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Department for Manufacturing,  
Innovation, Trade, Resources and Energy

## Update on South Australia's Uranium Exploration and Mining

Ted Tyne, Executive Director, Mineral Resources  
with contributions from staff of the Mineral Resources Division



Government  
of South Australia

Department for Manufacturing,  
Innovation, Trade,  
Resources and Energy

**PACE** *exploration*  
**2020** *mining*  
*energy*  
*global*

[www.dmitre.sa.gov.au](http://www.dmitre.sa.gov.au)



# Update on SA's Uranium Exploration and Mining

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- Australia is the world's fourth largest uranium producer and we have the world's largest resources
- South Australia hosts over 80% of Australia's combined RAR & inferred uranium resources and produces ~7% of world production
- Over 3 million tonnes of  $U_3O_8$  identified in Major Mines or Advanced Projects - Olympic Dam is world's largest Uranium Deposit
- In 2011/12 >7,500 tonnes of  $U_3O_8$  produced – 58% of Aust.
- Almost half of SA's record number of 977 mineral Exploration Licences list uranium as a target
- SA is continuing to develop uranium mines through efficient legislation, assessment and approvals processes, with best practice environmental regulation
- PACE 2020 is continuing to deliver a wealth of pre-competitive information, data and new mapping coverages, designed to bring forward new discoveries

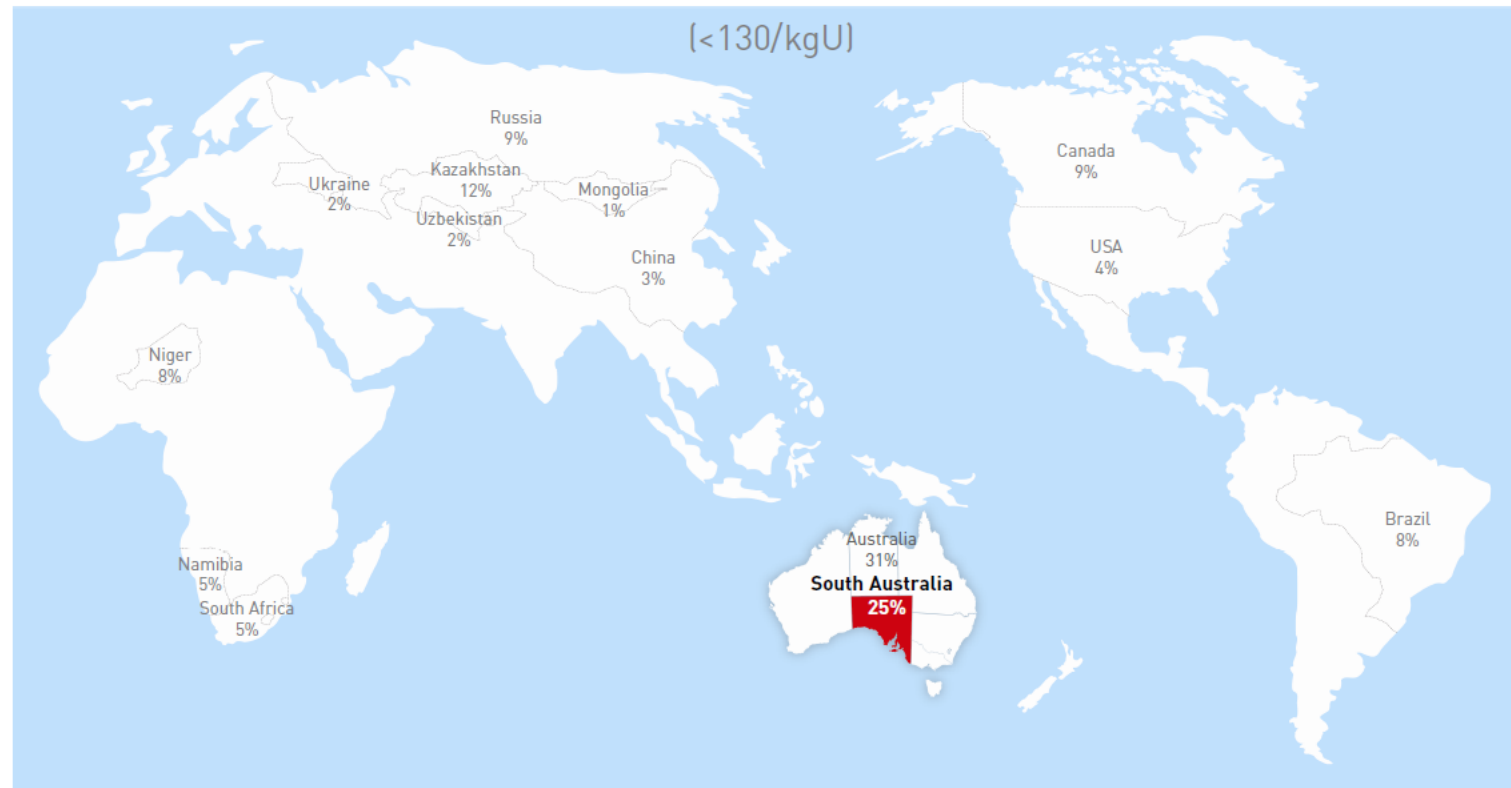


## URANIUM IN SOUTH AUSTRALIA



**Adelaide**  
SOUTH AUSTRALIA

# GLOBAL DISTRIBUTION OF IDENTIFIED URANIUM RESOURCES



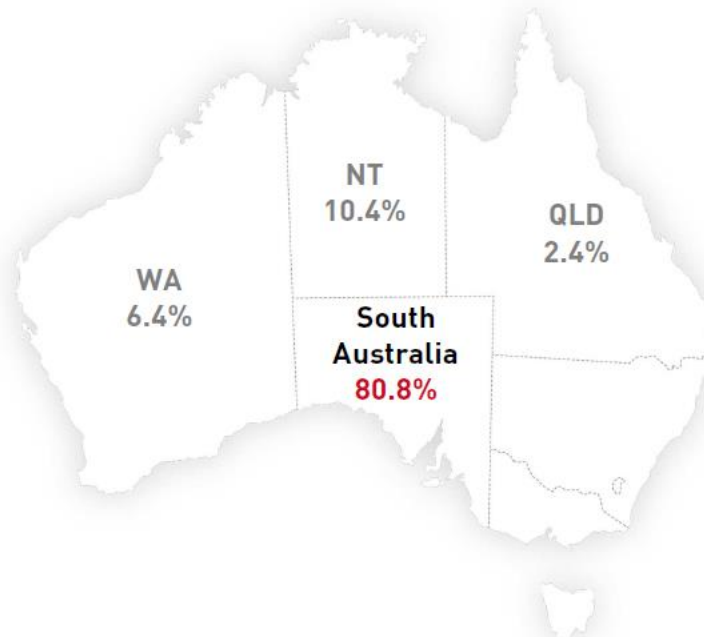
- South Australia has 25% of global 'Identified resources' recoverable <USD130/kgU
- Uranium was first discovered in South Australia at Radium Hill in 1906. For over the last 25 years South Australia has been continuously producing uranium.
- South Australia is internationally recognised for its high prospectivity and proven track record of uranium mining.
- There are currently 21 compelling uranium investment opportunities in South Australia

# SOUTH AUSTRALIA'S URANIUM POTENTIAL



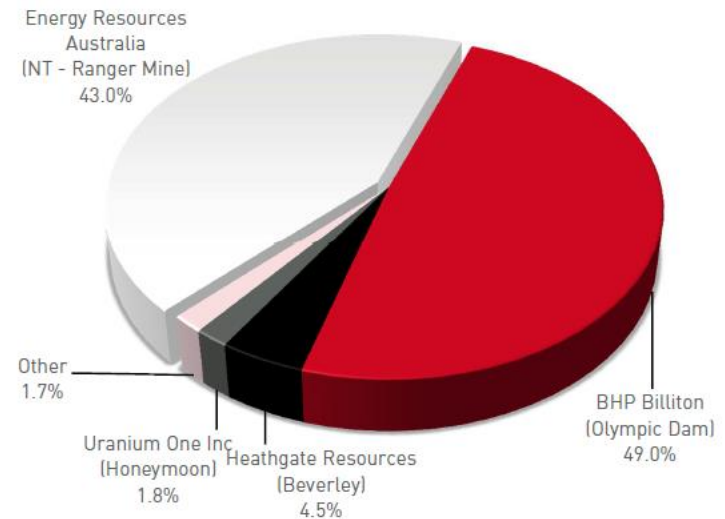
Identified Resources (RAR & Inferred)

As at December 2010



Revenue Market Share

As at June 2011



- South Australia is the home of Australia's uranium industry.
- South Australia is home to over 80% of Australia's combined RAR and Inferred uranium resources. Due to the highly prospective geology there are substantial opportunities to discover further deposits.
- There are three active major mines in South Australia with over 56% of the national market share.
- Four Mile is on schedule to become Australia's next major uranium mine in June 2013, Australia's fifth and South Australia's fourth.



