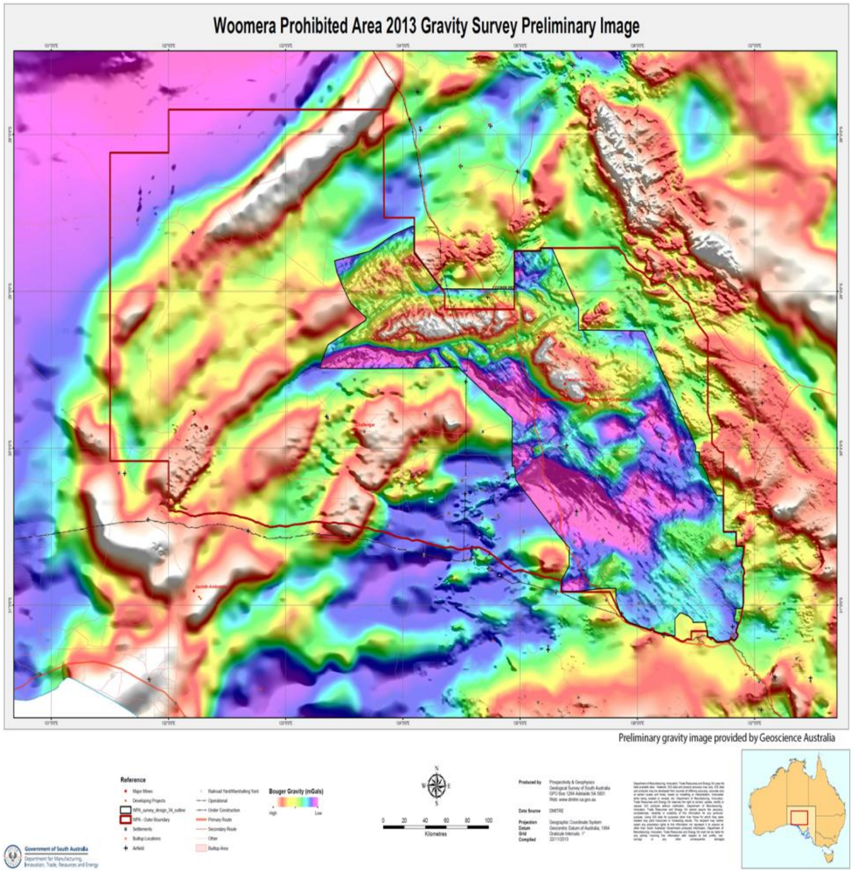
What is the future for Government Geoscience Initiatives in Australia?



Paul Heithersay

SEG International Exchange Lecturer 2014

UNCOVER

SUMMIT 2014

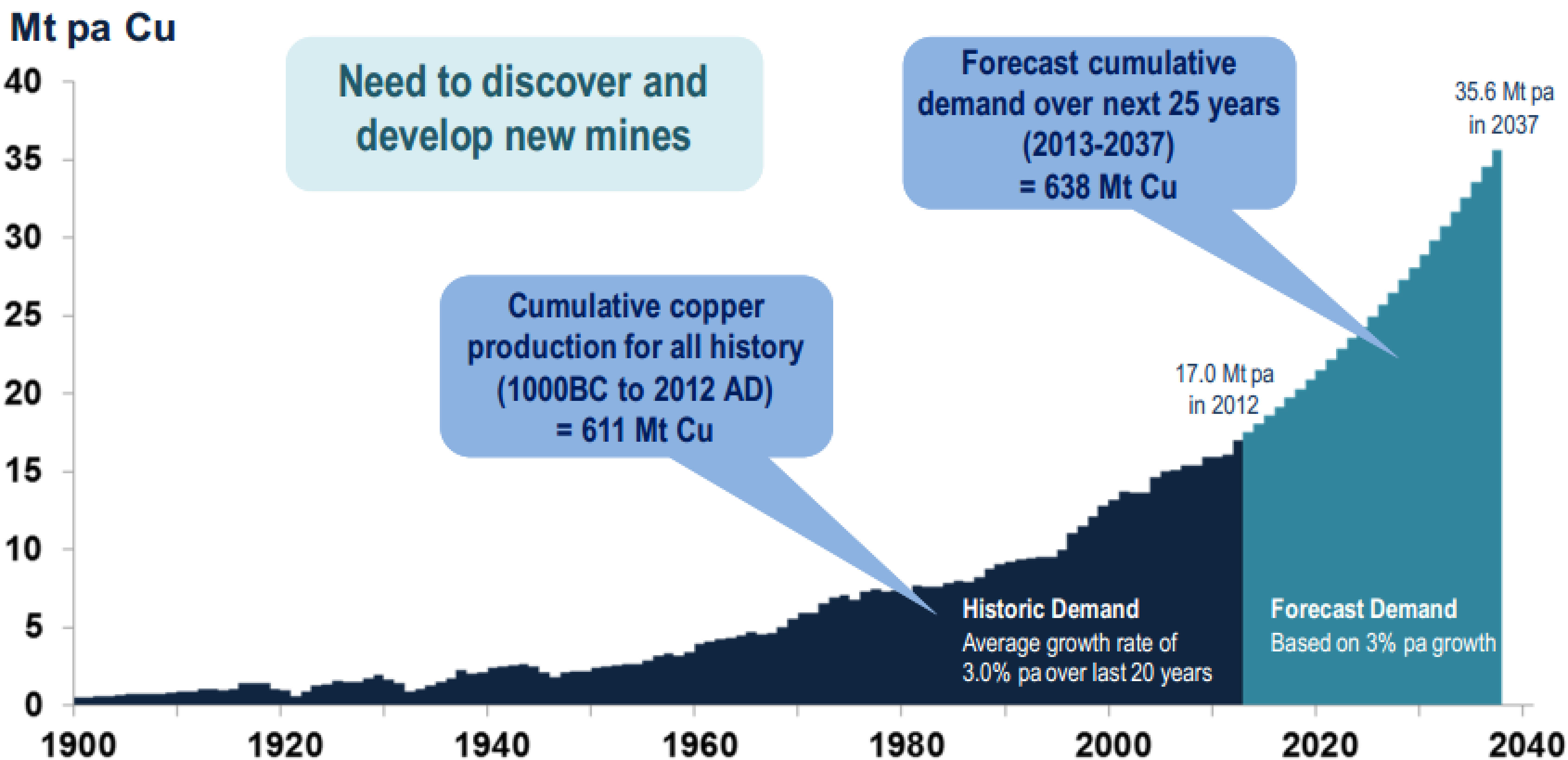
Adelaide

Conclusion

- Australia has a the grand challenge supplying food and resources to the world
- Australia is losing global market position in exploration expenditure
- It’s a global game and needs a national approach
- The UNCOVER framework is perfectly timed to fit this imperative
- It’s a three legged race now: Community, Industry and Government are linked

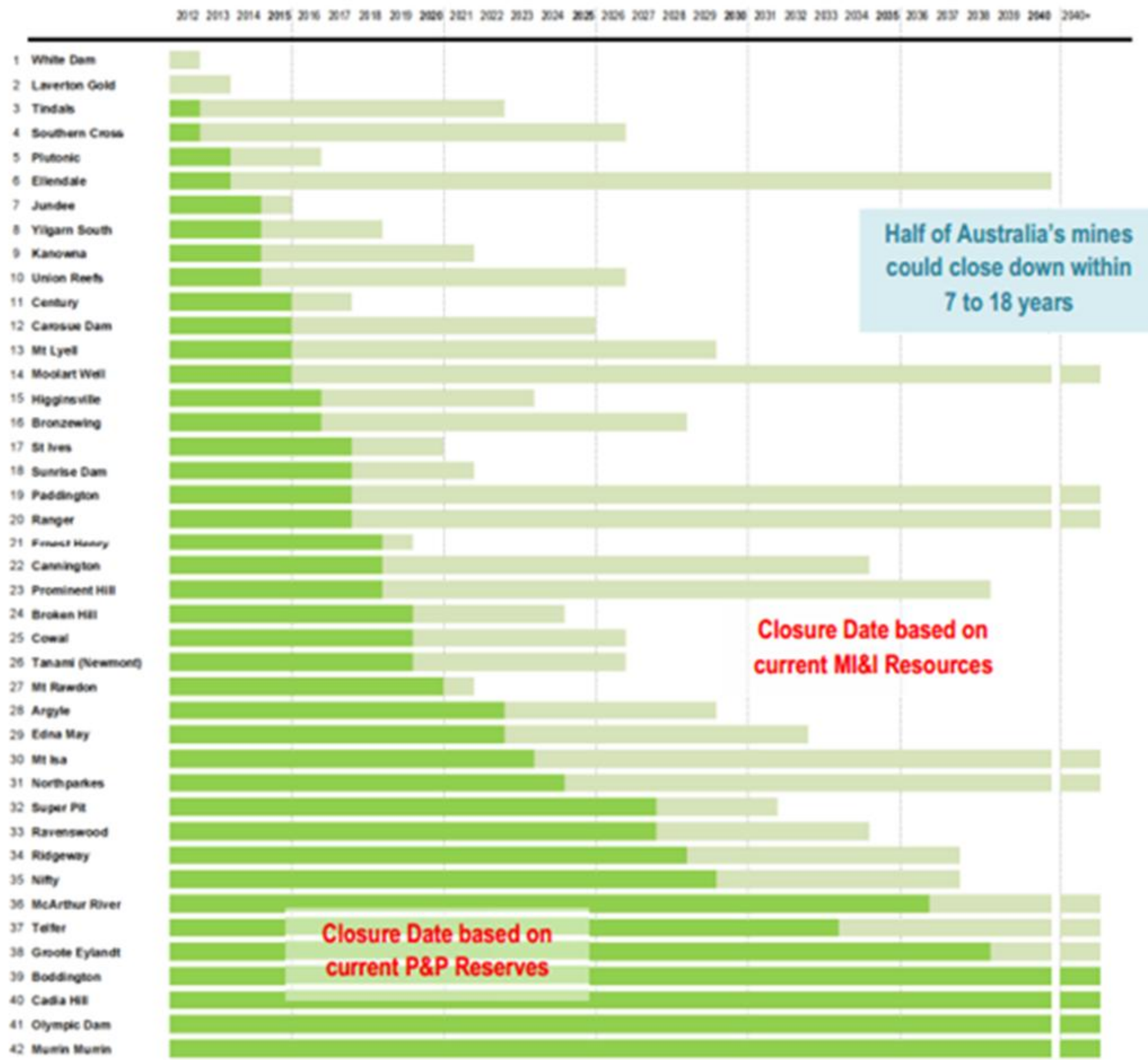
World's metal production doubles every 20-25 years

