provides a stratigraphically sorted list of the selected unit/event and all its associated child units. Overview reports are available as a table of contents or as fully expanded reports.

Related units and events are hyperlinked, and further reports are generated on the fly. Hyperlinks to Geological Survey of Western Australia publications are also provided. Explanatory Notes reports can be exported as PDF, or Microsoft Word and Excel documents.

ENS incorporates business rules that facilitate the sorting of rock units in a chronostratigraphic sequence. Spatial interrogation returns a list of rock units stratigraphically sorted (i.e. youngest at the top and oldest at the bottom) **within individual tectonic units**. Tectonic units themselves are ordered relative to each other in a single framework for the State — thereby providing the digital

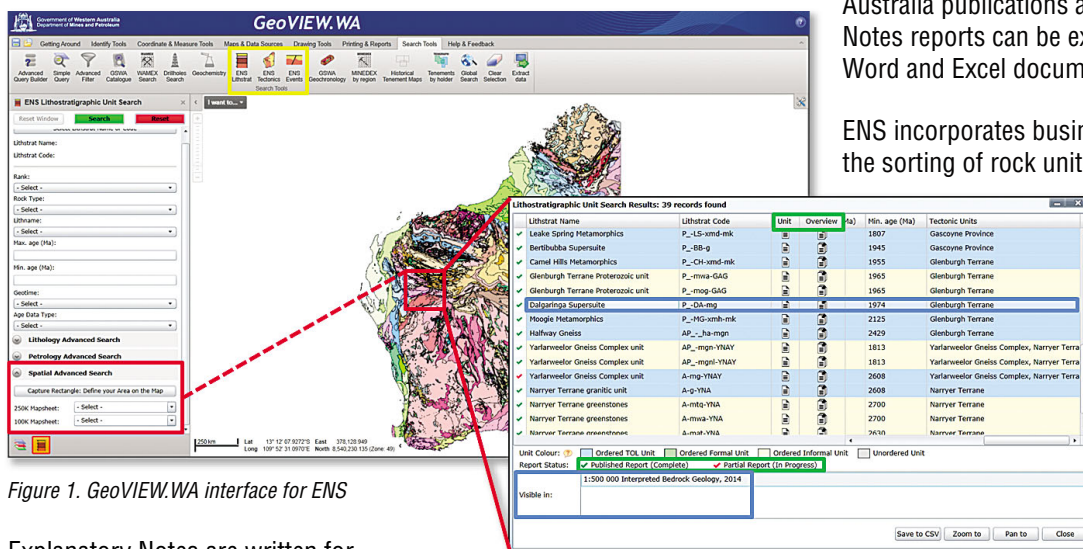


Figure 1. GeoVIEW.WA interface for ENS

Explanatory Notes are written for Lithostratigraphic units (both named and un-named), Tectonic units and Events, and are delivered via GeoVIEW.WA by a set of *ENS search tools* (yellow highlighted box in figure). Spatial and textual query interfaces allow customers to produce geoscience reports by selecting a unit, a generalized parameter (e.g. age, rank), or an area of interest (by map name or rectangle; red boxes in figure). If a selected unit is represented in GeoVIEW.WA, the layer/s in which it is visible is/are highlighted in a dedicated window (blue boxes in figure).

equivalent of the 'geological' column of a map legend.

The Explanatory Notes information provided in GeoVIEW.WA is updated weekly. Access GeoVIEW.WA on the Department of Mines and Petroleum website at [www.dmp.wa.gov.au/geoview](http://www.dmp.wa.gov.au/geoview).

For more information, contact Angela Riganti ([angela.riganti@dmp.wa.gov.au](mailto:angela.riganti@dmp.wa.gov.au)).

continued from page 1 and onto page 3

Significant success stories have included the Nova and Camelwood nickel deposits, the Yeneena copper deposits, Millenium zinc and the Dusk Til Dawn gold discovery. The Nova discovery, which was supported by co-funding in 2011–12, is currently in mine development stage with production due to commence in 2016.

The Economic Impact Study released earlier this year shows that the EIS generates \$10.3 million of exploration activity for every \$1 million spent by the EIS, with the long-run expected total benefit to the State in terms of higher Gross State Product being \$23.7 million.

The Co-funded Drilling Program refunds up to 50% of direct drilling costs with caps of \$150 000 for a multi-hole project, \$200 000 for a single deep hole, and \$30 000 for a prospector's project. Payments are made to successful

applicants after completion of drilling and submission of reports which are released publicly via the department's WAMEX database after a six-month confidentiality period.

Round 12 of the EIS attracted 77 applications requesting \$8.60 million in co-funding.

The minister said the Liberal National Government had committed a further \$10 million a year to the EIS until the end of June 2017.

See [www.dmp.wa.gov.au/eisdrilling](http://www.dmp.wa.gov.au/eisdrilling) for any updates on the project.

For more information, contact Margaret Ellis ([margaret.ellis@dmp.wa.gov.au](mailto:margaret.ellis@dmp.wa.gov.au)).

## Co-funded Exploration Drilling R12, 2016



	<i>Applicant name</i>	<i>Drilling project title</i>	<i>Target commodities</i>
1	Agnew Gold Mining Company	Agnew Stratigraphic	Au
2	Anglo American – Traka Resources JV	Musgraves Havarti Manyas La Serena project	Ni, Cu, Pt, Au
3	Anglo American Exploration (Aus)	West Musgraves Pepperjack and Rokpol project	Ni, Cu, Pt, Au,
4	Antipa Minerals	Rimfire	Au,Cu, Ag, W
5	Antipa Minerals	North Telfer – Minyari Prospect	Au-Cu-W
6	AusQuest Ltd	Balladonia Nickel-Copper	Ni- Cu
7	Black Raven Mining	BRM – SW Target	Cu, Zn
8	Caravel Minerals Ltd	Wongan Hills	Cu, Au
9	Cassini Resources Ltd	Babylon Prospect – West Musgrave Project	Ni-Cu-PGE
10	David Reed	Kalgoorlie Project	Au
11	Encounter Resources	BM7 and BM7 East Prospects	Cu, Co
12	Encounter Resources	Aria Prospect	Cu, Au
13	Enterprise Metals Ltd	Bono GEM Anomaly	Au, Cu, Zn, Pb, Ag
14	Evolution Mining	Broads Dam Stratigraphic Investigation Drill Hole	Au
15	Goldphyre Resources Ltd	Lake Wells Potash Deep Drilling	Potash, gold, base metals
16	Hanking Gold Mining Pty Ltd	Copperhead Magnetic Targets	Au
17	IronRinger (Killarney) Pty Ltd	Killarney 3	Cu, Au, Graphite
18	Kalamazoo Resources Pty Ltd	Cork Tree Copper Project	Cu
19	Kalgoorlie Consolidated Gold Mines	Central Corridor	Au
20	Kalium Lakes Potash Pty Ltd	Lake Sunshine Test Bores	K, Mg
21	Marindi Metals Pty Ltd	Prairie Downs	Cu, Pb, Zn, Ag, Au
22	MRG Metals Ltd	Xanadu – Pertinax Deep Hole	Au
23	Nexus Minerals	Pinnacles Project	Au
24	NiCul Minerals Ltd	Jameson PGE Drilling, Spinifex Range Project, West Musgrave Province	Pt, Pd, Au, Cu
25	Northern Star Resources – Kal Ops	Star Trek Seismic Reflector	Au
26	Orion Gold NL	Plumridge East Gravity Targets	Ni, Cu, PGE
27	Panoramic Resources	Deep Diamond Drilling and Dhem, Dave Hill Eastern Kimberley	Ni, Cu, Co, PGEs
28	Polar Metals Pty Ltd	Polar Bear Project, Nanook Gold Prospect	Au
29	Prenti Exploration Pty Ltd	Mad Gap Yards	Diamond
30	Ram Resources Ltd	West Kimberley Nickel	Ni, Cu, Co, PGE
31	Redcliffe Resources Ltd	Nambi Deep Drilling Programme	Au
32	Rox Resources Ltd	Fisher East, Musket	Ni
33	Rumble Resources Ltd	Beadell Project Kaos and 99 IP and EM Prospects	Cu, Zn, Pb, Ag
34	Segue Resources Ltd	Salt Creek Complex Characterization and Prospectivity	Ni, Cu, PGE, Cr
35	St George Mining Ltd	Ascalon gold target	Au
36	Stirling Minerals Pty Ltd	Oldham Range Project	Ni, Cu, Zn
37	Talisman Mining Ltd	Sinclair Nickel Project – Schmitz Well South	Ni,
38	Traka Resources Ltd	South Hill Area (Block 12 Spectrem survey area)	Cu, Ni, PGE
39	Venus Metals Corp Ltd	Inky South EM Copper Targets	Cu, Zn & Precious Metals
40	Warriedar Pty Ltd	Duke Halloysite Project	Halloysite
41	Anthony Stehn	Two Peaks Drilling Proposal	Au Ag Pb Cu
42	Brutus Constructions Pty Ltd	Bottle Well Nickel Prospect	Ni
43	Christopher Potts	Lurgan Project	Au
44	David Pascoe	Waverley	Au
45	Ladislav Stanko	Stanko's Reward	Au, Ni
46	Peter Kerley	Never Can Tell	Au
47	Steven Kean	Turnpike	Au
48	Vanguard Exploration Ltd	Fairbairn Copper Project	Cu, Au