# SOUTH AUSTRALIAN URANIUM RESOURCES & PRODUCTION

## DEPOSITS

- 3,008,744 tonnes of  $U_3O_8$  resources identified in Major Mines or Advanced Projects
- Olympic Dam is the World's largest Uranium deposit with 2,921,280 tonnes of  $U_3O_8$

## PRODUCTION

- 2011 production of  $U_3O_8$  was 4,415 t which equates to 62% of Australian production (7,056 t)
- South Australian production equates to 6.8% of global production (64,402 t)
- Uranium is only authorised to be exported via Adelaide & Darwin port facilities (WA to ship via these ports)
- Four Mile has government approval and will commence production in the June quarter 2013.

## EXPLORATION

- 27 active companies
- \$45m (25% of national expenditure) in 2011
- \$69m (38% of national expenditure) in 2010

## DEVELOPMENT

- 17 prospects have been identified in predominantly Sandstone or Breccia deposits



# MAJOR MINES & ADVANCED PROJECTS IN SOUTH AUSTRALIA



LOCATION	COMPANY	ORE RESOURCE (million tonnes)	U <sub>3</sub> O <sub>8</sub> RESOURCE (tonnes)	DEPOSIT TYPE
<b>MAJOR MINE</b>				
Olympic Dam*	BHP Billiton	9,129 mt at 0.032%	2,921,280	Breccia
Beverley	Heathgate Resources	7.7 mt at 0.27%	20,790	Sandstone
Beverley North	Heathgate Resources	2.2 mt at 0.18%	3,960	Sandstone
Honeymoon	Uranium One	1.2 mt at 0.24%	2,880	Sandstone
		Sub Total	2,948,910	
<b>ADVANCED PROJECT</b>				
Crocker Well	Sinosteel	13.25 mt at 0.0283%	3,750	Vein
	PepinNini Minerals	8.9 mt at 0.0275%	2,448	Vein
Four Mile ^	Quasar Resources	9.8 mt at 0.33%	32,340	Sandstone
Junction Dam	Marmota Energy Ltd	4.36 mt at 0.0437%	1,905	Sandstone
	Teck, PlatSearch, etc.			
Samphire	Uranium SA	45.5 mt at 0.028%	12,740	Sandstone
		22 mt at 0.0292%	6,424	Sandstone
		Sub Total	59,607	

\* Uranium is a co-product

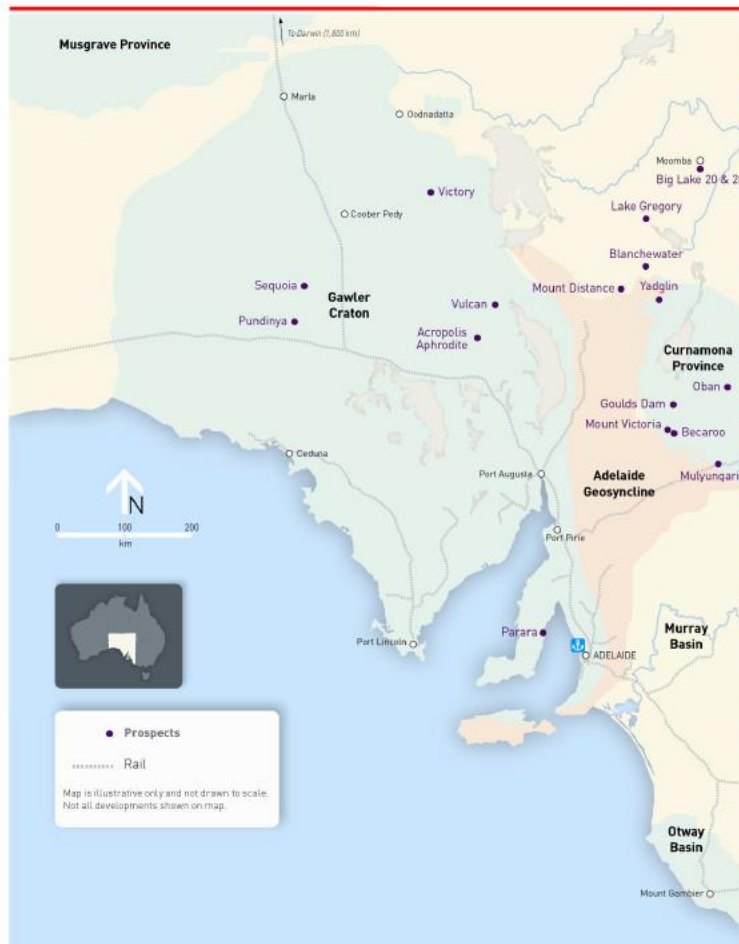
Total

3,008,517

^ Scheduled to commence production Jun-Sept 2013



# MINING PROSPECTS IN SOUTH AUSTRALIA



LOCATION	COMPANY	DEPOSIT TYPE
<b>PROSPECTS</b>		
Acropolis *	BHP Billiton Ltd	Breccia
Aphrodite	BHP Billiton Ltd	Breccia
Becaroo *	Sinosteel Midwest Corp	Sandstone
Big Lake 20 & 28 (Sturt JV Project)	Focus Minerals Ltd	Sandstone
Blanchewater (Maree)	Cauldron Energy Ltd	Sandstone
Goulds Dam (Billeroo)	Uranium One Ltd	Sandstone
Lake Gregory *	Regalpoint Resources	Sandstone
Mount Distance	Sojitz Corporation	Sandstone
Mount Victoria	PepinNini Minerals	
Mulyungarie	Marmota Energy Ltd	Sandstone
Oban	Havilah Resources	Sandstone
Parara *	Rex Minerals Ltd	
Pundinya	Marmota Energy	Sandstone
Sequoia (Commonwealth Hill ) *	Apollo Minerals Ltd	
Victory (Edward Creek)	Reedy Lagoon Corp Ltd	
Vulcan *	Tasman Resources	Breccia
Yadglin (Lake Frome JV)	Heathgate Resources	Sandstone

\* Uranium is a co-product

*A number of companies are currently operating in SA under the exploration model based on the analogy of the Chu-Saryssu and Syrdarya uranium fields in Kazakhstan. The economic sandstone-hosted uranium deposits occur up to 250km from the uranium source region.*





# South Australia

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Best Practice Regulation of  
Uranium Exploration and Mining



## Opportunity at risk

Regaining our competitive edge  
in minerals resources

Report commissioned by and prepared  
for the Minerals Council of Australia

SEPTEMBER 2012

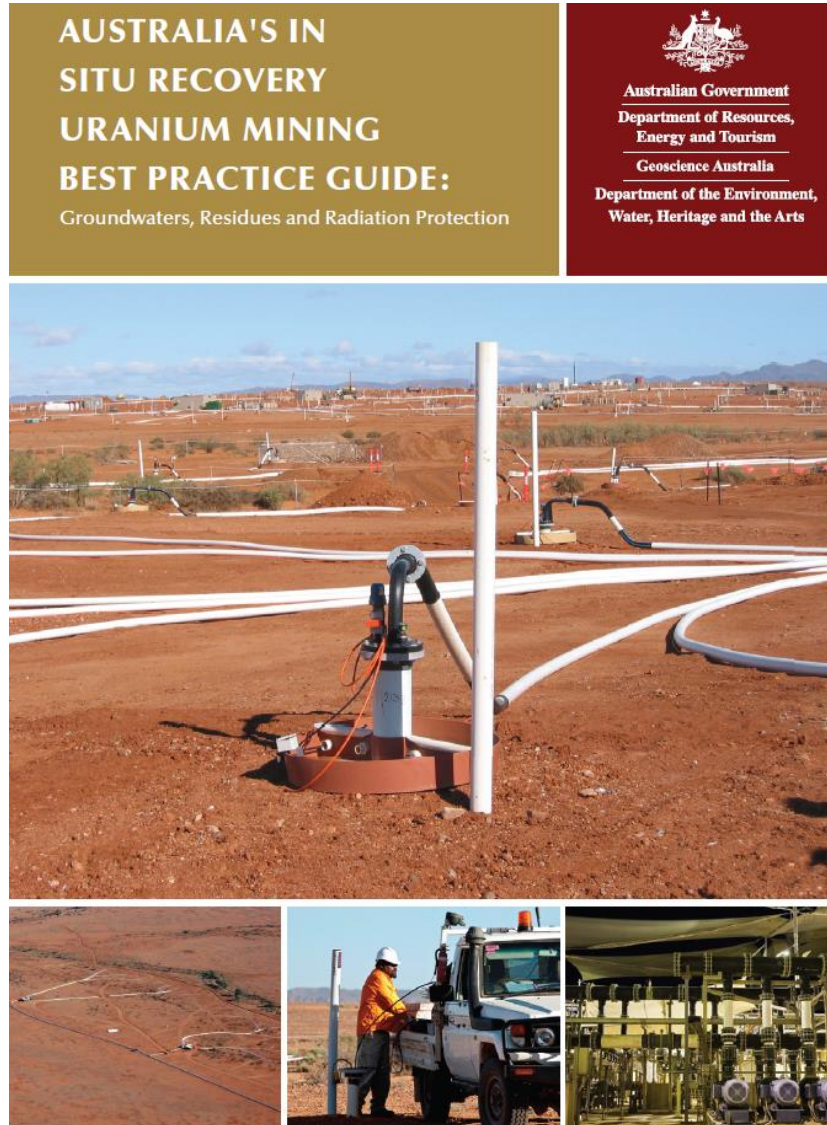
PORT JACKSON PARTNERS

**South Australia's lead agency model for the assessment of significant projects could serve as a model for all States.**

Under the South Australian model, project proponents are allocated a case manager who coordinates all development, environment and licensing approvals processes with a view to delivering projects with 'minimum risk in minimum time'.