Primary copper production: 1900-2040



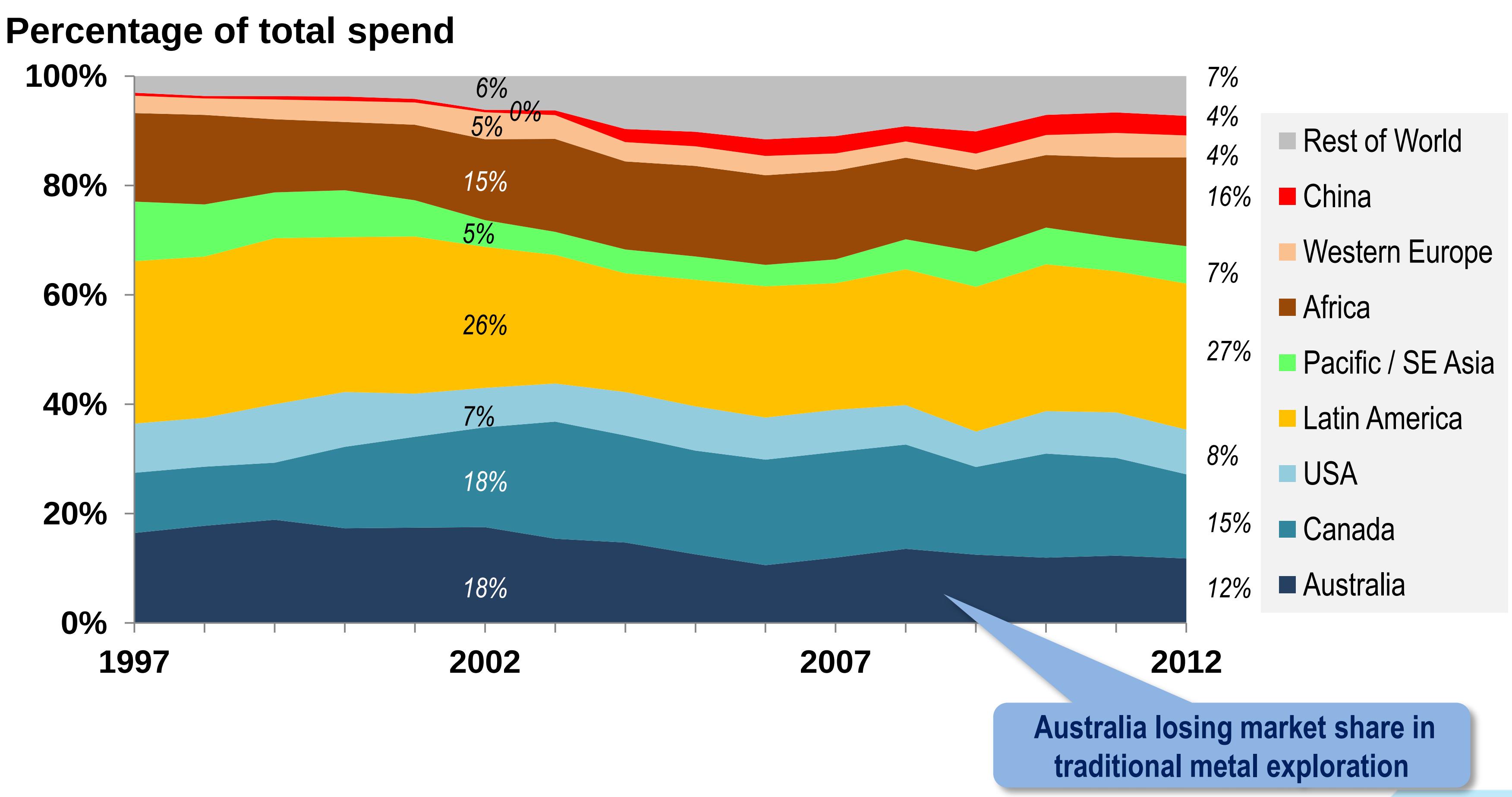
Minex Consultin

Half of Australia's mines will close in 7 to 18 years



Minex Consulting

Exploration Expenditures: World by Region – *excluding Bulks and Uranium*: 1997-2012

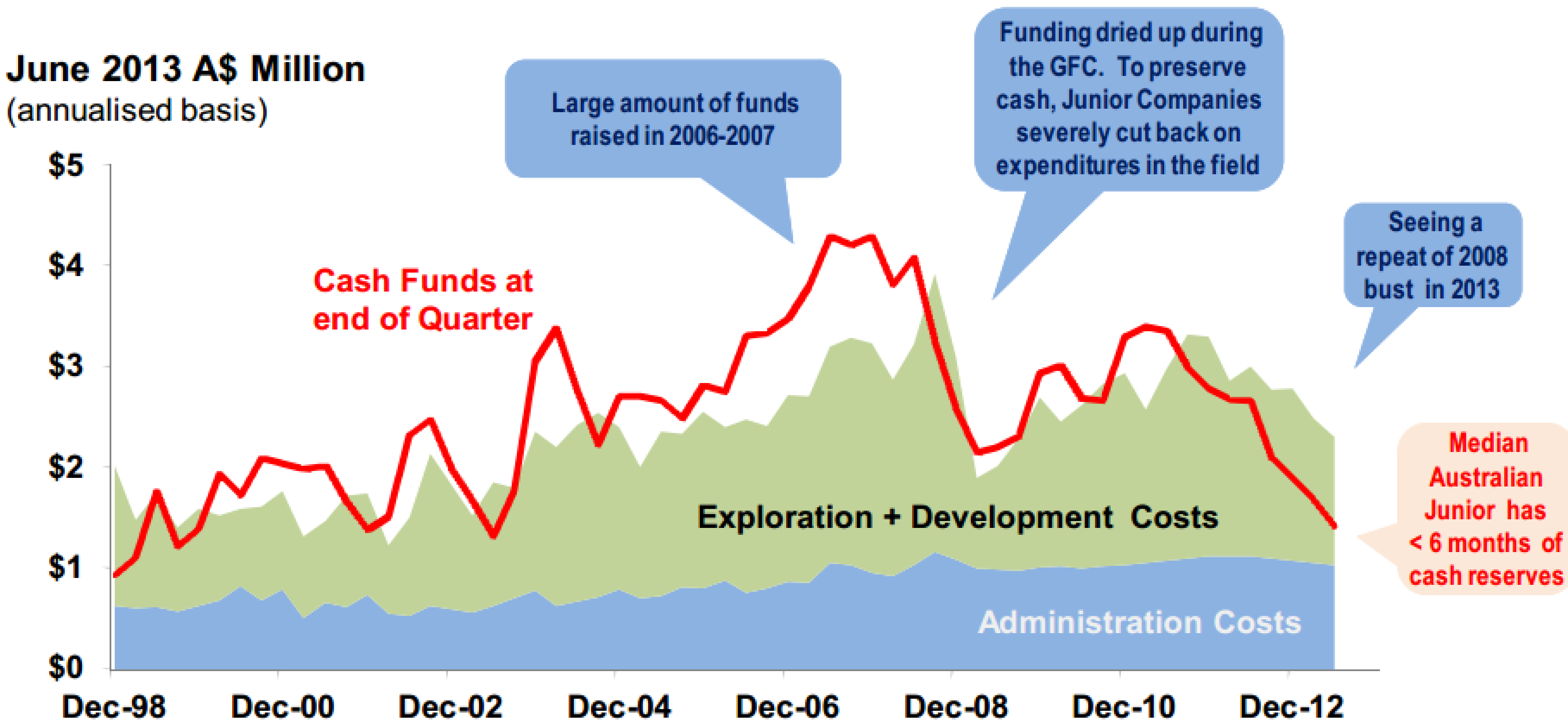


Note: "Rest of World" refers to Russia, Eastern Europe, Central Asian Republics, Mongolia, Middle East and South West Asia (including India and Pakistan)

Sources: MinEx Consulting estimates, based on data from ABS, NRCan, OECD and MEG

Spending by Junior Explorers is driven by availability of funds

Cash and Expenditures for the MEDIAN Australian Junior company: 1998- June 2013



Campaigns ▼ Get Organised ▼ Act Now ▼ Learn ▼ Resources ▼ Regions ▼ Donate ▼

[Latest Appeal | What's New | Take Action | Events | Latest News | Member Groups | Video Gallery]

GET EMAIL UPDATES

DONATE ACT NOW

SHOP EVENTS

Lock the Gate Alliance is a national grassroots organisation made up of thousands of individuals and over 160

Lock The Gate Alliance uniting to protect our cor expansions. In a David-a global corporations, our integrity and imagination