Figure 2. List of successful applicants



## GSWA in the Browse Basin

The gas discovery well for the Torosa field in the Browse Basin, Scott Reef 1, intersected a thick sequence of gas-bearing reservoirs within the Lower–Middle Jurassic sandstones of the Plover Formation. Eight appraisal wells were drilled to further delineate the extent of the field, leading to an estimation of P50 reserves at 11.5 TCF gas and 121 MMbbls condensate.

A satellite sweep of Australia's territorial seas in May 2014 detected a number of small rocks exposed on the Scott Reef due to Cyclone Fay's strike in 2004. The rocks prompted the redrawing of maritime boundaries between Western Australia and Commonwealth Waters and a re-assessment of reservoirs in this area.

An independent seismic interpretation of four reservoir horizons and the fault network by the Geological Survey of Western Australia's (GSWA) Basins and Energy section allowed the reservoir distribution to be evaluated by the Petroleum Division. The Department of Mines and Petroleum's independent evaluation proved to be similar to that of the company responsible for the tenements, therefore assuring a high level of agreement in the allocation of petroleum between the Commonwealth (34.6%) and the State of Western Australia (65.4%).

For more information, contact  
Alex Zhan (alex.zhan@dmp.wa.gov.au) or  
Charmaine Thomas (charmaine.thomas@dmp.wa.gov.au).

## GSWA database training — dates for 2016

Find out how to access data online and understand our systems including:

- WAMEX
- GeoVIEW.WA
- GeoMap.WA
- Data and Software Centre
- Mineral drillholes and geochemistry databases
- Department of Mines and Petroleum new and improved website

### PERTH

Mineral House, 100 Plain Street, East Perth

**Thursday 3 March**

**Thursday 9 June**

**Thursday 27 October**

### KALGOORLIE

Central campus of the Goldfields Institute of Technology,  
34 Cheetham Street, Kalgoorlie

**Thursday 10 March**

**Thursday 16 June**

**Thursday 3 November**

**Sign up now for FREE training!**

See the Department of Mines and Petroleum website for more details and to register at <[www.dmp.wa.gov.au/training](http://www.dmp.wa.gov.au/training)>.

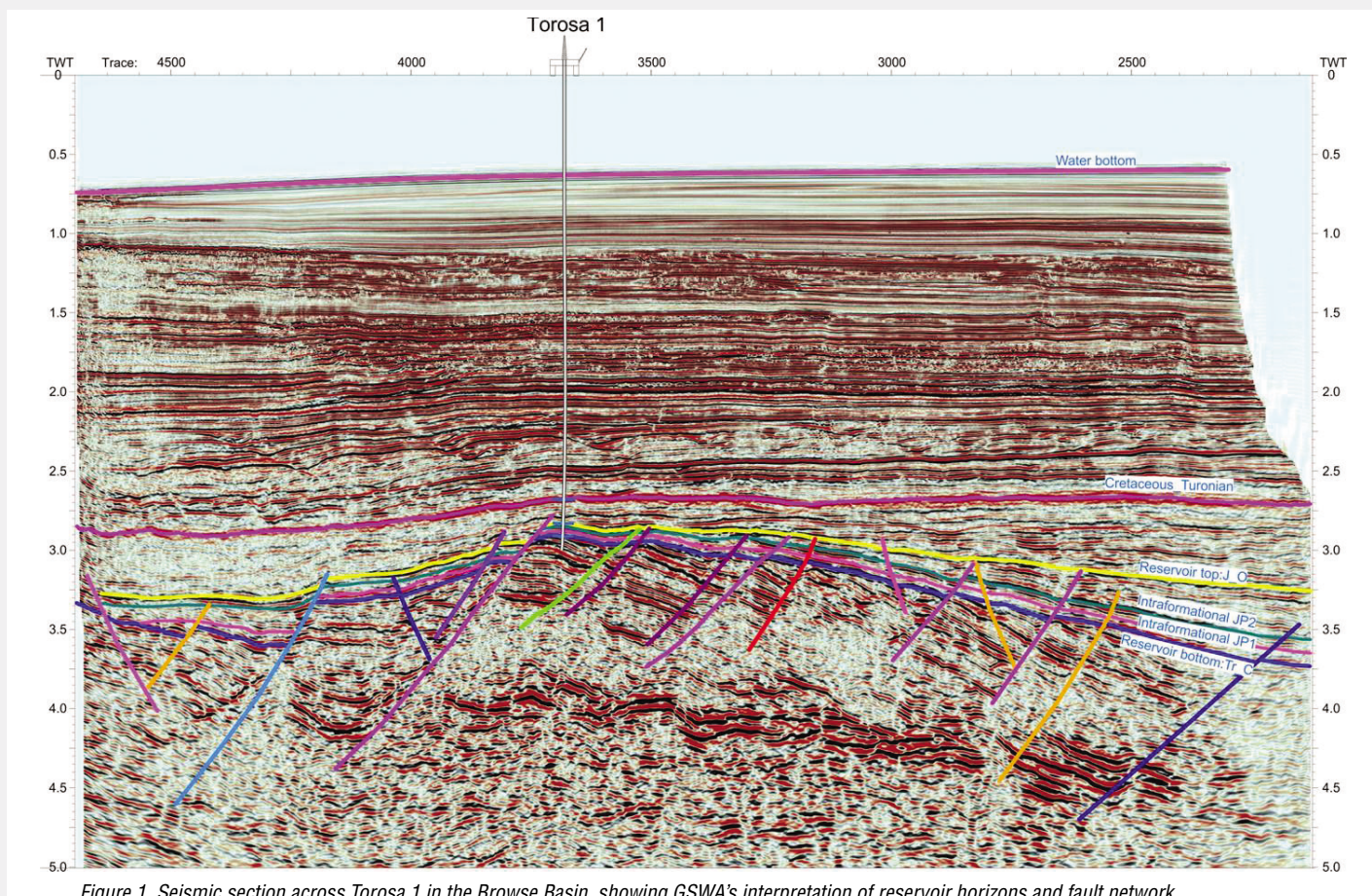


Figure 1. Seismic section across Torosa 1 in the Browse Basin, showing GSWA's interpretation of reservoir horizons and fault network



## Gravity and magnetic study of the western Amadeus Basin

Recently released Geological Survey of Western Australia (GSWA) Report 154 by C Foss and others, provides a geophysical study of the western Amadeus Basin using all available gravity and magnetic datasets. It was carried out by CSIRO as part of the broader scale COBRA (Central Oz Basins Resources Assessment) project; a collaboration between CSIRO, Government Geological Surveys, and industry partners. This component of the project was funded by the Exploration Incentive Scheme (EIS).