**South Australia targets six months for mineral lease approvals for major mines**, well below national benchmarks of one to two years. For example, approvals for Prominent Hill took five months and Jacinth-Ambrosia took seven months.

# South Australia in partnership with Australian Government Environmental Regulators – Achieving Uranium Mining Environmental Best Practice



Best Practice Guide for ISR Uranium Mining developed by Geoscience Australia in collaboration with DMITRE to provide guidance for the assessment process for Beverley North Uranium Mine



# South Australia

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International Partnerships and Collaborations  
with Province of Saskatchewan,  
China National Nuclear Corporation  
and the IAEA

Positioning SA as a Leader in Uranium Geoscience



THE INDEPENDENT AUTHORITY  
MINING | METALS | FERTILIZERS

## Uranium

*“Uranium is the next great China story.  
What China did for iron ore in the last decade,  
it will do for uranium in the coming decades”.*

*A Trench & D Packey 2012  
Australia’s Next Top Mining Shares – Major Street Press*

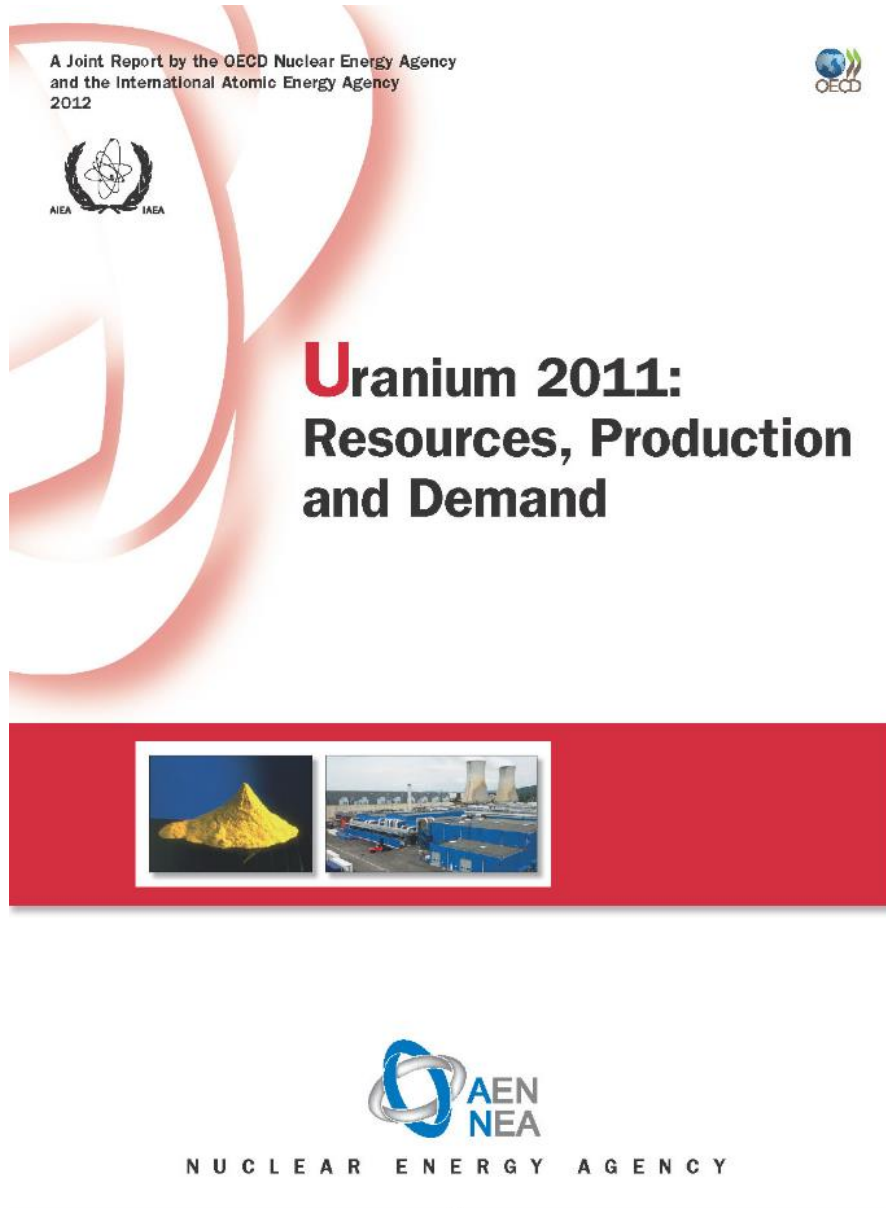


# China – South Australia – Saskatchewan Uranium Geoscience Partnership established October 2012





# The IAEA Red Book

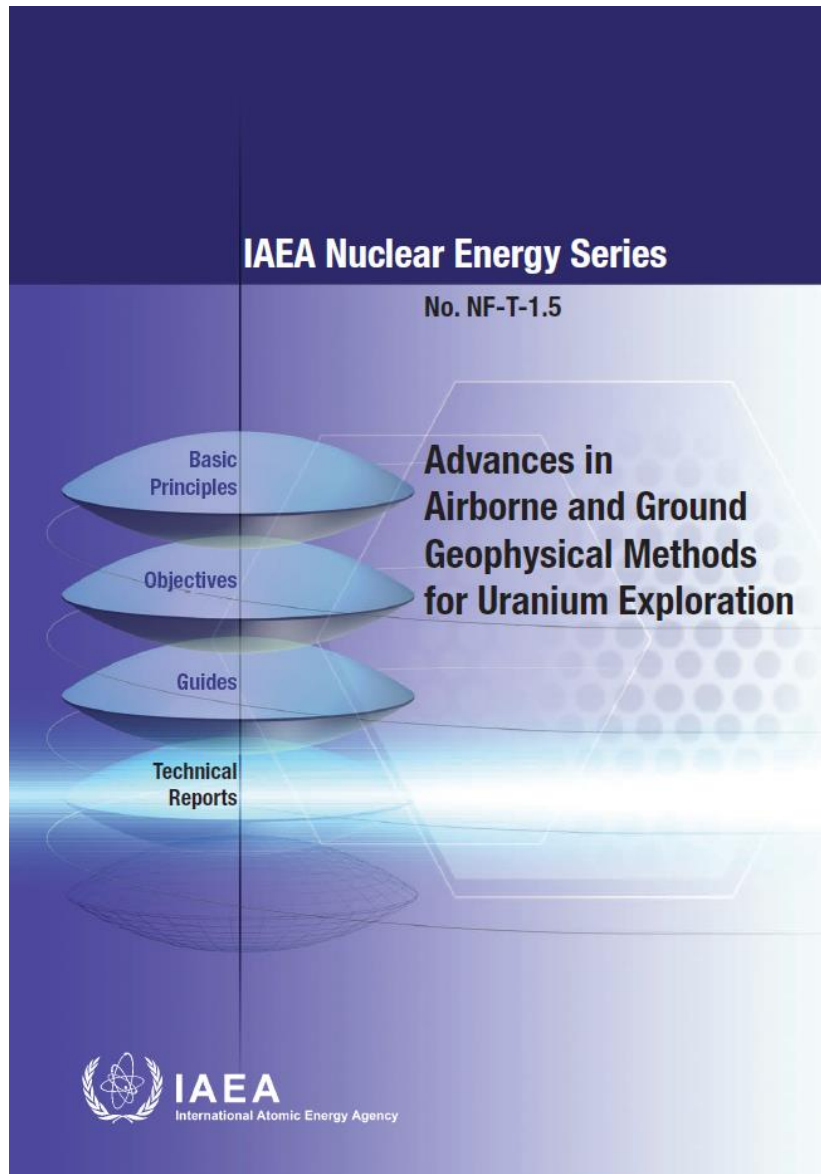


The latest IAEA Red Book on  
Uranium 2011: Resources,  
Production and Demand

Major contribution from  
Dr Martin Fairclough, Chief  
Geoscientist, GSSA



# The IAEA Nuclear Energy Series



The latest IAEA Nuclear Energy Series on  
Advances in Airborne & Ground Geophysical Methods for Uranium Exploration

Developed by a number of global experts with contributions from SA





# South Australia

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Government of SA and PACE 2020 initiatives