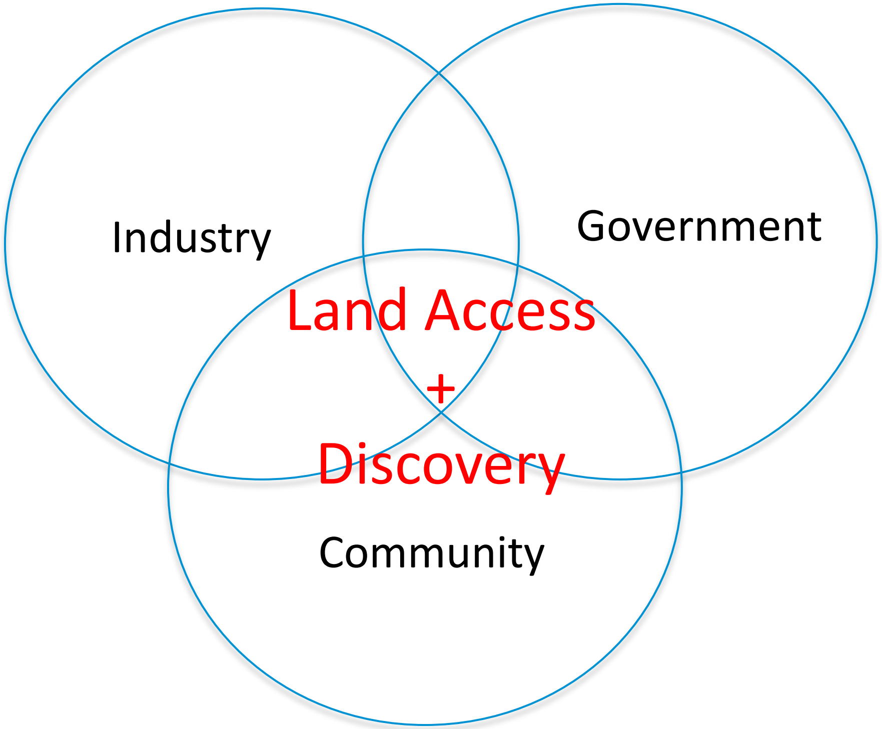
Find a Member Group

It's a three legged race now

Access to capital

Costs escalating

Market driven timeframes



Royalties

Local industry

Regional communities

Facebook

Ok if it is somewhere else

Compliance

Overall Community Benefit

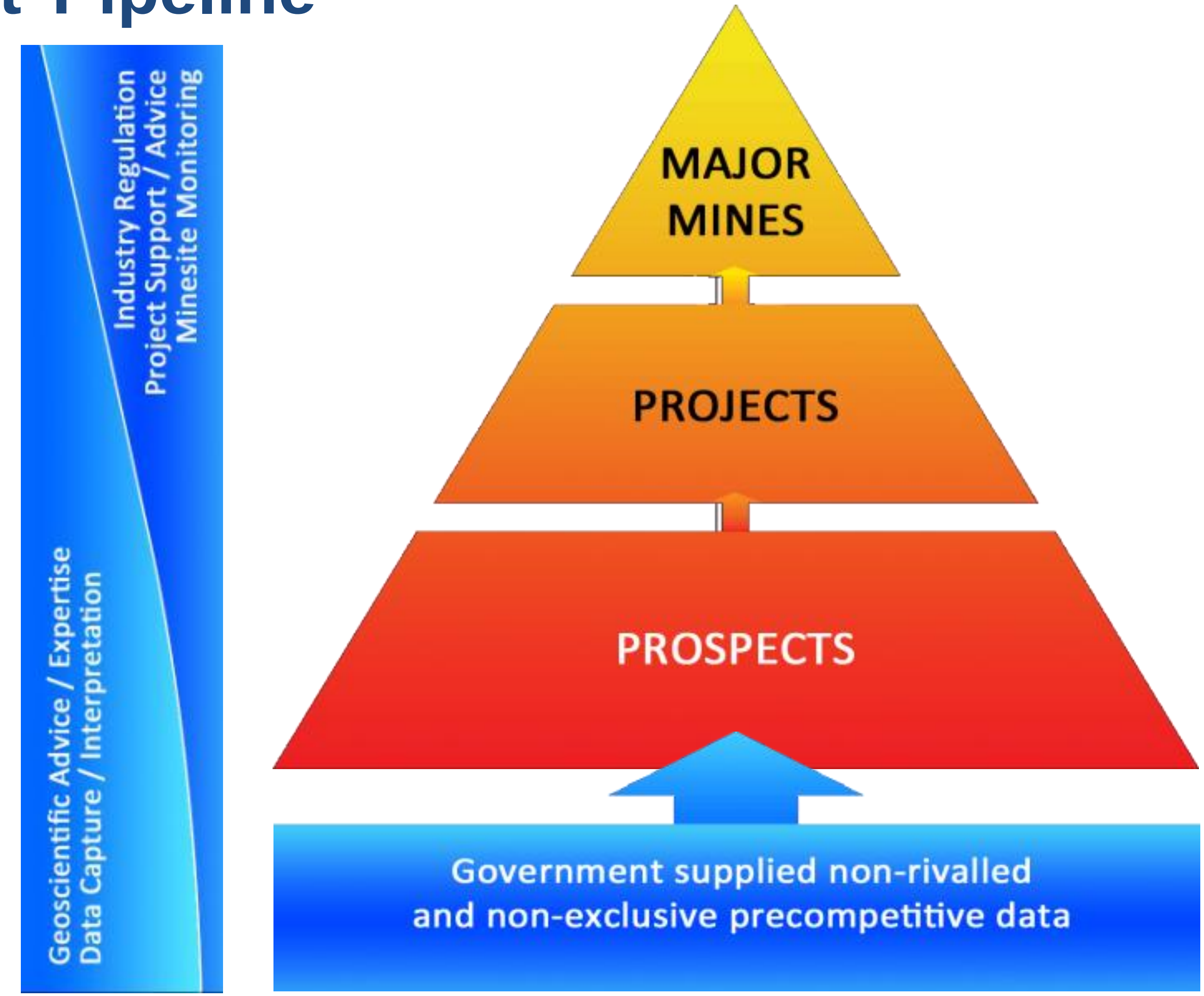
A global game needs a national approach

- National Depth and Cover map
- National map of deep crust and upper mantle
- National distal footprints
- National 4 D Metallogenic Map
- National research network
- Technology transfer process

Deep Cover Exploration Impediment…

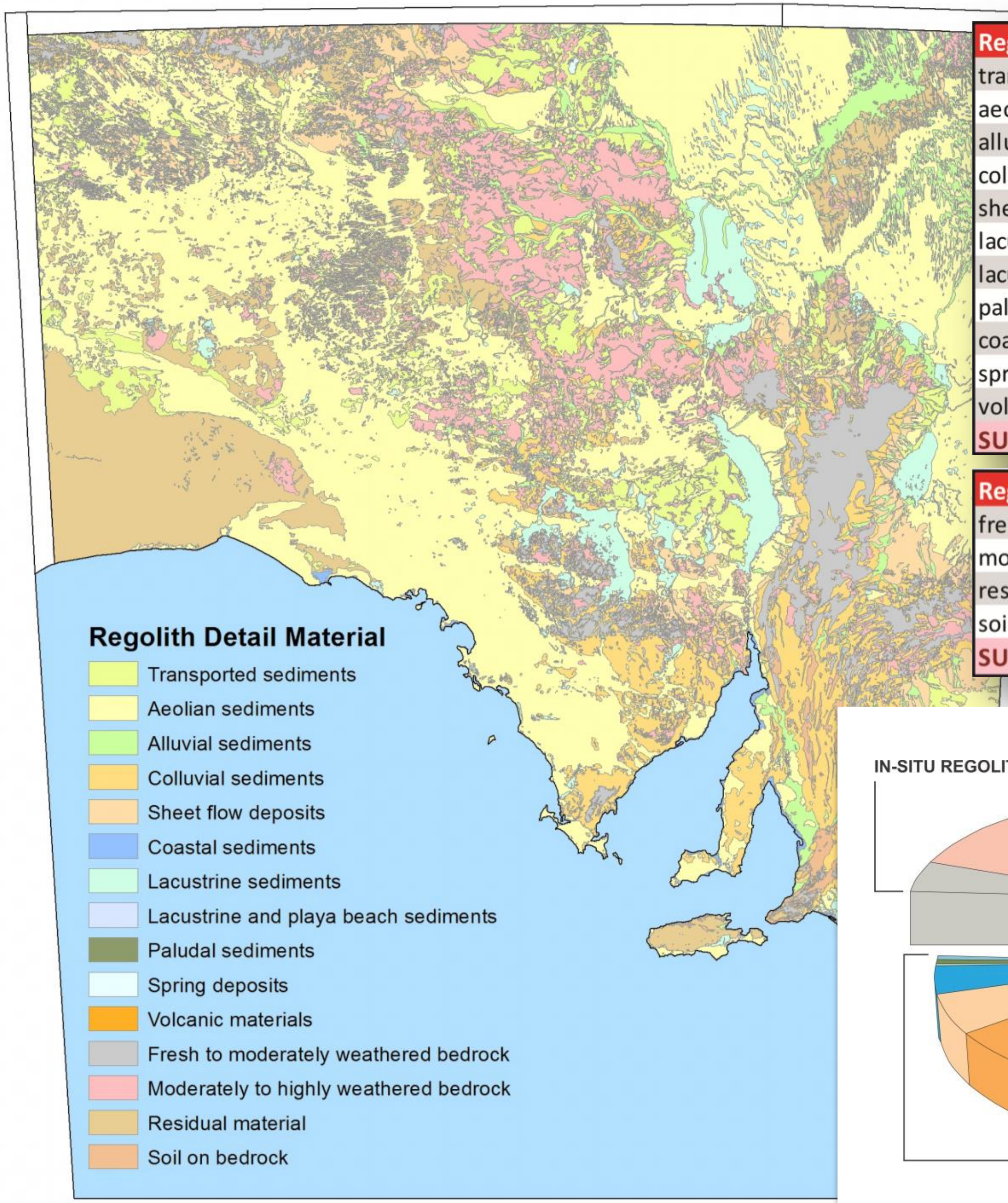
Moon Plain, Stuart Shelf, SA (Photo S.Hill)

Project Pipeline



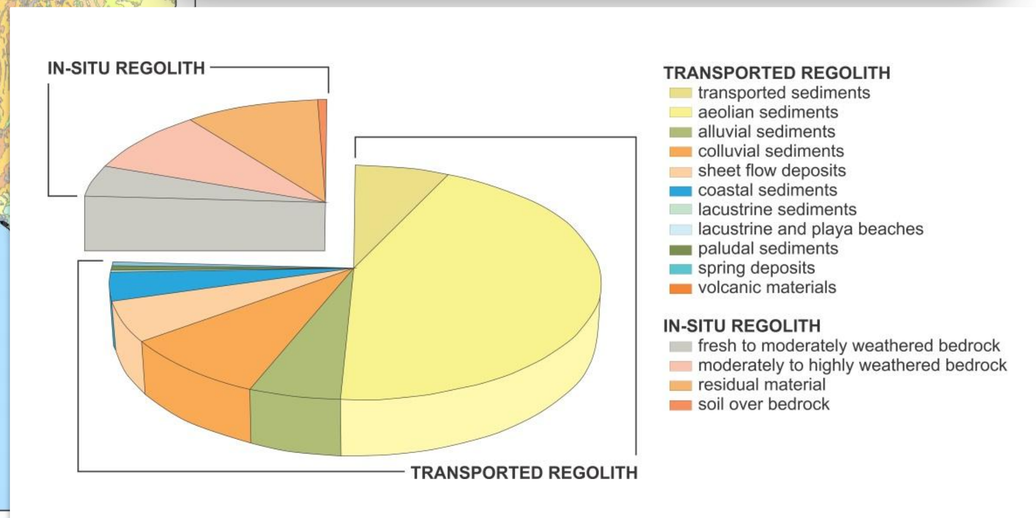
South Australia – the state is covered! (from Carmen Krapf, GSSA)

75% is transported regolith!