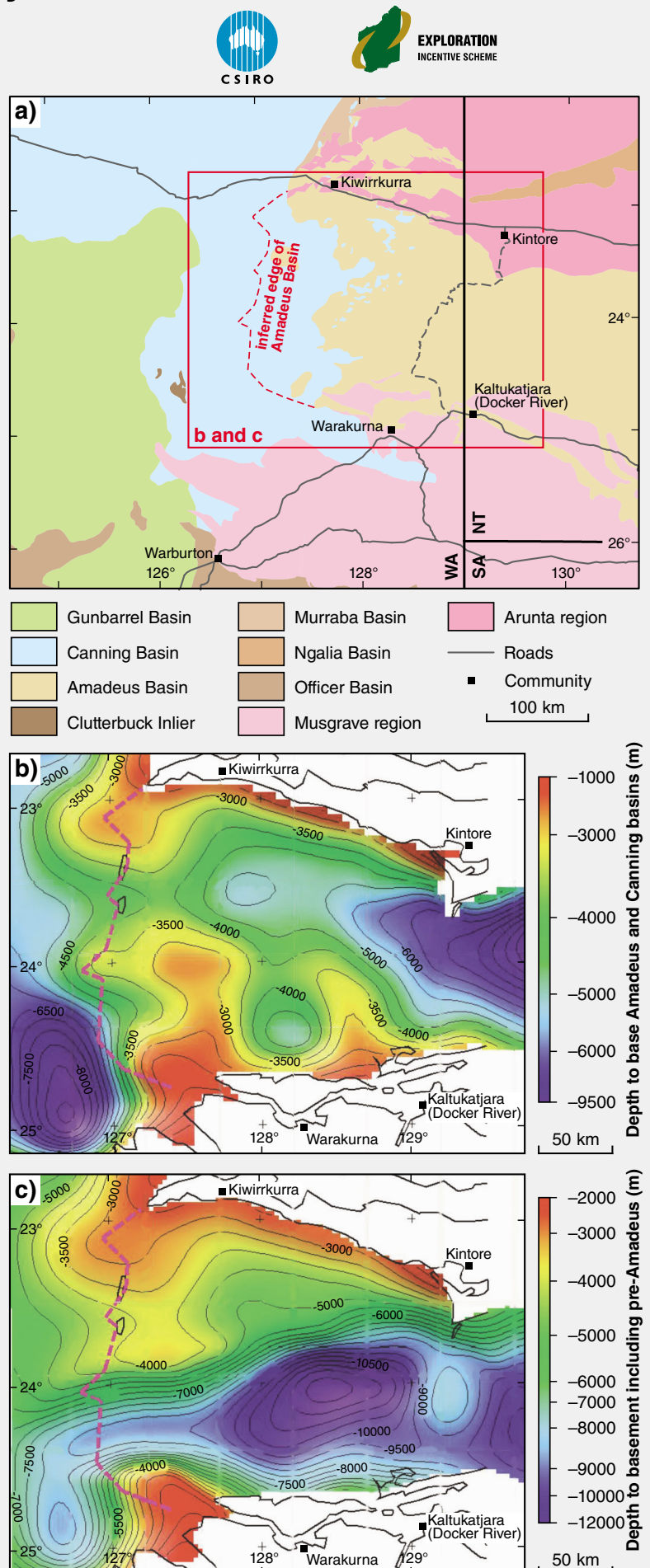
The western Amadeus Basin, situated between the Arunta (north) and Musgrave (south) basement regions, and overlapped by the Canning Basin from the west (Fig. 1a), is a barely explored frontier area for petroleum and mineral resources. The basin as a whole is of early Neoproterozoic to late Paleozoic age, and contains oil and gas fields with Ordovician and late Neoproterozoic reservoirs in the Northern Territory. The Western Australian end of the basin, predominantly of Neoproterozoic age, is poorly exposed and currently lacks seismic data or deep drilling, so an understanding of basin thickness and large-scale structure must be derived mainly from modelling of potential field data.

The magnetic field data clearly delineates the structural basin margin, even when concealed beneath overlapping Canning Basin strata. Sparse magnetic field anomalies allow estimates of depth-to-magnetic basement, which are often in excess of 10 km. Because such depths are considered improbable from known Amadeus Basin stratigraphy alone, they are inferred to locally include a magnetically transparent pre-Amadeus sedimentary or metasedimentary package. The basin model is derived primarily from gravity data. The thickest Amadeus section is modelled to exceed 8 km in the far east of the study area (Fig. 1b). Sedimentary strata thin towards the west with less than 3 km (mainly Canning Basin) overlying a broad north-south basement ridge considered to define the western edge of the Amadeus Basin. The integration of gravity and magnetic modelling allows the mapping of the pre-Amadeus package beneath the southern part of the Amadeus Basin (combined with the Amadeus section in Fig. 1c).

**GSWA Report 154 COBRA — Amadeus Basin project: gravity and magnetic study of the western Amadeus Basin, Western Australia** is available as a free downloadable PDF from [www.dmp.wa.gov.au/ebookshop](http://www.dmp.wa.gov.au/ebookshop).

For more information, contact Peter Haines ([peter.haines@dmp.wa.gov.au](mailto:peter.haines@dmp.wa.gov.au)).

Figure 1 a) Simplified bedrock geology of the study area; b) modelled thickness of Amadeus and overlapping Canning Basin strata, with magnetically defined Amadeus Basin western structural edge indicated by the red dashed line; and c) modelled depth to crystalline basement, which includes a pre-Amadeus sedimentary or metasedimentary package beneath the southern Amadeus Basin



## The State Map, 2015 – it's how we roll



The 14th edition of the **Geological Map of Western Australia** (Fig. 1) was released on 17 December 2015. It is the first release since 1998 of a flagship Geological Survey of Western Australia (GSWA) map that has been produced on average about every eight years since 1894. This map is the culmination of 15 years of work that has profoundly reshaped how GSWA delivers geoscience data and products. The map is the first to be compiled entirely by digital means, with spatial accuracy inherited from and reflecting larger scale spatially accurate geological mapping, rather than compiled by hand from pre-existing maps and then digitized and manipulated to produce the final product. The map and associated 1:2 500 000 digital layers were produced by rolling up 1:500 000 digital layers, which in turn were produced by rolling up 1:100 000 digital data now available over much of the State. The map thus inherits 1:500 000 scale spatial accuracy across Western Australia.