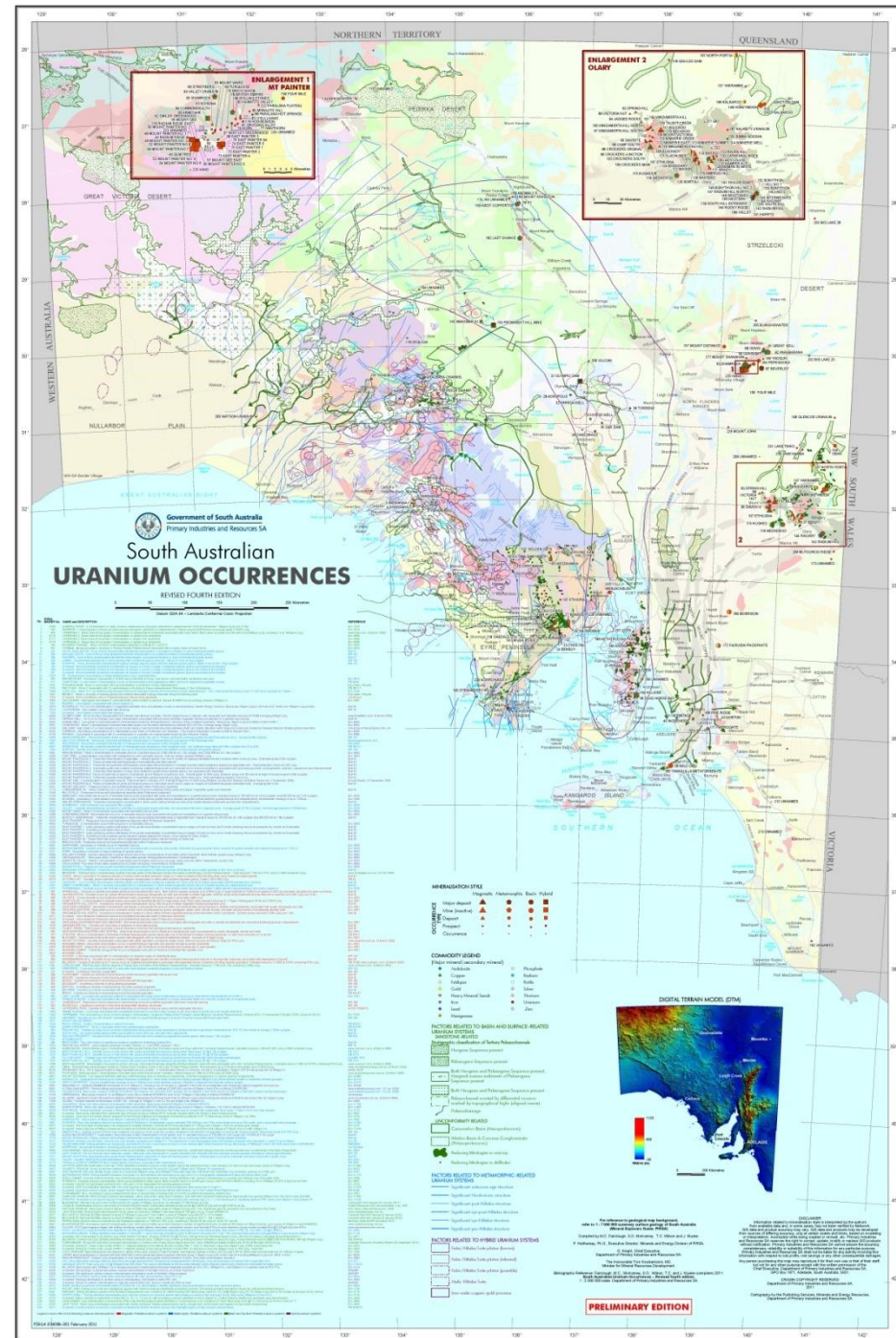
bringing forward Uranium discoveries

# PACE & GSSA Projects

## Uranium Occurrences Map (5<sup>th</sup> Edition)

- Known uranium occurrences and significant geological parameters for each deposit type have been collated and represented spatially as a 'key ingredients' map
- 5<sup>th</sup> edition released
- Significant number of additions
- Classification scheme

Fairclough, M.C., McAvaney, S.O., Wilson, T.C. and Kluske J. (compilers) 2012. South Australian Uranium Occurrences – Revised edition. 1:2 000 000 scale. Department of Primary Industries and Resources SA.





# PACE & GSSA Projects



## Uranium and Uranium Mineral Systems of South Australia Report (Wilson, T)

Second edition available for download

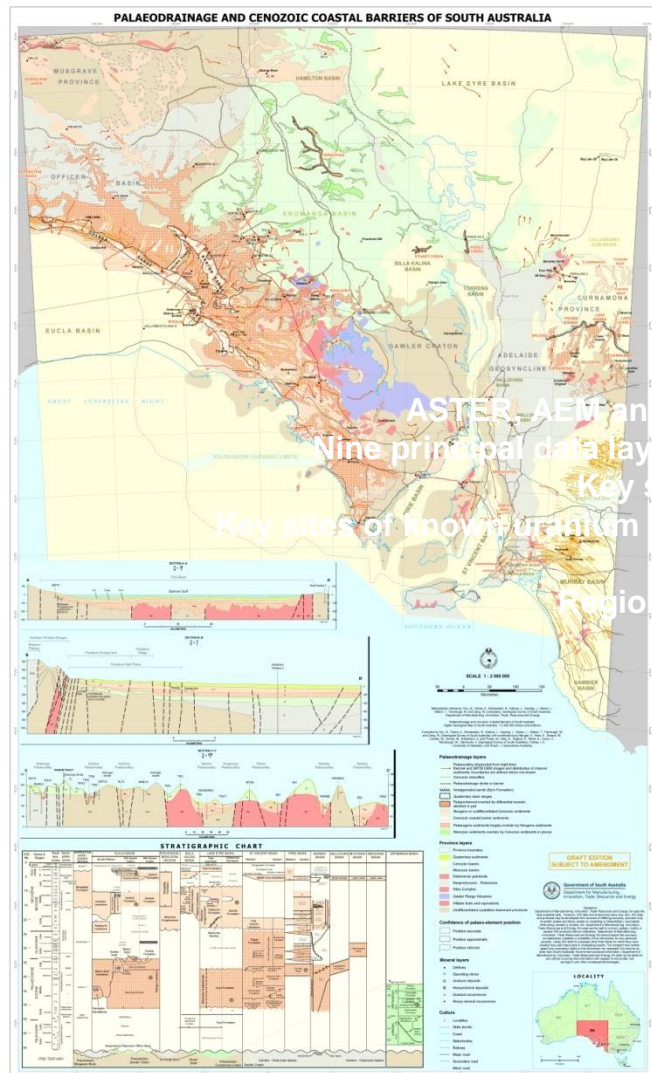
[http://www.minerals.dmitre.sa.gov.au/geological\\_survey\\_of\\_sa/geology/commodities/uranium](http://www.minerals.dmitre.sa.gov.au/geological_survey_of_sa/geology/commodities/uranium)



# PALAEODRAINAGE AND CENOZOIC COASTAL BARRIERS OF SOUTH AUSTRALIA MAP



Hou B., Fabris A., Michaelsen B., Katona L., Keeling J., Stoian L., Wilson T., Fairclough M. and Zang W. (compilers)

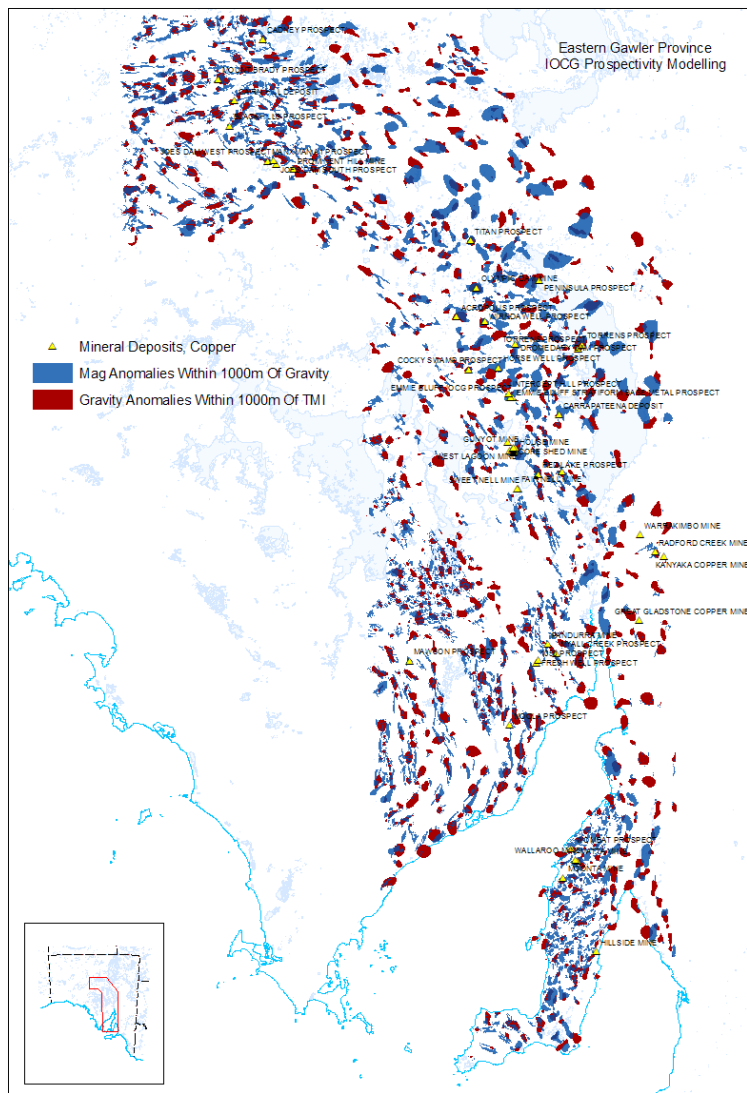


- ASTER, AEM and Exploration data
- Nine principal data layers with attributes
- Key sites or references
- Key sites of known uranium and heavy mineral occurrences
- Regional cross sections