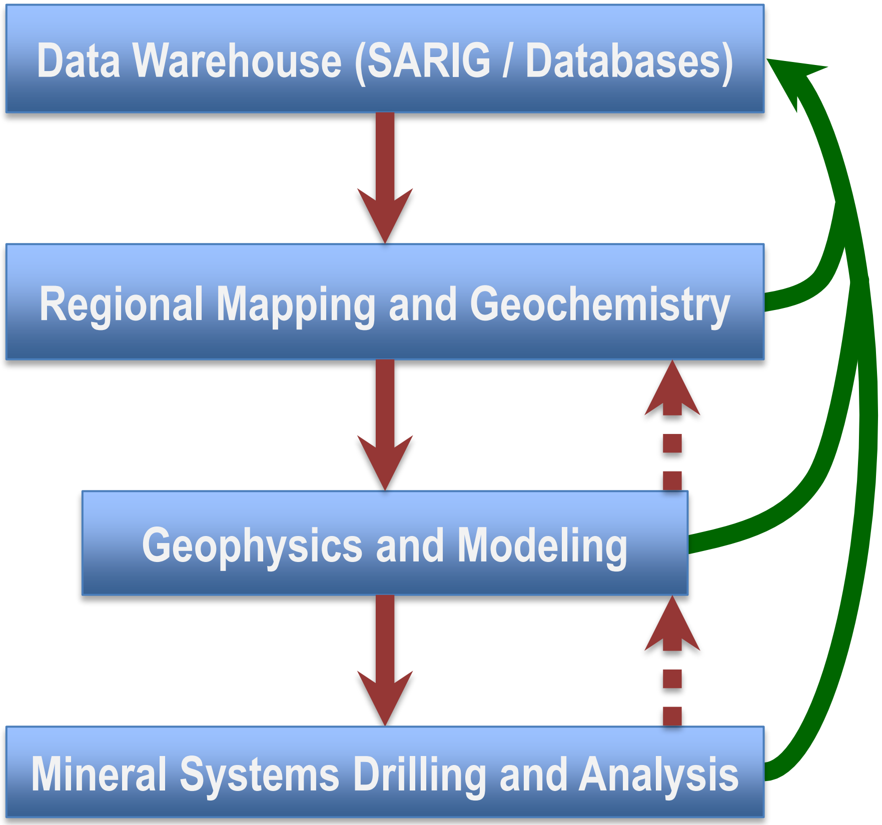


Regolith Material TRANSPORTED	AREA in sqkm	AREA in %
transported sediments	69304.44	7.05
aeolian sediments	429955.94	43.76
alluvial sediments	52894.60	5.38
colluvial sediments	85602.62	8.71
sheet flow deposits	53286.47	5.42
lacustrine sediments	39114.82	3.98
lacustrine and playa beach sediments	954.26	0.10
paludal sediments	8036.47	0.82
coastal sediments	4282.08	0.44
spring deposits	279.50	0.03
volcanic materials	78.28	0.01
SUM TRANSPORTED	**743789.47**	**75.70**

Regolith Material IN-SITU	AREA in sqkm	AREA in %
fresh to moderately weathered bedrock	43481.04	4.43
moderately to highly weathered bedrock	90126.05	9.17
residual material	98452.61	10.02
soil on bedrock	6709.09	0.68
SUM IN-SITU	**238768.79**	**24.30**



Transformative Precompetitive Geoscience Workflow



- *Characterising cover*
- *Lithospheric architecture*
- *4D geodynamic and metallogenic evolution for ore deposit origins*
- *Characterising and detecting distal footprints of covered mineral systems*
- Cheaper, faster drilling
- Effective data delivery and interpretation
- Develop new and innovative exploration techniques and methodologies

New Data Releases for Pre-competitive Exploration Workflow

Marree Region

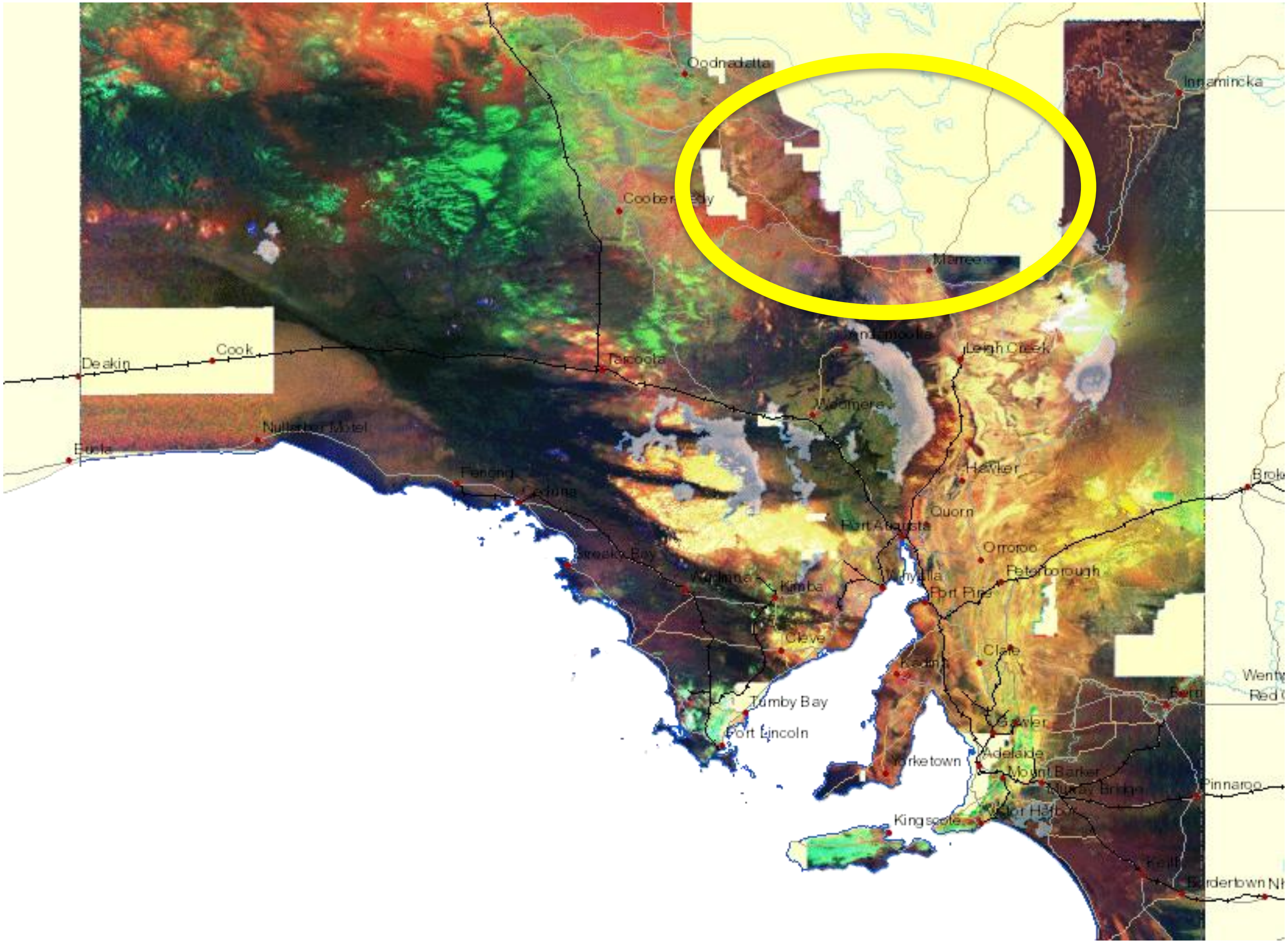
- New edition 1:250k Geology Sheet (White, Sheard & Reid, 2012)
- Prospective for wide range of commodities, especially uranium and base metals
- Most of region has Mesozoic to Recent transported cover (esp. aeolian dunes)
- DMITRE / Geoscience Australia: Frome Airborne Electro-Magnetic (AEM) survey

New Marree Airborne Data Release

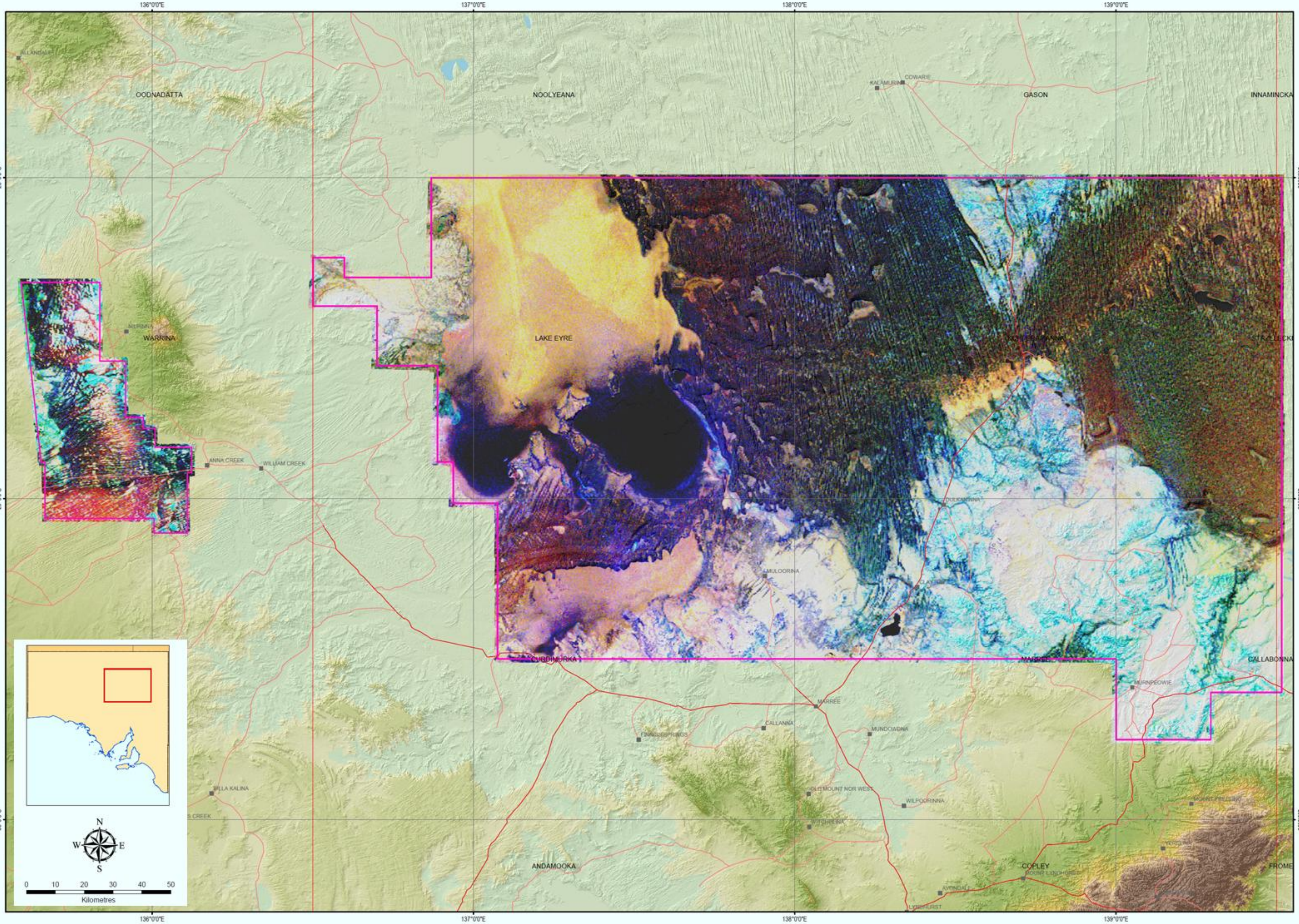
  - Commenced September 2012
  - Cost $810,000 (from 2011/12 PACE Budget)
  - 131,437 line km data within 45,000 km^2
  - 400 m line spacing / 80 m fixed wing flight elevation
  - Geoscience Australia conducted tender process and QA/QC
  - Public release via SARIG