The first step towards smart, spatially accurate Statewide geology was made in 2001, when a digital 1:500 000 seamless interpreted bedrock geology (IBG) layer was compiled, primarily from extant 1:250 000 maps. The two compilers, Vanderhor and Flint, had to work at an average rate of one 1:250 000 sheet per day to complete the job. This was then used to generate a new, detailed 1:500 000 map of tectonic units of Western Australia, by Tyler and Hocking. The IBG and Tectonic Units layers were revised incrementally but slowly, and a new Tectonic Units version was released in 2007. Small amendments have continued to be made since then on the tectonic units and the 1:500 000 geology, but the big advances since 2001 were in developing the back end to the digital process. This came to fruition in 2014 with the release of fully re-interpreted and re-compiled 1:500 000 geology and tectonic unit layers.

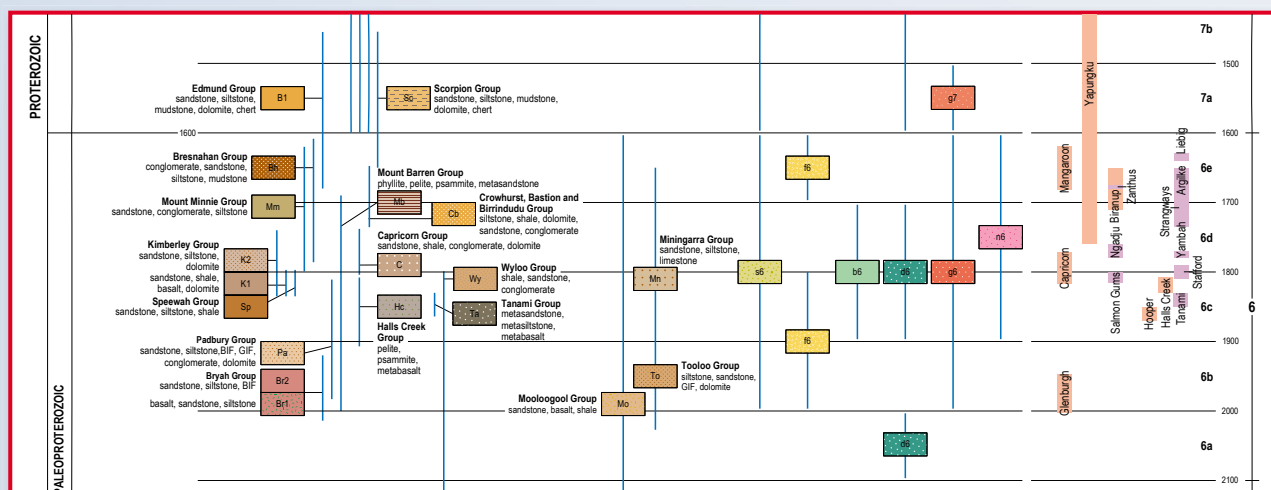
The roll up process for the 1:2 500 000 layers consists of selectively merging 1:500 000 spatial units according to definitions held in the recently released Explanatory Notes System (ENS), while preserving polygon boundaries and relationships wherever possible. Lithostratigraphic units are depicted at subgroup or suite level, or higher, and correlations

across tectonic unit boundaries (as in the Neoproterozoic Centralian Superbasin) are taken into account. For the first time since 1988, dykes across the State have been re-compiled, and in the associated digital layer have attributes that reveal the various dyke suites, swarms, and ages where known.

The printed map may appear little different in most places from its 1998 predecessor, other than a far denser depiction of dykes across the State, and substantial changes where mapping has taken place since 1998. However, there is now an accompanying set of spatially accurate digital layers that are slightly more detailed than the printed map. These layers consist of the primary 1:2 500 000 State interpreted bedrock geology, the 1:2 500 000 State Cenozoic geology, the 1:2 500 000 State interpreted dyke suites, and the 1:2 500 000 State interpreted bedrock linear structures layer. These can be interrogated online via GSWA's free GeoVIEW.WA interface, or via a users' ArcMap- or MapInfo-compatible GIS system. A wealth of underlying attributes is then revealed — the geology is smart, rather than a simple two-dimensional map.

Some of the more noticeable changes to the printed map are in the marginalia. The accompanying tectonic units map is now reproduced at 1:10 000 000, and is considerably more detailed than the 1998 version, having been rolled up and simplified from the 1:500 000 geology. The legend is constructed using similar principles to 1998 but has also been totally redesigned (see excerpt below) with a modified grouping of the 100 million-year time slices used in the coding of the Precambrian, presentation of Phanerozoic and Precambrian units in a single stratigraphic column, the depiction of known age ranges for all units, and the inclusion for the first time of major orogenic and tectonic events.

In future, annual or semi-annual updates to the 1:500 000 and 1:2 500 000 digital datasets will mean that the State geology remains current, and will prevent the long delays in the release of this data that have been experienced in the past.



Legend detail showing enhanced age ranges, revised stratigraphic subdivision and coding, and new depiction of orogenies and tectonic events