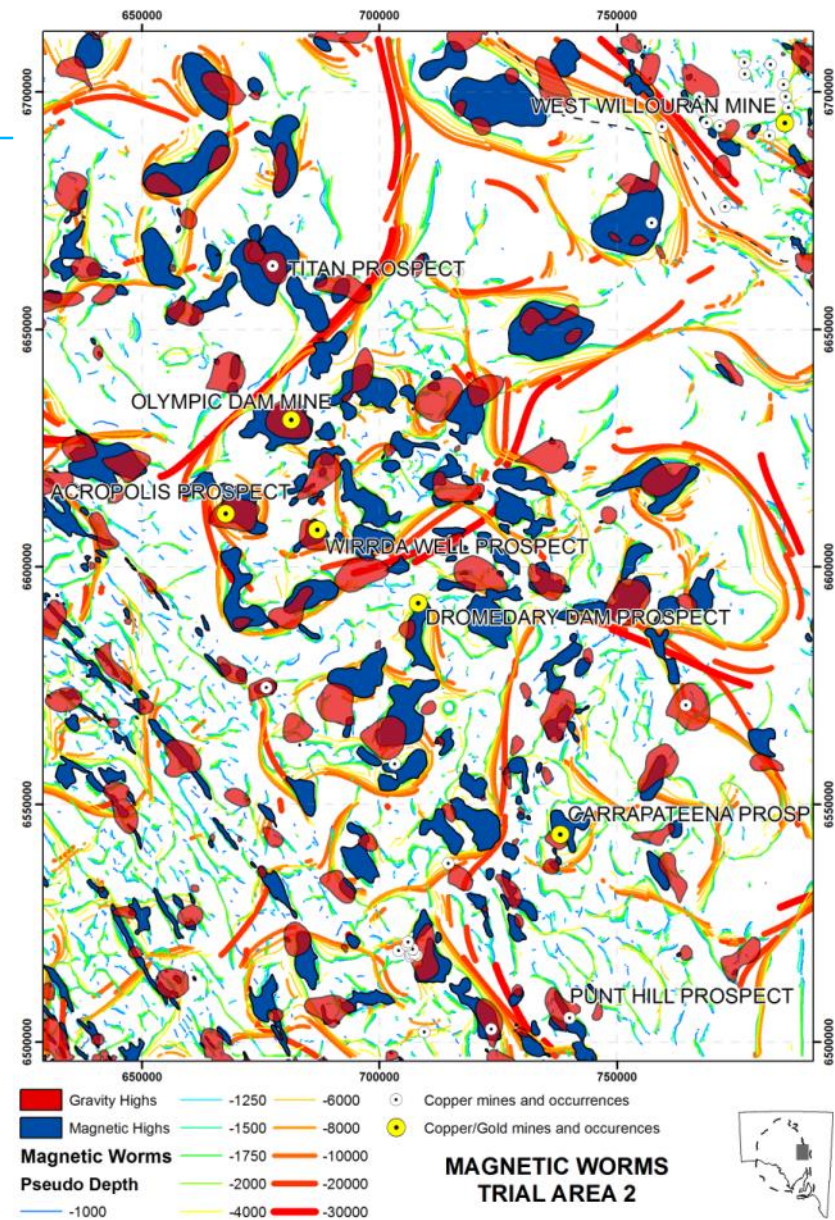


# GEOPHYSICAL TARGETING OF IOCG DEPOSITS

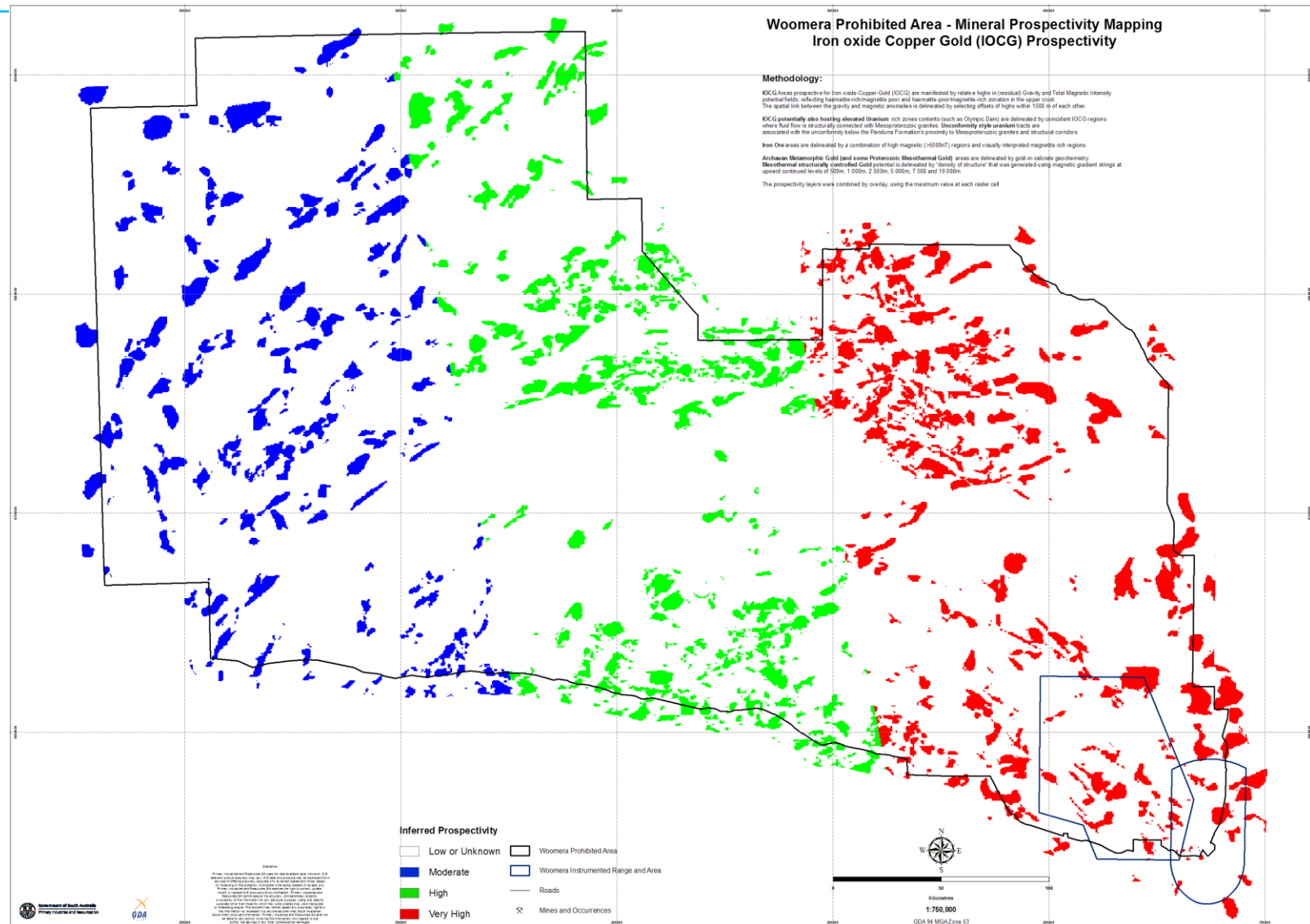


Occurrence name	Residual gravity anomaly area (Sq Km)	Residual magnetic anomaly area (Sq Km)	Residual gravity anomaly maxima (mGal)	Residual TMI anomaly maxima (nTesla)	Coincident anomaly image
Olympic Dam	53.2 (3)	74.2 (3)	5.2 (1)	420 (7)	
Prominent Hill	51.8 (4)	3 (14)	1.9 (6)	2540 (3)	
Torrens Prospect	3.1 (16) 27.7 (8) 64.4 (1)	17.5 (12) 49.7 (7)	2.75 (5)	1580 (4)	
Acropolis Prospect	54.5 (2)	86.8 (2)	4.3 (2)	2900 (2)	
Carrapateena Prospect	13.1 (12)	68.5 (4)	0.55 (12)	100 (13)	
Cockey Swamp Prospect	15 (11)	10.8 (13)	0.6 (11)	230 (10)	
Emmie North Prospect	11.3 (13)	27.5 (9)	1.05 (9)	490 (6)	
Dromedary Dam Prospect	1.5 (18) 17.2 (10)	61.3 (5)	0.45 (13)	230 (11)	
Punt Hill Prospect	3 (17) 3.2 (15) 9.9 (14)	45.8 (8)	0.8 (10)	120 (12)	
Horse Well Prospect	45.8 (5)	95 (1)	1.15 (8)	350 (8)	
Titan Prospect	24.3 (9)	23.5 (10)	3.35 (4)	4100 (1)	
Red Lake Prospect	34.5 (7)	51.7 (6)	3.45 (3)	330 (9)	
Wirrda Well Prospect	34.9 (6)	22 (11)	1.75 (7)	1270 (5)	