- Radiometric data
- Magnetic data

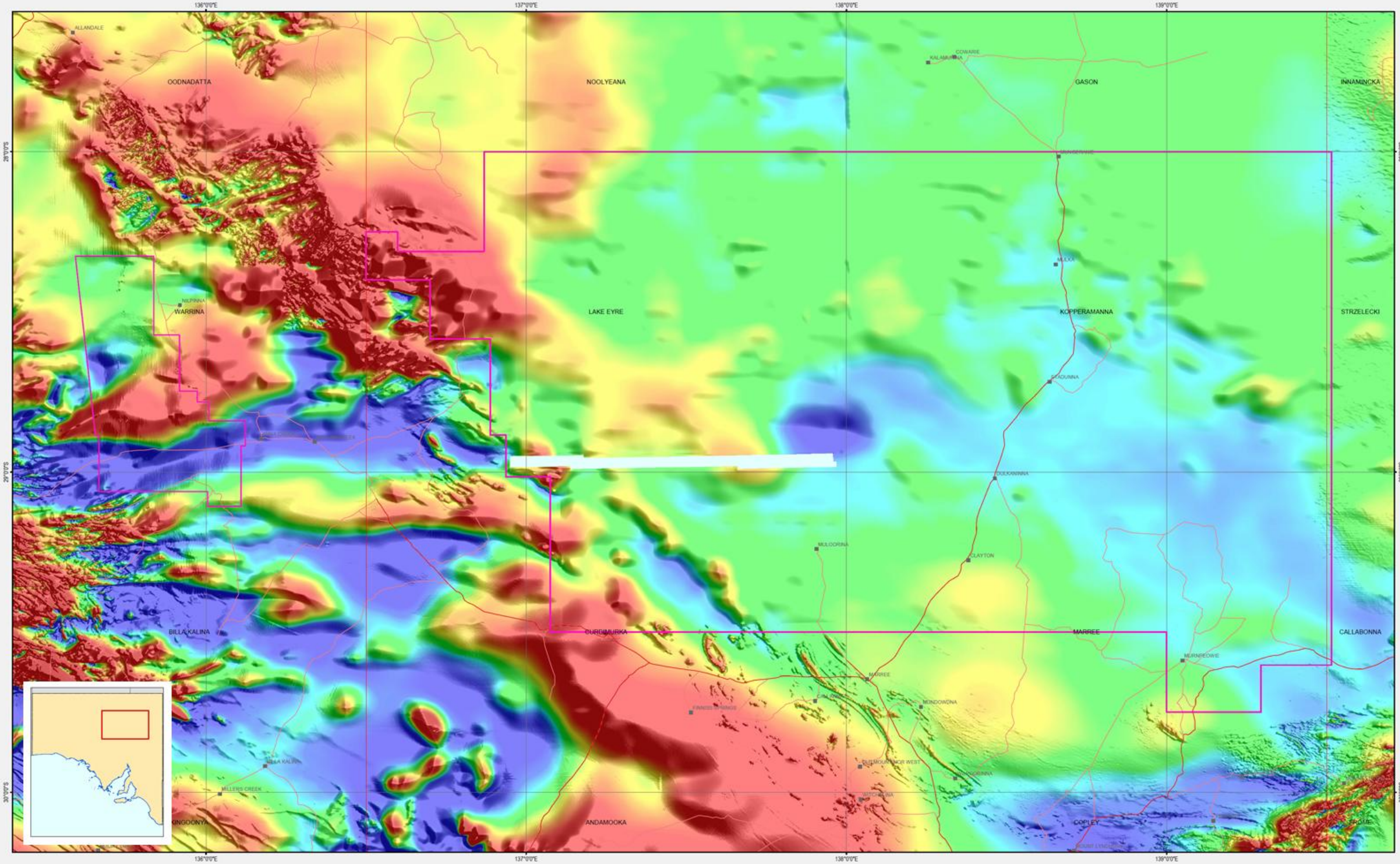
SA Radiometrics Coverage…



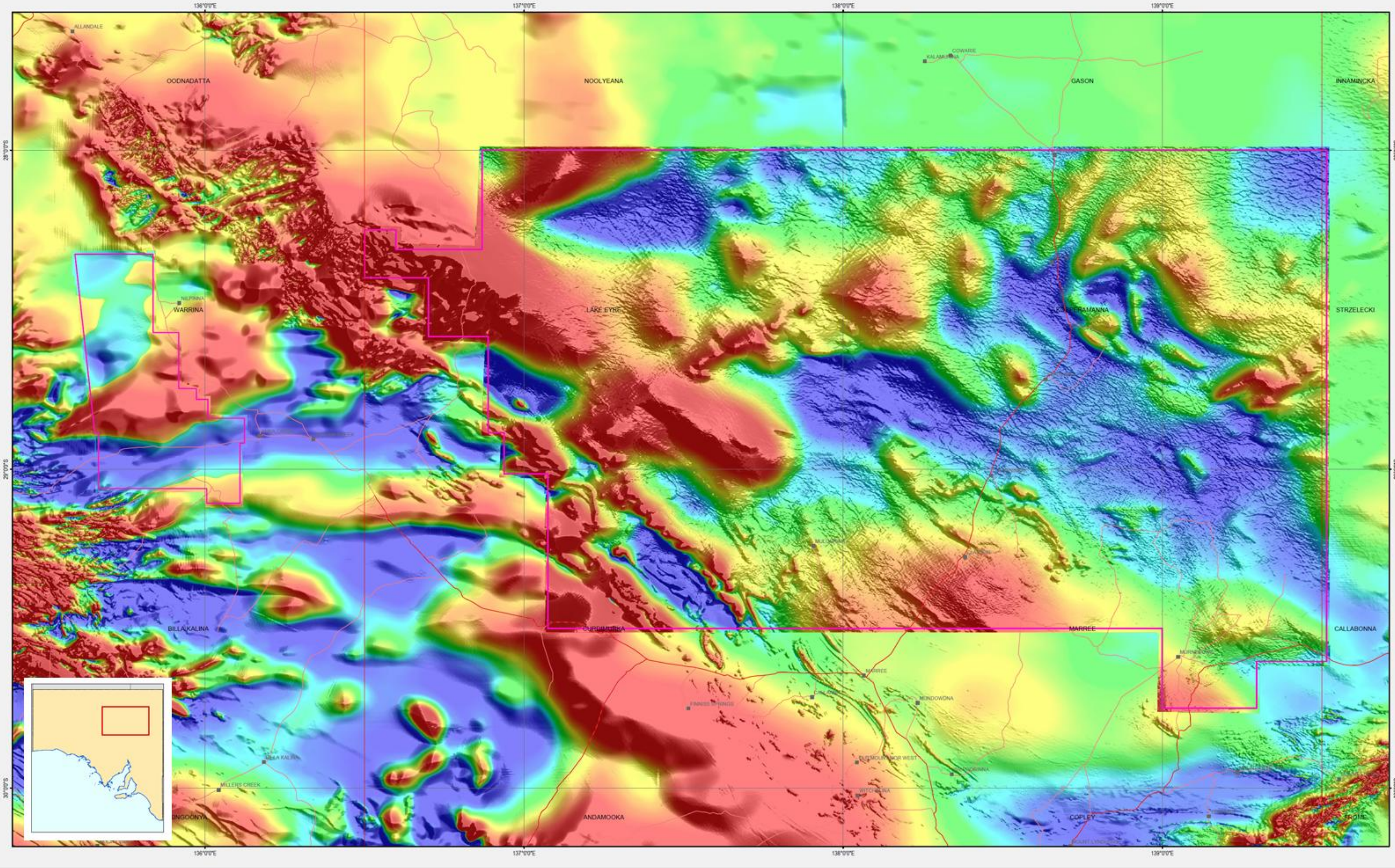
Marree - Ternary Radiometric Image

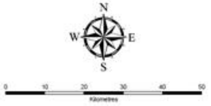


Marree Region - Total Magnetic Intensity - Pre 2013 Survey



Marree Region - Total Magnetic Intensity - Post 2013 Survey (Preliminary)