# Geological map of Western Australia

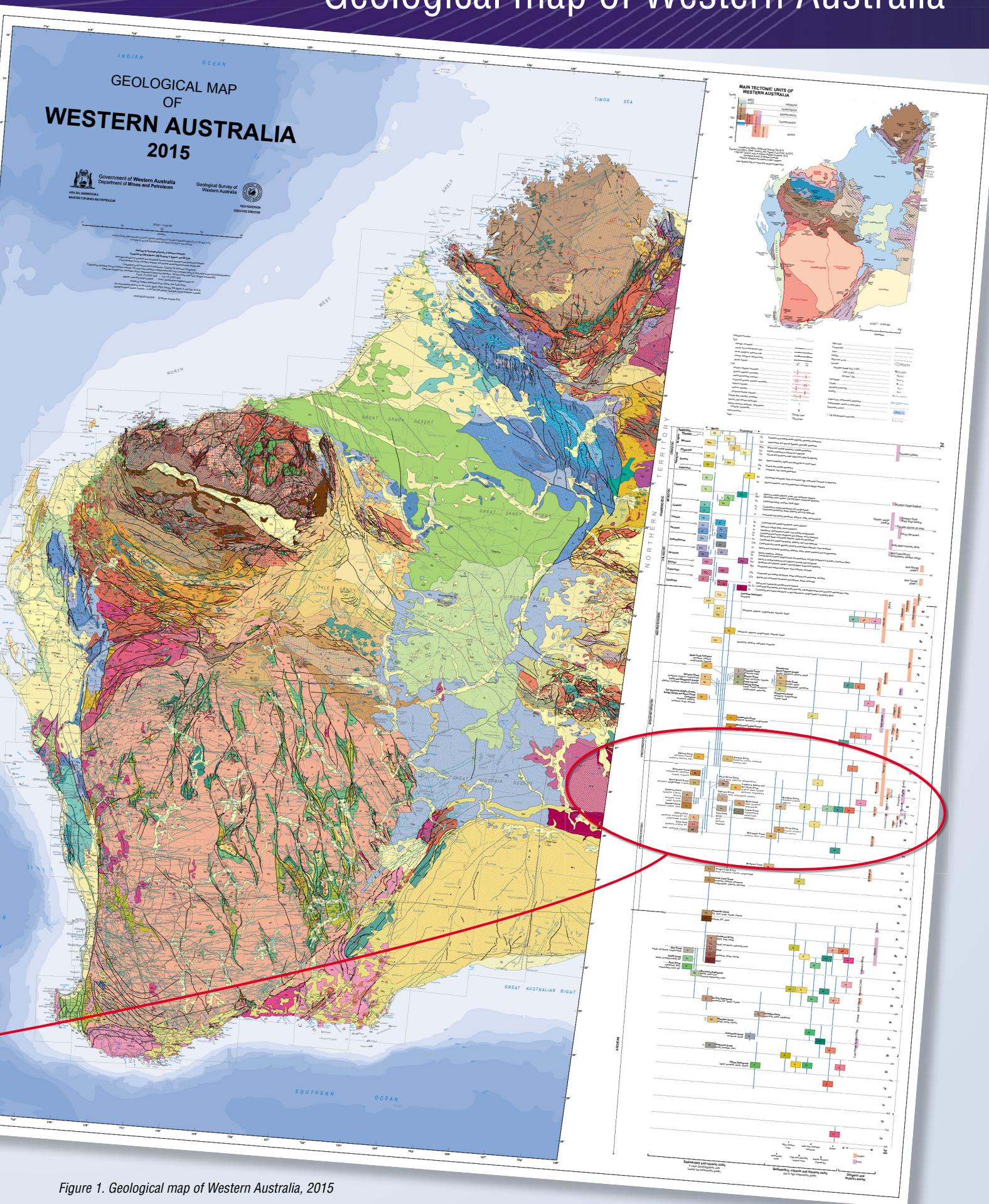


Figure 1. Geological map of Western Australia, 2015

A PDF of the map and the associated digital data files can be downloaded from the Data and Software Centre at [www.dmp.wa.gov.au/datacentre](http://www.dmp.wa.gov.au/datacentre).

For more information, contact  
David Martin ([david.martin@dmp.wa.gov.au](mailto:david.martin@dmp.wa.gov.au)).



## Publication of the first GSWA 3D models

The first 3D geology digital packages ('3D Geomodel Series') were released to the public on 30 November 2015. They include a full representation of the area in three dimensions as well as the standard 2D digital data suite. All aspects of the model can be viewed with Geoscience Analyst, an easy-to-use free third-party viewing software that is included in the package. Also provided are the 3D contents of the package in widely used file formats for import into the users' own software. With the publication of three-dimensional geological models, the Geological Survey of Western Australia (GSWA) is enabling a better understanding of the Earth's structure, and an improved knowledge base to underpin exploration for mineral and energy resources.

Faults, fracture zones and shear zones can be pathways for fluids and melts within the solid Earth. The Earth's 3D structure therefore not only reflects the distribution of physical properties of the rock mass in bedrock, sedimentary basins and regolith cover, but often relates very closely to the spatial distribution of mineral deposits and energy resources that formed as a consequence of fluid flow in the Earth's crust. 3D structural modelling and numerical simulation of geological processes are emerging techniques that can be used to extend knowledge from exposed and well-understood areas to inaccessible or data-poor parts of the Earth's crust and lithosphere, and to test the validity of conceptual models and interpretations.

The construction of 3D models utilizes the full spectrum of extensive geological mapping and geophysical (magnetic, gravity, deep seismic reflection) data acquired by GSWA as part of the Exploration Incentive Scheme (EIS). Differences in the physical properties within the Earth allow inversion of the data to give property distributions from which boundaries can be inferred at depth. No geophysical dataset contains uniquely correct solutions when the question of depth versus density/susceptibility/seismic velocity is concerned, but when all datasets are used in conjunction, the correlations increase and the ambiguity decreases. Modelling synthesizes these data into a product which simultaneously explores and unites the 3D information contained within each dataset.

The first two 3D Geomodel Series products released are the Windimurra, and the Sandstone models. These regions, located in the northern Yilgarn Craton, have known deposits of vanadium and gold. The models enhance exploration potential for more gold, platinum group elements, nickel, and copper.

At Windimurra in the Murchison Domain of the Yilgarn Craton, the 3D model predicts where ultramafic rocks, prospective for chrome and platinum group elements, may continue at depth beneath the surface. Windimurra is the first of a

number of prospective large igneous complexes within the Yilgarn to be modelled; applying the same techniques to many other similar rock assemblages could vastly increase the exploration space for magmatic intrusion-related commodities such as nickel and copper.

The Sandstone model, which includes significant gold deposits, explores the deep fault geometries across the Northern Yilgarn Craton. Such structural models at the scale of the Earth's crust can image the architecture of a mineral system from ancient mantle-tapping fault zones to

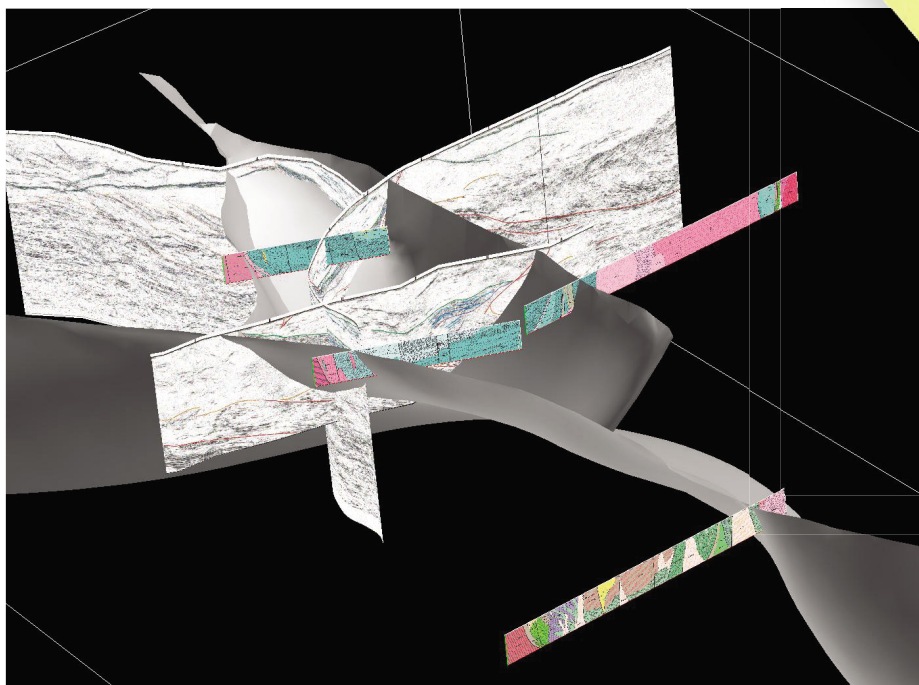


Figure 1. Geological sections from the 1:100 000 map series and seismic interpretations which went into building the Windimurra model. Grey lines show the model faults.