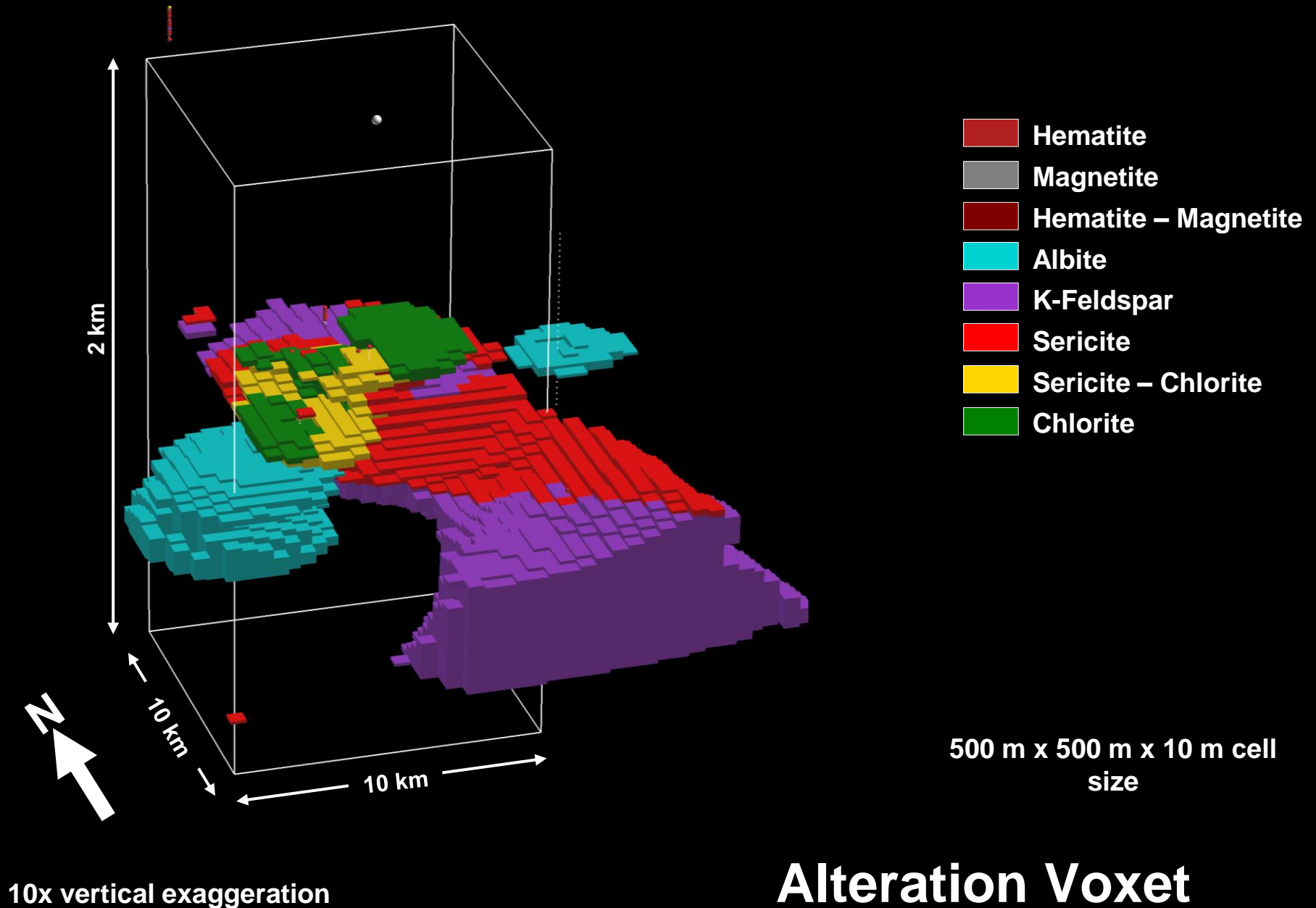
# STRUCTURAL TARGETING OF IOCGU DEPOSITS



# SOURCE-ROCK TARGETING OF IOCGU DEPOSITS



# 3D Mineral Mapping of IOCGU deposits





# **CARIEWERLOO BASIN UNCONFORMITY-RELATED URANIUM PROJECT**

Wilson T., Fairclough, M., Gouthas G., van der Wielen S., Mauger A. and Gordon G.

A Memorandum of Understanding between the Geological Survey of South Australia and the Saskatchewan Ministry of Resources and Energy, Canada was signed in 2009.

Analogies between the Athabasca Basin, Canada and the Cariewerloo Basin, South Australia.



Saskatchewan  
Ministry of  
Energy and  
Resources

# CARIEWERLOO BASIN PROJECT DATA RELEASE 2012

## HyLogger

95 drillholes

SWIR and TIR

PY-1 (DH 20712) SWIR

Vanguard-1 (DH 18092) TIR

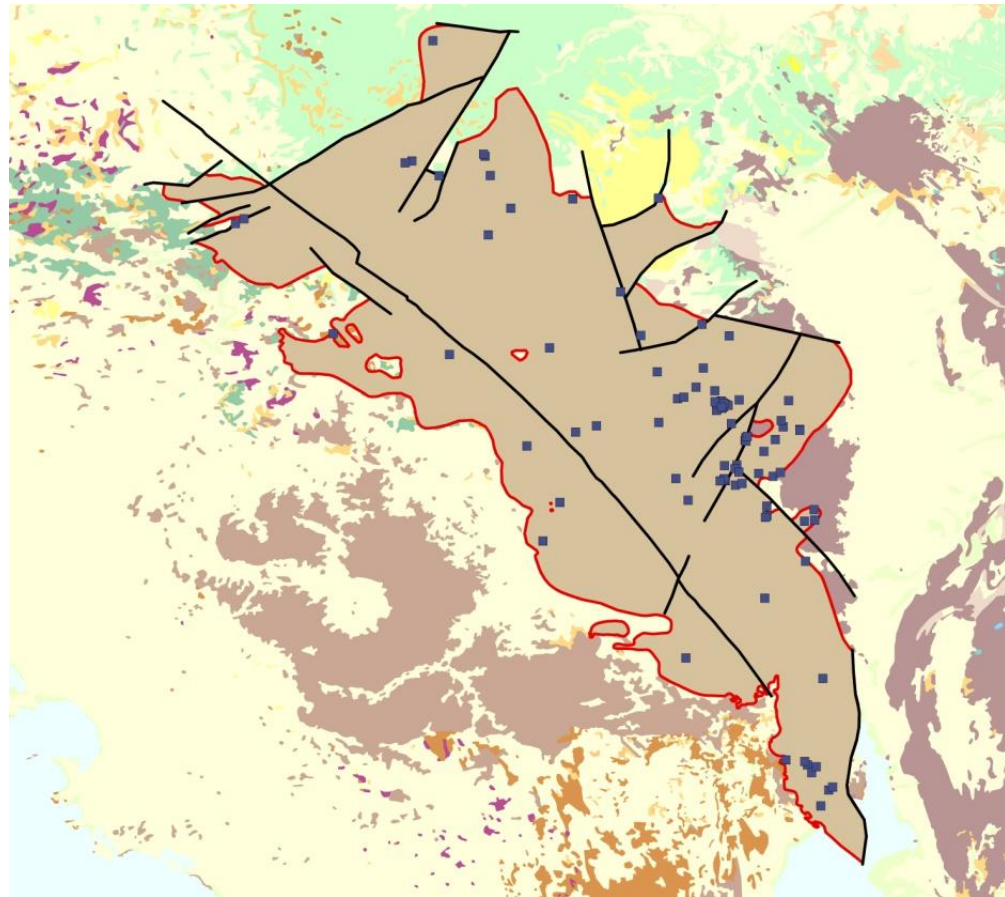
## Stratigraphic Logging

HyLogger datasets

## Geochemical Datasets

FPXRF

Assay





# CALCRETE-HOSTED URANIUM MINERAL POTENTIAL MODELLING

van der Wielen S. and Wilson T.