New Data Releases for Pre-competitive Exploration Workflow

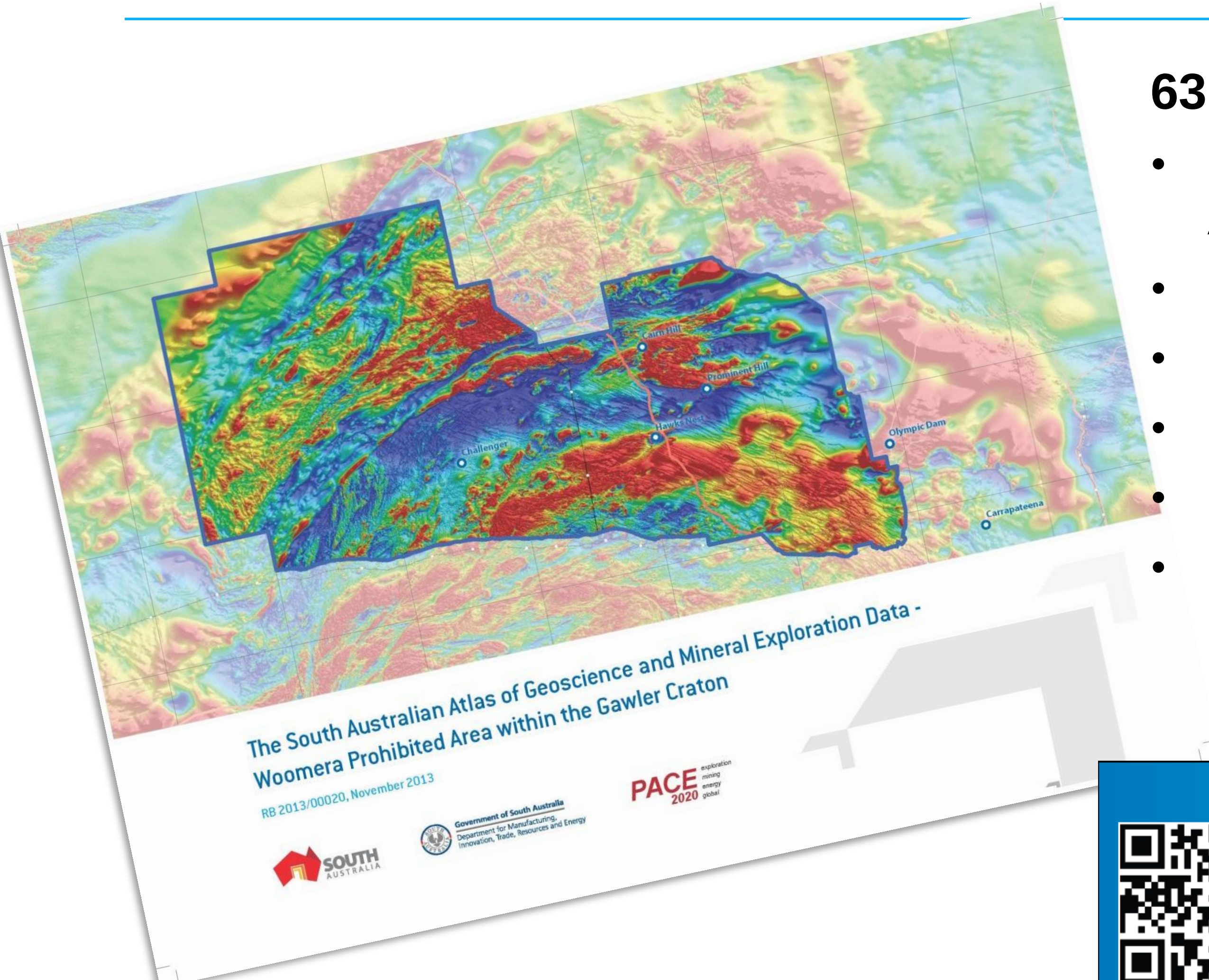
Woomera Prohibited Area (WPA)

- **South Australia Atlas of Geoscience and Mineral Exploration Data – Woomera Prohibited Area within the Gawler Craton**
  - Visual display of current open file exploration data

- **Gawler Craton (WPA) Gravity Survey**
  - Partnership between DMITRE / Geoscience Australia / Department of Defence
  - 34,541 new gravity measurements at 1 km x 1 km resolution, except in the continual use zone of the WPA where resolution is 2 km x 2 km
  - 3,458 repeat stations (QA/QC)
  - ~$2 M from 2012/13 PACE Budget

- **Gawler Craton (WPA) Reprocessed and Recompiled Magnetics Data**
  - Addition of 2000-2007 open file data
  - GSSA reprocessing
  - Compliments Gravity Survey Data
  - Valuable mineral system targeting data, especially for IOCG systems

South Australia Atlas of Geoscience and Mineral Exploration Data – Woomera Prohibited Area within the Gawler Craton



63 key maps and images!

- Land Access & Administration
- Geology
- Geophysics
- Drillholes & Rock Samples
- Remote Sensing
- Historic Exploration

Now available on SARIG!!!

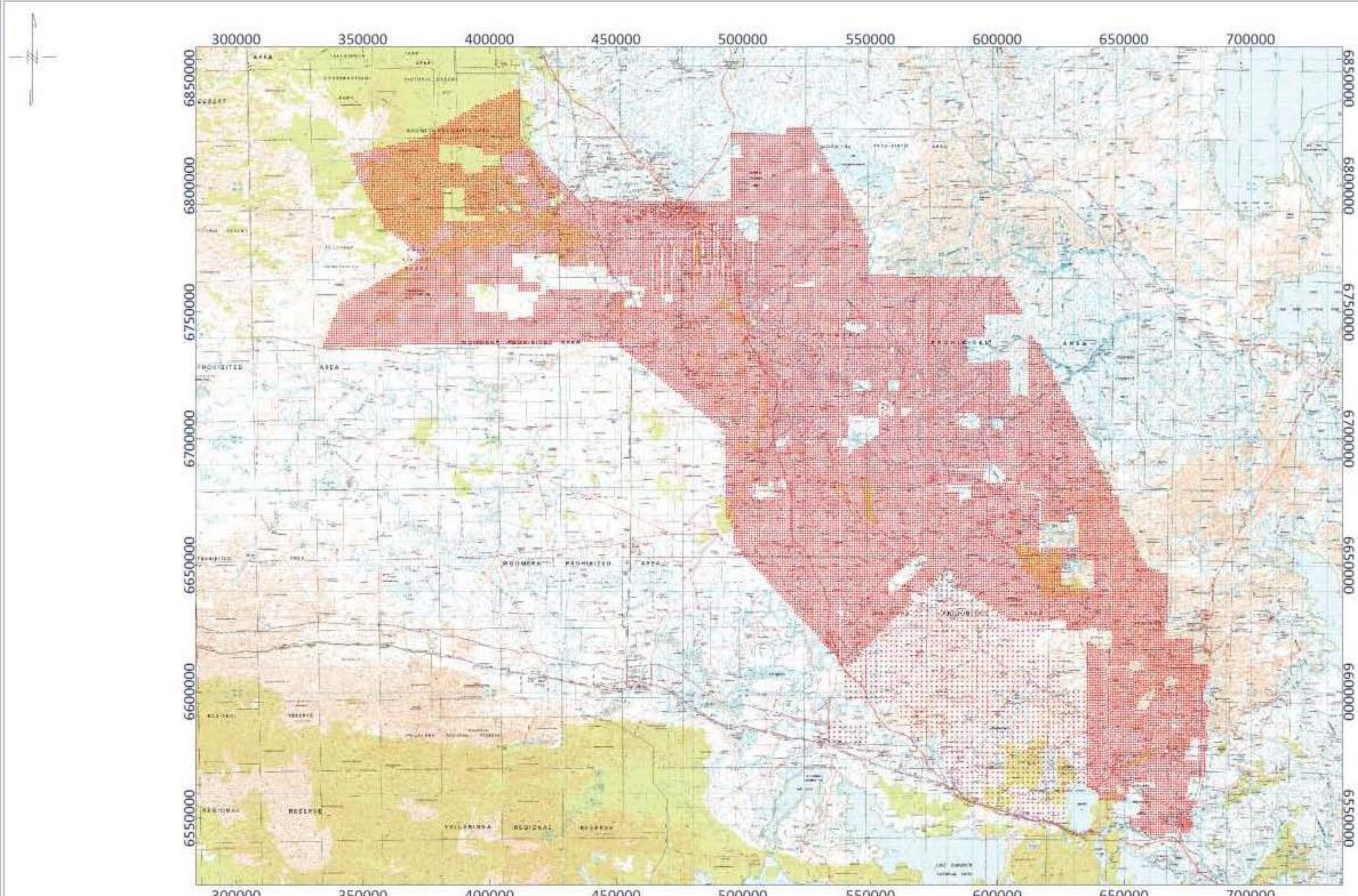
The South Australian Atlas of Geoscience and Mineral Exploration Data - Woomera Prohibited Area within the Gawler Craton

RB 2013/00020, November 2013

The Atlas document, and all constituent data, are freely avaliable through the South Australian government's online geoserver

SARIG

sarig.dmitre.sa.gov.au



GEOSCIENCE AUSTRALIA - PROJECT 201350

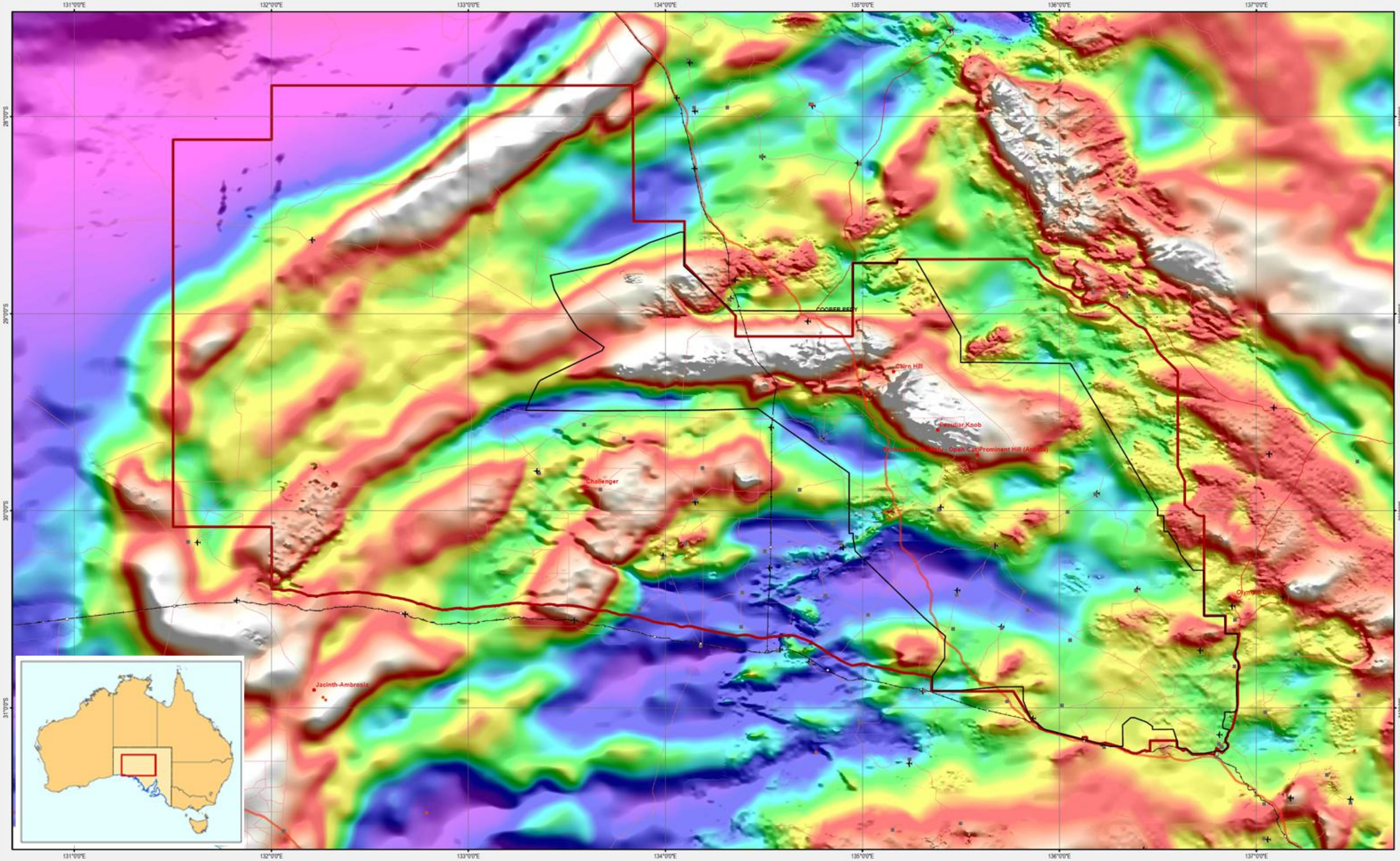
Woomera Prohibited Zone Regional Gravity Survey
Gravity Station Locations
34,697 Stations Acquired