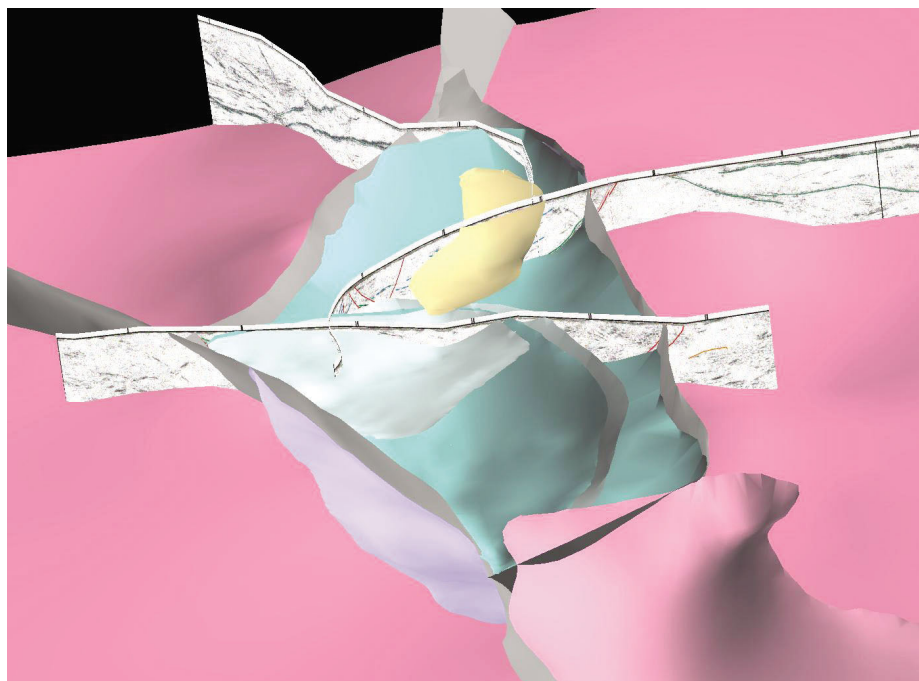


Figure 2. Model surfaces from the Windimurra model within the framework of the seismic interpretations



*Figure 3. The Sandstone greenstone belt model surfaces were derived from surface geological mapping, gravity and magnetic potential field inversions and a deep seismic reflection survey.*

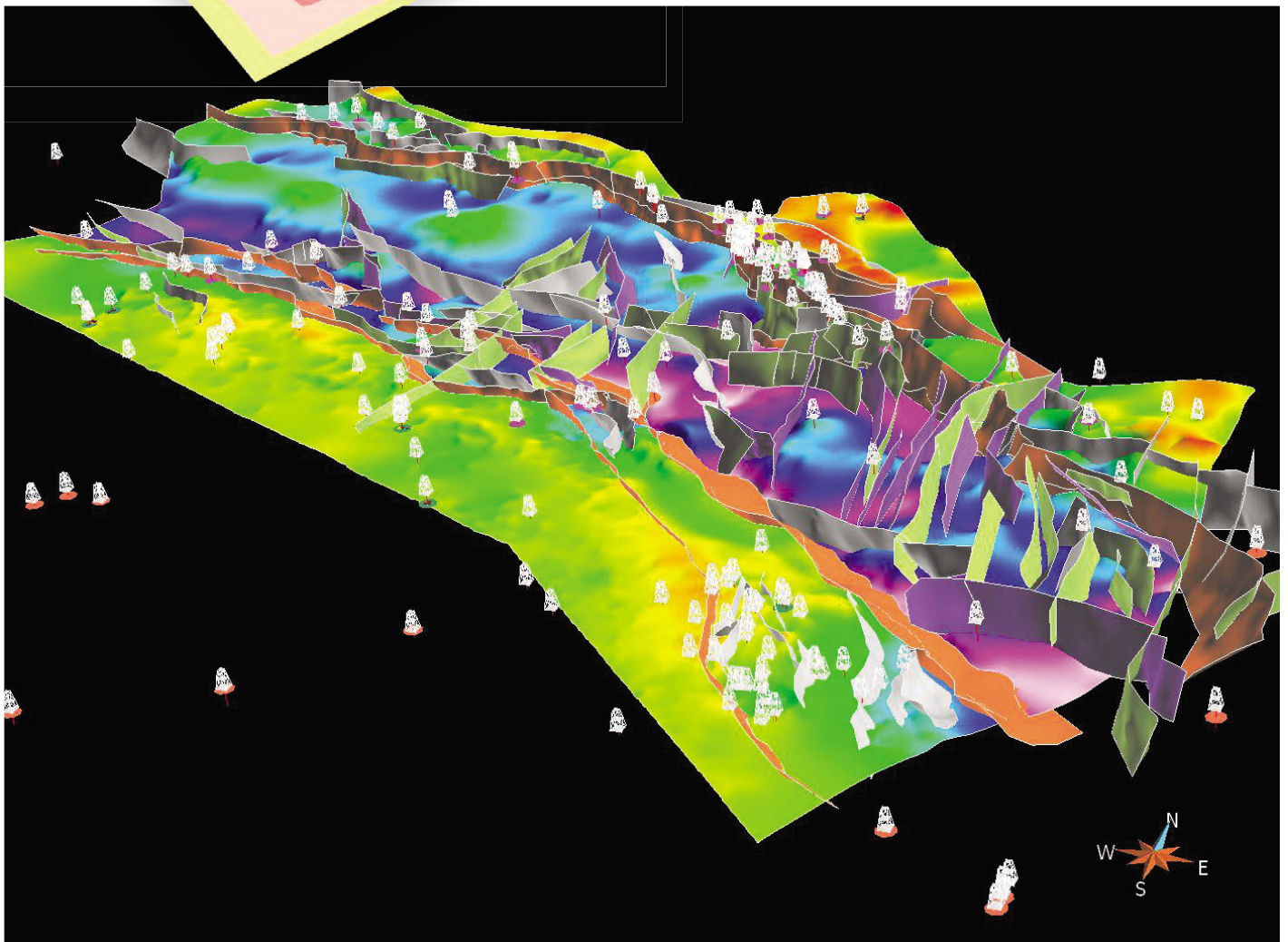
mineralized rocks near the surface. A more comprehensive fault model that spans across several mineral camps in the Northern Yilgarn Craton is due to be released in 2016.

In early 2015, a 3D model of the Canning Basin was released as part of a collaborative project between GSWA and the Centre for Energy Geoscience at The University of Western Australia. This model provides an important contribution to better understand the geological evolution of the Canning Basin. The model also helps to identify prospective areas for petroleum production and carbon sequestration, and petroleum and shale gas potential of the Canning basin.

The digital models are available on USB flash drives that contain all the software for viewing the model in 3D. The USBs also include accompanying GSWA Records which provide detailed background information for the 2D GIS components of the digital packages.

Windimurra, 2015: 3D Geomodel Series and Sandstone, 2015: 3D Geomodel Series are accessible via the DMP eBookshop at [www.dmp.wa.gov.au/ebookshop](http://www.dmp.wa.gov.au/ebookshop).

For more information, contact  
Ruth Murdie ([ruth.murdie@dmp.wa.gov.au](mailto:ruth.murdie@dmp.wa.gov.au)).



*Figure 4. The Canning Basin model shows the depth to basement, several generations of faults, and the wells from where the data originated.*

# Roger Hocking bids farewell to GSWA

## The retiring type



After 41 years at the Geological Survey of Western Australia (GSWA), Roger Hocking has retired.

Roger arrived in Perth from New England in New South Wales on 10 December 1974 and joined GSWA the next day. Roger was attracted by Perth's proximity to the coast and the opportunities for surfing the Indian Ocean waves. In fact, photographic evidence suggests he fitted the surfer model of the 70s — lean, with long sun-bleached hair.

He was initially attracted to the coastal gorges as well as the spectacular scenery of the Murchison River Gorges at Kalbarri. His work on the early Paleozoic Tumblagooda Sandstone offered an exciting location for research for his Master's degree, which he completed in the mid-1980s. Roger's foundation work on this little-described formation was recognized by a work colleague who named a fossilized arthropod escape burrow after him — *Tumblagoodichnus hockingi*! Further accolades followed, with his name also put to a coarse and warty-textured Permian brachiopod (*Neochonetes (Sommeriella) hockingi*), and a short

and stumpy Devonian coral (*Disphyllum hockingi*).