Uranium source

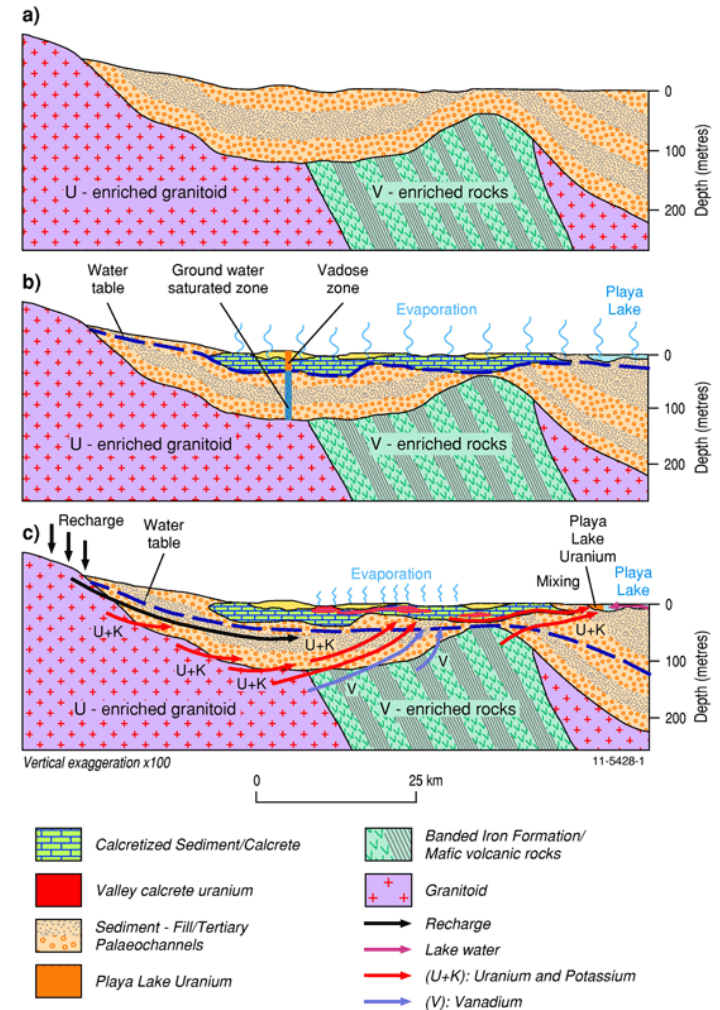
Vanadium source

Groundwater flow system

Calcrete

Climate

Groundwater salinity



Liu and Jaireth, 2011

# *Frome Embayment TEMPEST™ AEM*

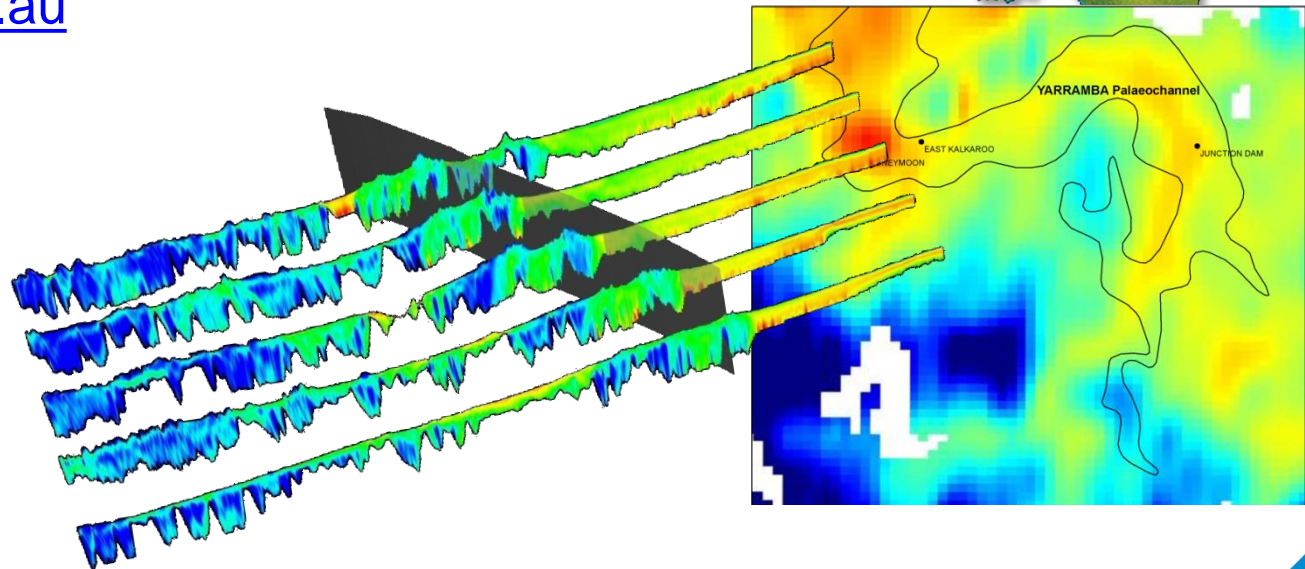
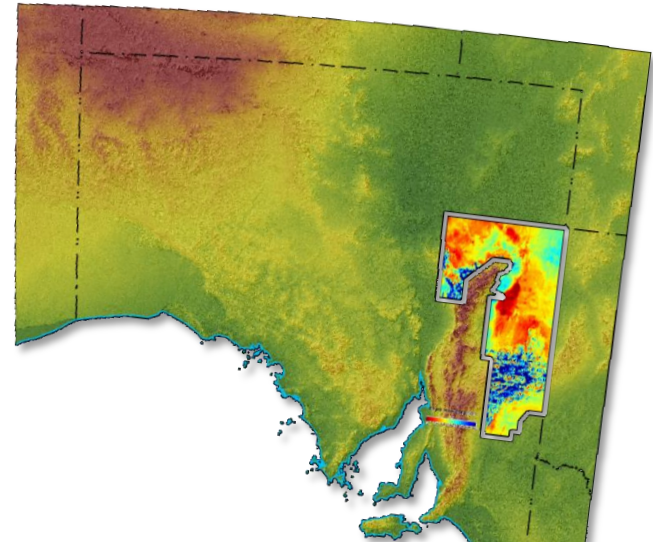


Collaboration with Geoscience Australia. Cost: \$2.5M (PACE \$0.25M).

Northern Murray Basin to north of Flinders Ranges: 95 000 km<sup>2</sup> total area, 25 000 line km

Available for download

[www.ga.gov.au](http://www.ga.gov.au)





Australian Government  
Geoscience Australia



Government of South Australia  
Department for Manufacturing,  
Innovation, Trade, Resources and Energy

# The Frome airborne electromagnetic survey, South Australia:

Implications for energy, minerals and regional geology

*Edited by I. C. Roach*

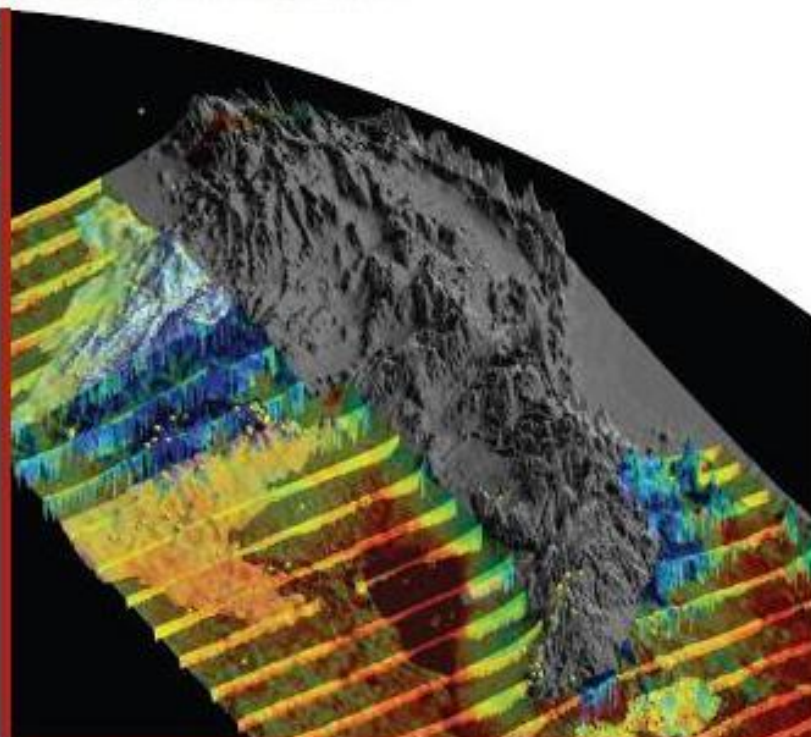
*With contributions from: R. C. Brodie, M. T. Costelloe, A. J. Cross,  
T. Dhu, A. J. Fabris, S. B. Hore, E. A. Jagodzinski, S. Jaireth, L. F. Katona,  
J. L. Keeling, P. D. Magarey, A. B. Marsland-Smith, B. H. Michaelsen,  
I. C. Roach, C. E. Wade and T. Wilson*

Record

2012/40

GeoCat #  
73713

DMITRE  
Report Book  
2012/00003



APPLYING GEOSCIENCE TO AUSTRALIA'S MOST IMPORTANT CHALLENGES

GEOSCIENCE AUSTRALIA Edited by  
RECORD 2012/040 I. C. ROACH

GEOLOGICAL SURVEY OF SOUTH  
AUSTRALIA  
REPORT BOOK 2012/00003

# PACE 2020 – Gawler Craton Gravity Survey 2013

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Gravity survey designed by Geological Survey of South Australia