Survey By: Daishsat Geodetic Surveyors

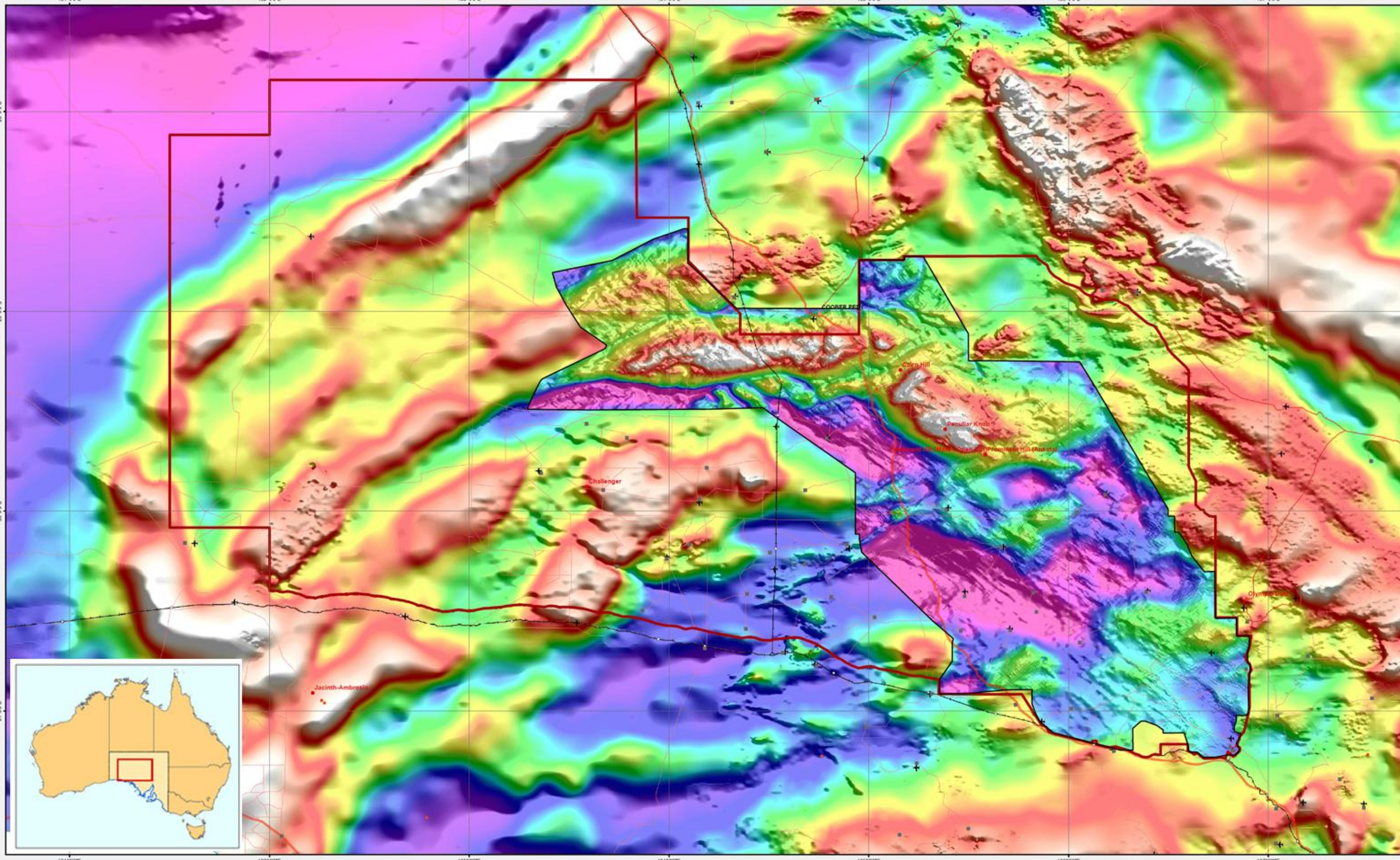
1km x 1km / 2km x 2km Regional Grid
Daishsat Project #13005
May - October 2013
Created By: G.A. Coopes

Scale 1:1600000
25000 0 25000 50000 75000
(meters)
GDA94 / MGA zone 53

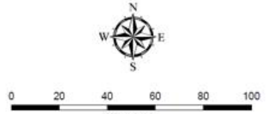
Woomera Prohibited Area Gravity 2011



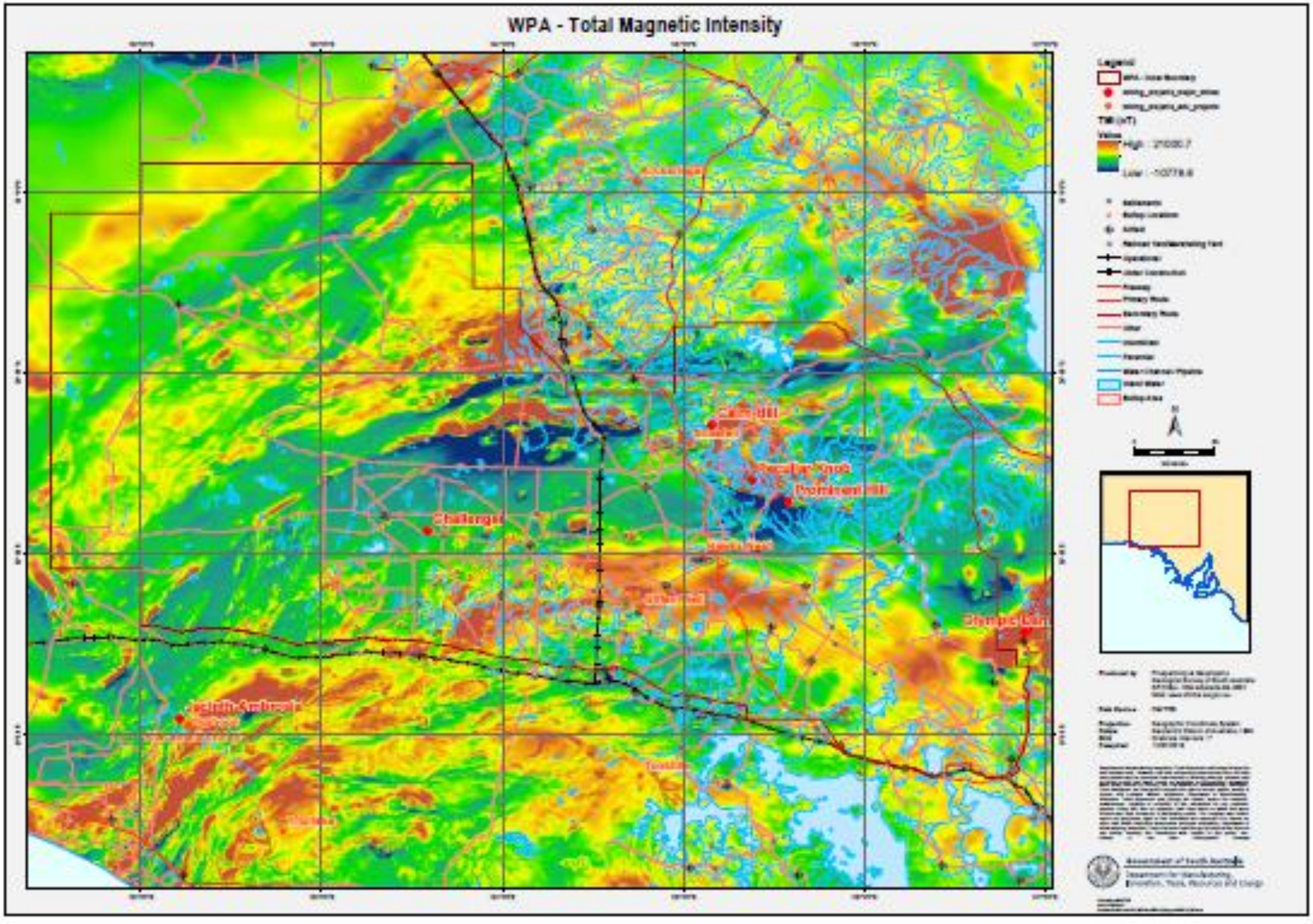
Woomera Prohibited Area 2013 Gravity Survey Preliminary Image