Over the next ten years of field- and office-based studies that included the publication of numerous Explanatory Notes, Reports, papers, and a Bulletin, Roger's name became synonymous with the Carnarvon Basin. For petroleum exploration companies and many generations of geology students he was 'Mr Carnarvon Basin'. During the 1980s Roger also contributed significantly to the understanding of other Phanerozoic basins in the State — reflected in Memoir 3 and also in the 1988 State geological map, which he co-authored. In the late 1980s to early 1990s he continued work on the Carnarvon Basin, carrying out core-based studies of the North West Shelf.

By 1993, Roger's main area of research had moved to the Lennard Shelf Devonian reef complex. These fossilized reefs — the Great Barrier Reef of the Devonian — kept Roger busy for the next four years culminating in co-authorship of a special series of eight maps that would ultimately accompany Bulletin 145, published in 2009 under the authorship of PE Playford, RM Hocking and AE Cockbain. He nostalgically recalls the luxury of being able to bathe almost every night in beautiful rock pools during these long field seasons — and maintaining a suntan that lasted four years. It was during this time that Roger's prowess at campfire cooking was passed on to those 'younger geologists' who worked with him, as well as his tastes in somewhat obscure 1960s and 1970s music.

In 1997, Roger commenced mapping in the Paleoproterozoic Earaheedy Basin. His 'holistic view of the scope of the project boundaries' led to him working on neighbouring Neoproterozoic successions, as well as discovering the first recorded gold mineralization at Quadrio Lake in the Little Sandy Desert. He transitioned seamlessly from the Phanerozoic to the Proterozoic. In 2007 Roger took up the mantle of Chief Geoscientist. In this role he utilized his broad-ranging experience of most of Western Australia's basins to offer high-level advice and expertise to enhance understanding of the geological framework of Western Australia both within and outside GSWA, and was a mentor to many younger GSWA recruits. He also sought opportunities to promote the many outstanding geological features of Western Australia in the area of geotourism.

After co-authoring the 1998 State map, he has been instrumental in bringing the next State map into the digital world of 2015; its release date serendipitously aligned with his date of commencement at GSWA.

We wish Roger well in the new phase of his life.



## Geological Survey Open Day

**Friday 26 February 2016**

**8.30 am – 4.30 pm**

Followed by a Sundowner

**Esplanade Hotel, Fremantle**  
Cnr Marine Tce & Essex St

This is a great opportunity to hear presentations on the latest results from GSWA's geoscience programs, including collaborative work with CSIRO and the Centre for Exploration Targeting (CET).

Activities and results of the Exploration Incentive Scheme will be outlined including the launch of Round 13 of the Government Co-funded Exploration Drilling program.

Throughout the day there will be geological presentations, an extensive poster display, and demonstrations of online systems.

**Register online at**

**[www.dmp.wa.gov.au/gswa2016](http://www.dmp.wa.gov.au/gswa2016)**

For further information, call **(08) 9222 3168**



## GSWA regional geophysics surveys: December 2015 update

The latest release of Geological Survey of Western Australia (GSWA) regional geophysical surveys is the Ngururra gravity survey.

### Data downloads



Final data releases from the Geophysical Archive Data Delivery System can be found at <[www.ga.gov.au/gadds](http://www.ga.gov.au/gadds)>.

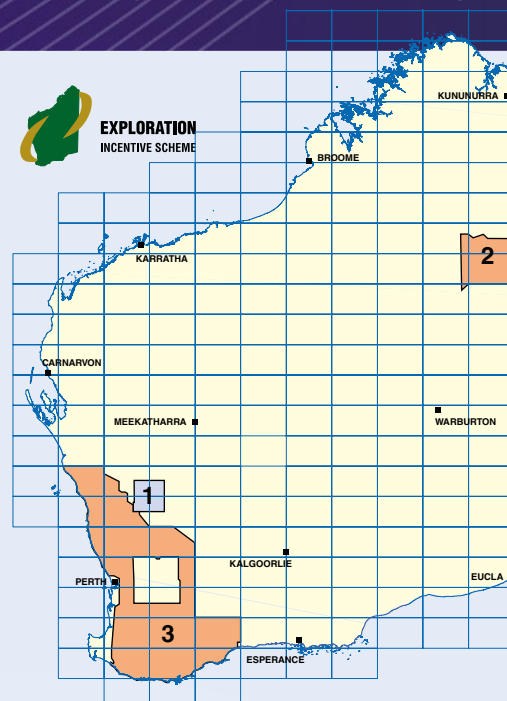
Grids and images from the GSWA website are available from <[www.dmp.wa.gov.au/geophysics](http://www.dmp.wa.gov.au/geophysics)>.

Subscribe to the GSWA eNewsletter for alerts of preliminary and final data release dates.

Survey outline shapefiles are available online at <[www.dmp.wa.gov.au/geophysics](http://www.dmp.wa.gov.au/geophysics)>.

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

 Airborne mag-rad surveys  
 Ground gravity surveys



ID	Area/Name	Method	Configuration	Units	Status	Start	End	Release
1	Yalgoo 2015	Mag-Rad	100 m; E/W	111 000 km	Pre-release	31/05/15	27/09/15	10/12/15
2	Ngururra 2015	Gravity	Grid 2.5 km	4 964 stns	Released	10/05/15	13/06/15	30/07/15
3	SW Yilgarn 2015	Gravity	Roads 2 km	23 719 stns	Processing	12/06/15	02/12/15	Mar-16*

Mag-Rad = Magnetic/Radiometric

## Perth and Peel Green Growth Plan

The impact of future development in the Perth and Peel regions is the focus of the draft *Perth and Peel Green Growth Plan for 3.5 million* (Green Growth Plan) which was released for public comment on 17 December 2015. This Plan is the culmination of the 4.5 year multigovernment agency strategic assessment of the Perth and Peel Region.

The Perth and Peel regions are projected to grow to 3.5 million people by 2050 — an increase of almost 70% on our current population. Supporting this growth and delivering an efficient and liveable city while protecting our unique natural environment is a significant challenge. The State Government prepared the Green Growth Plan to meet this challenge, and in this context it delivers two critical outcomes. It will cut red tape by securing upfront Commonwealth environmental approvals, and streamline State environmental approvals for the development required to support growth to 3.5 million people. It also plans for unprecedented protection of our bushland, rivers, wildlife and wetlands.

The assessment managed by the Department of Premier and Cabinet was the largest undertaking of its kind in Australia. The Land Use Geoscience section of the Geological Survey of Western Australia (GSWA), in close collaboration with other government agencies, industry and other divisions within the Department of Mines and Petroleum (DMP), played a key role in identifying strategic basic raw materials (BRM) within the regions. GSWA's assessment process involved Geographical Information System (GIS) based multicriteria decision making to ensure the final footprint for BRM extraction took into consideration relevant factors such as biodiversity, resource availability, opportunities for sequential land use and access including transport costs.