Approximately **34,000 gravity stations**

Majority of survey is a 1km x 1km grid (2km x 2km grid in Southern region of the Continual Use Zone)

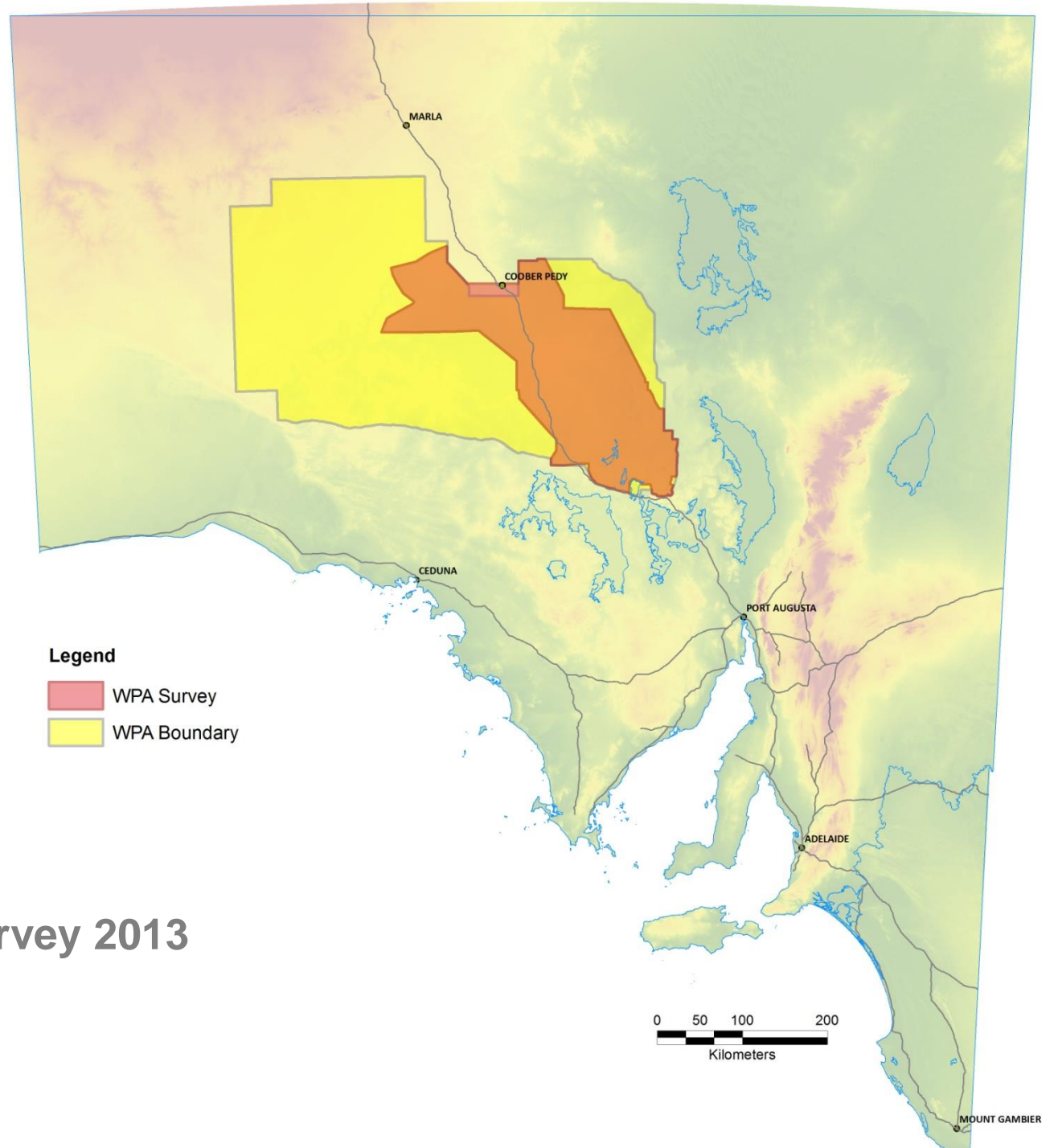
Partnership with GA in the tender process and managing the survey

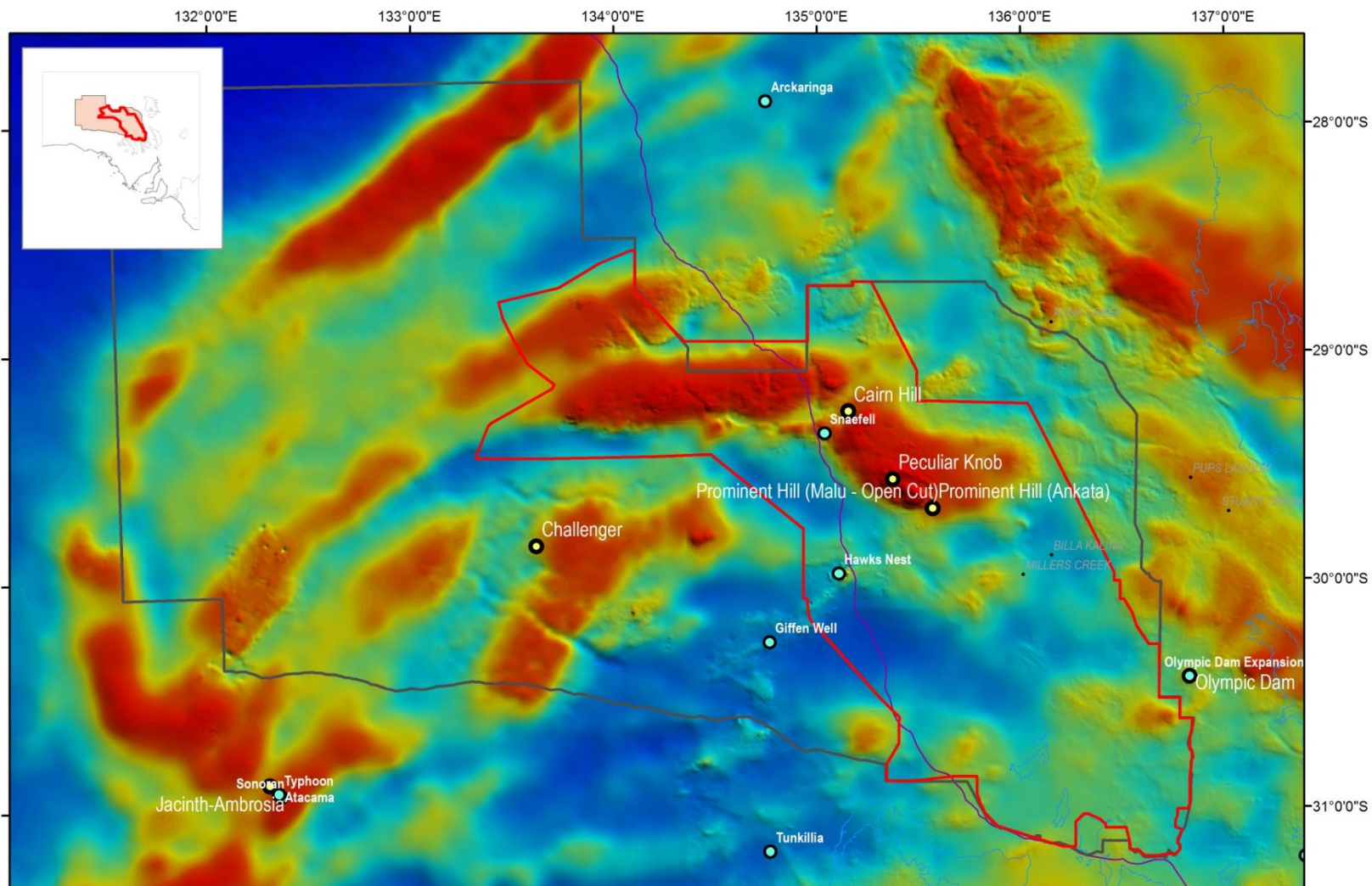
**Survey to commence in May 2013**





# PACE Gravity Survey 2013

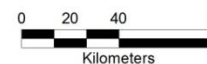




### Legend

- Mining Projects
- Major Mines
- WPA Survey
- WPA Boundary

1:2,000,000



## PACE Gravity Survey 2013



The background features a large, abstract geometric design. A diagonal line divides the image from the top-left to the bottom-right. The upper-left portion is a solid dark blue. The lower-right portion is white. Overlaid on these are several semi-transparent geometric shapes: a large blue rectangle in the upper-left, a smaller blue rectangle below it, a light blue rectangle further down, and a small green rectangle in the upper-right. The text 'South Australia' is positioned in the white area, below the diagonal line.

# South Australia

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Well positioned in the global uranium business

# SA's Uranium Exploration and Mining Business



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- South Australia hosts over 80% of Australia's combined RAR & inferred uranium resources and produces ~7% of world production
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- SA is delivering best practice regulation of uranium exploration and mining
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