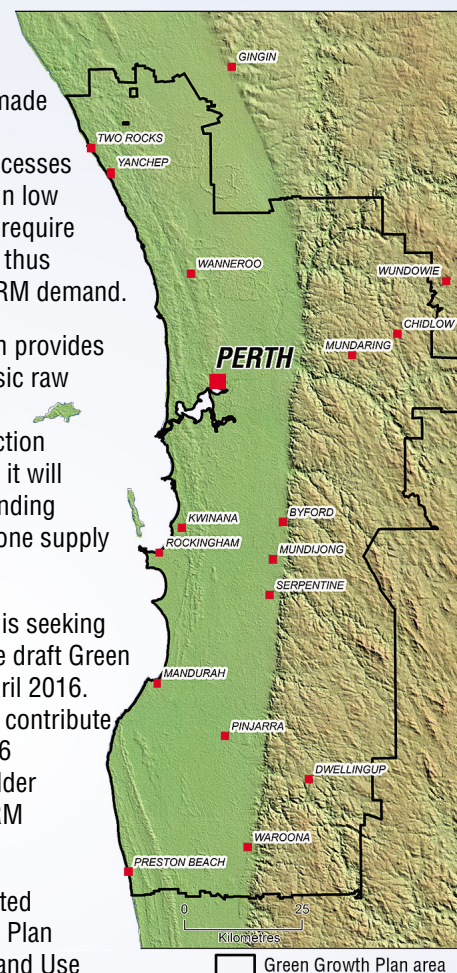
Significant input was made through the urban and industrial planning processes to avoid development in low lying areas that would require excessive BRM for fill, thus reducing the overall BRM demand.

The Green Growth Plan provides greater certainty to basic raw material operators regarding where extraction can be considered and it will resolve some long-standing issues, such as limestone supply to the north of Perth.

The State government is seeking public comment on the draft Green Growth Plan until 8 April 2016. GSWA will continue to contribute to the Plan during 2016 assisting with stakeholder feedback regarding BRM matters.

BRM mapping associated with the Green Growth Plan is available from the Land Use Planning layer in GeoVIEW.WA on DMP's website at <[www.dmp.wa.gov.au/geoview](http://www.dmp.wa.gov.au/geoview)>.

For more information, contact Warren Ormsby ([warren.ormsby@dmp.wa.gov.au](mailto:warren.ormsby@dmp.wa.gov.au)).



## RECORDS

Record 2015/1 Geological Survey work program for 2015–16 and beyond

Record 2015/3 Alteration mineral zonation associated with BIF-hosted iron ore: mineral mapping using hyperspectral drill core data  
*by L Chiarelli*

Record 2015/8 Detrital zircon geochronology of upper Ediacaran to lower Cambrian deposits (Supersequence 4), western Amadeus Basin: testing revised stratigraphic correlations  
*by PW Haines, MTD Wingate, CL Kirkland, and HJ Allen*

## 1:100 000 GEOLOGICAL SERIES MAP

MOUNT MAGNET, WA Sheet 2441  
*by I Zibra*

## 1:100 000 GEOLOGICAL INFORMATION SERIES

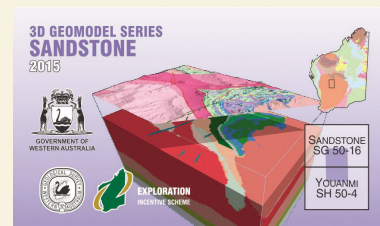
Western Capricorn Orogen, 2015

## NON-SERIES MAP

Geological map of Western Australia, 1:2.5 million 2015

## DATA PACKAGE

Sandstone: 3D Geomodel Series (includes Record 2015/11 The Sandstone greenstone belt, northern central Yilgarn Craton: 3D modelling using geological and geophysical constraints)  
*by RE Murdie, K Gessner, and SF Chen*



Windimurra: 3D Geomodel Series (includes Record 2015/12 The Windimurra igneous complex, Yilgarn Craton: an Archean layered intrusion revealed by seismic data and 3D modelling)  
*by TJ Ivanic and J Brett*

# DMP launches new website

The Department of Mines and Petroleum (DMP) is pleased to announce the launch of our brand new website. The site has many new features and enhancements including a greatly improved search function. It has been designed with our clients and stakeholders in mind — you! Its design is focused on being user-centric and intuitive.

DMP Director General Richard Sellers said the department had spent the last couple of years researching and designing the new website.

‘The way people access information online has changed in the six years since the current website was launched,’ he said earlier in the year. ‘The new website will be more intuitive and better reflect

the way our stakeholders want to use the site.’

There are a few things to note:

- Access to online systems is now on the right-hand side of every page. All your favourite systems are there (click on VIEW MORE to see the full list) and in some cases improved (e.g. GeoVIEW.WA now includes Statewide airphoto mosaic under ‘Landgate Aerial Imagery’ and Explanatory Notes System as new ‘Search Tools’).
- Quicklinks on the left-hand side allow repeat customers to easily navigate to their form or system of interest; on the right-hand side, the ‘Recently Viewed’ option keeps a memory to allow easy navigations to pages visited on previous sessions/visits.
- New layers relating to the Perth–Peel Green Growth Plan have been added to GeoVIEW.WA under the Land Use Planning tab.
- Resource Statistics has been moved to the Investors page.
- There will be different news items shown on the GSWA landing page.
- To see an overview of the site pertaining to GSWA, hover your mouse over ‘Geological Survey’ in the top navigation bar.

## Did you know?

All the final reports submitted under the Co-funded Exploration Drilling program of the Exploration Incentive Scheme (EIS) can be found in WAMEX (via GeoVIEW.WA Search Tools) by selecting ‘Co-funded drilling’ in the ‘Report Type’ drop-down.

You can access the new website as before at <[www.dmp.wa.gov.au/gswa](http://www.dmp.wa.gov.au/gswa)>.

Note that previous shortcuts will need to be refreshed.

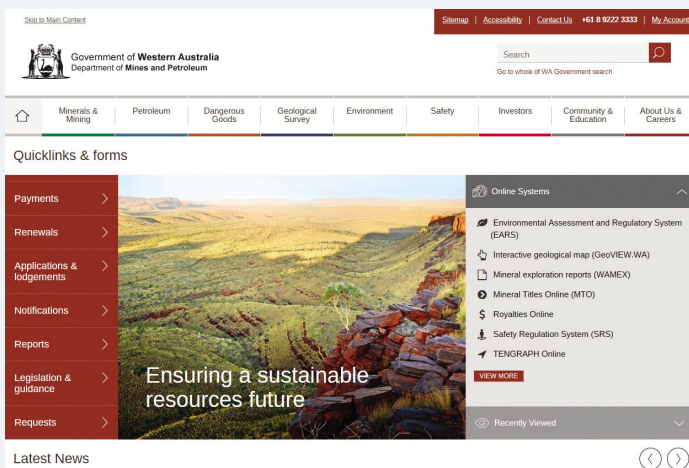


Figure 1. Landing page for the new DMP website

The Geological Survey of Western Australia (GSWA) has released almost 5000 geological products including books, maps and data packages. These can be found on our website at <[www.dmp.wa.gov.au/GSWApublications](http://www.dmp.wa.gov.au/GSWApublications)>.

Maps, USB data packages, and selected premium publications are available to purchase as hard copies via the online cart on the eBookshop at <[www.dmp.wa.gov.au/ebookshop](http://www.dmp.wa.gov.au/ebookshop)>. Alternatively, these products can be purchased from the Information Centre, First Floor, Mineral House, 100 Plain Street, East Perth, WA 6004, Australia, Phone: +61 8 9222 3459; Fax: +61 8 9222 3444. Records, Reports, Bulletins and non-series books cannot be purchased in hard copy but are all available as PDFs to view, and as a free download.

Products were produced using information from various sources. The Department of Mines and Petroleum (DMP) and the State cannot guarantee the accuracy, currency or completeness of the information. DMP and the State accept no responsibility and disclaim all liability for any loss, damage or costs incurred as a result of any use of or reliance whether wholly or in part upon the information provided in this publication or incorporated into it by reference.