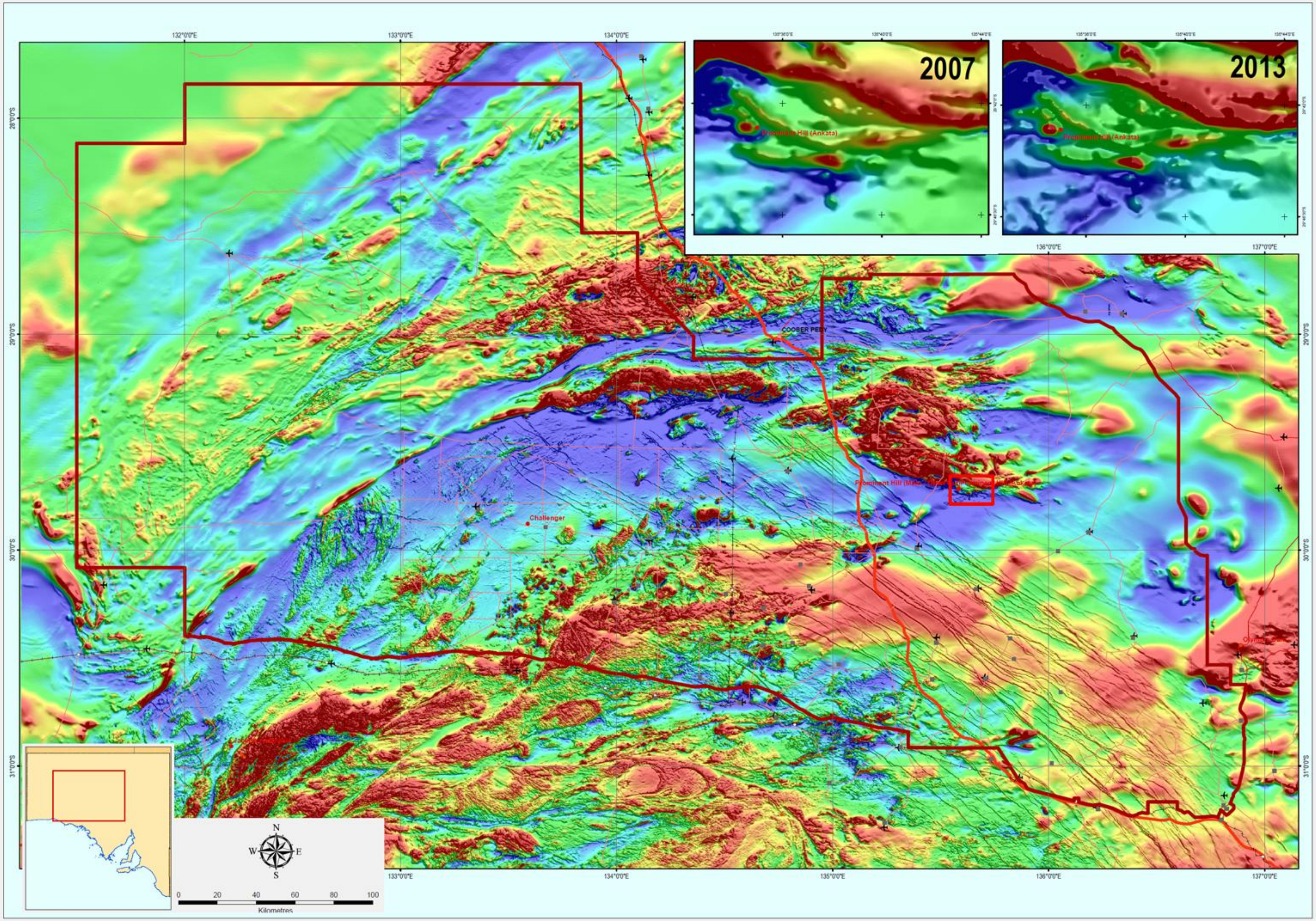
Preliminary gravity image provided by Geoscience Australia



WPA – Total Magnetic Intensity Image (2007)



WPA - Total Magnetic Intensity Image - Reprocessed 2013 (Preliminary)



Regional Mineral System Drilling…

Gibber plain (Photo S.Hill)

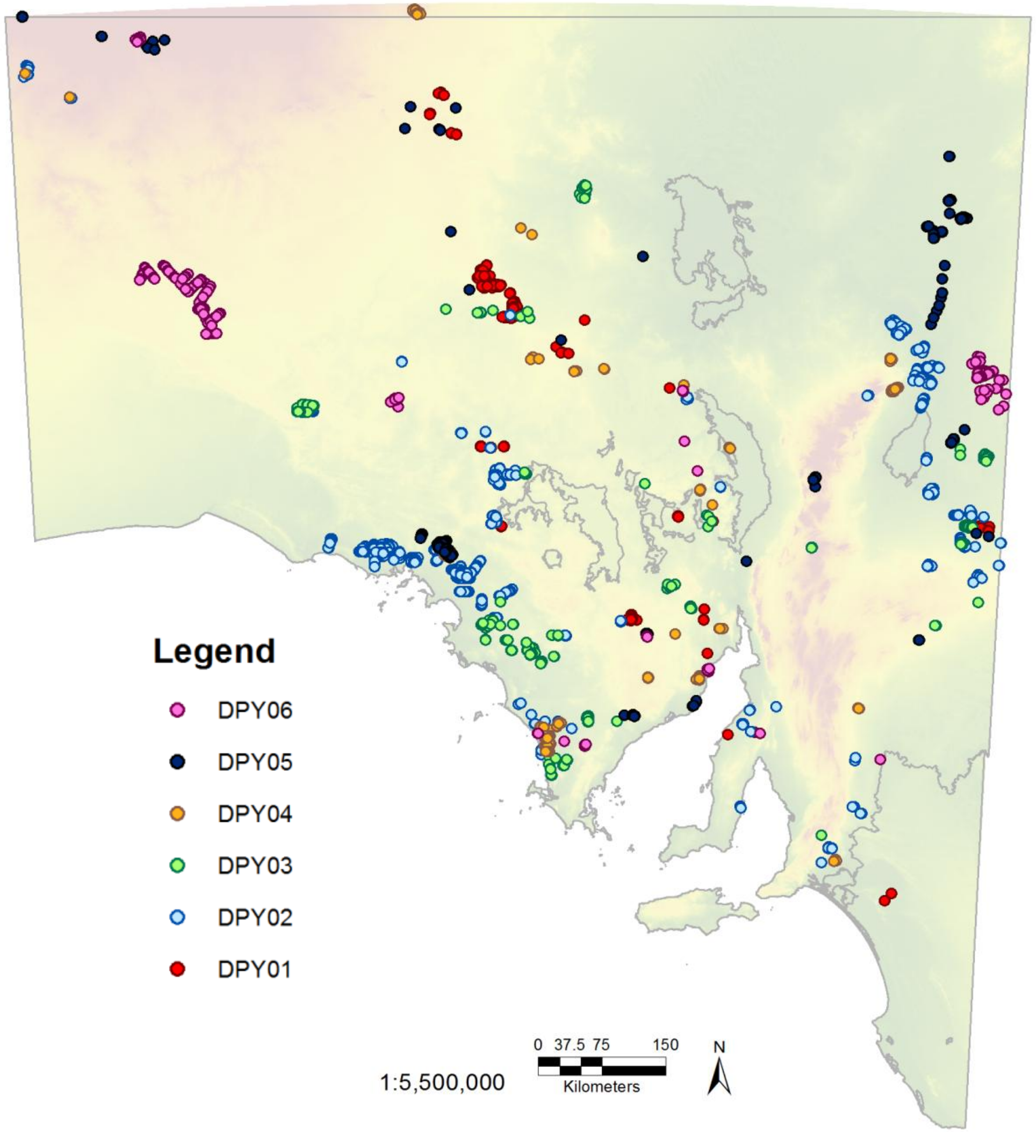
PACE Collaborative Drilling

8.8M Government spend leveraged over $24M from industry

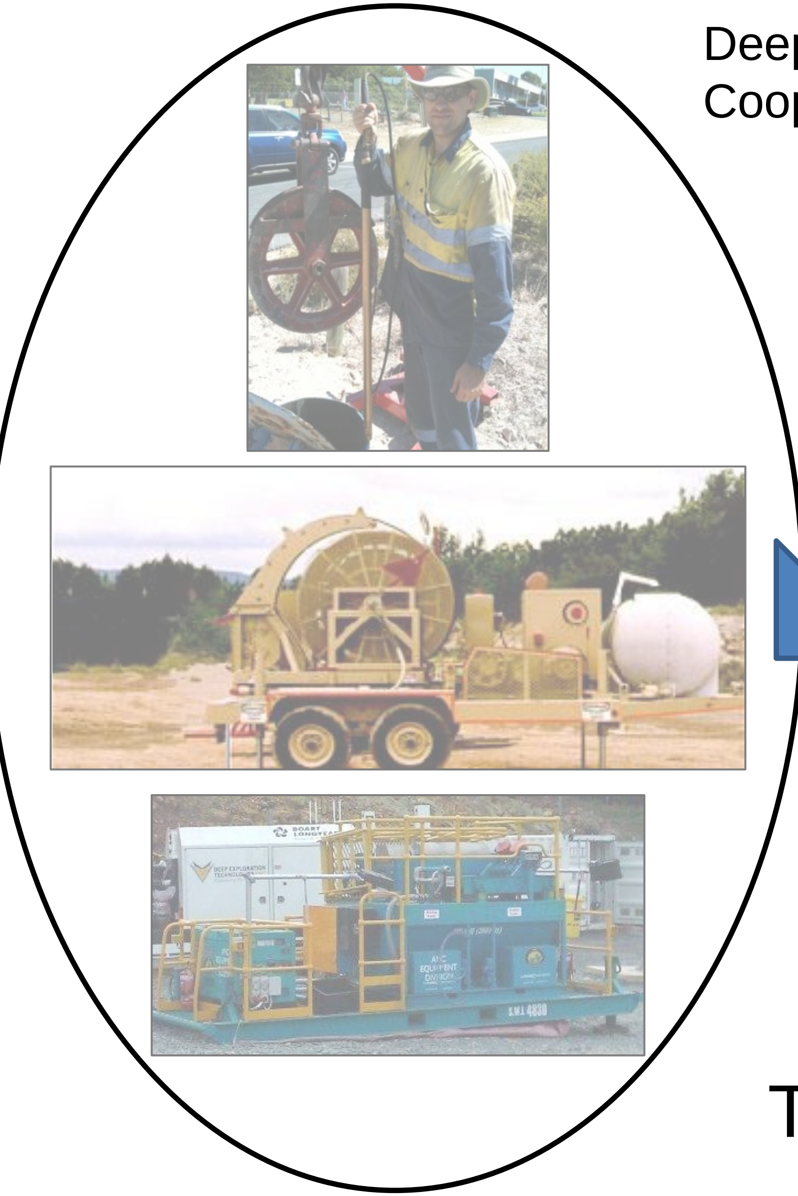
New assay results; downhole logs; petrophysics; geophysics;

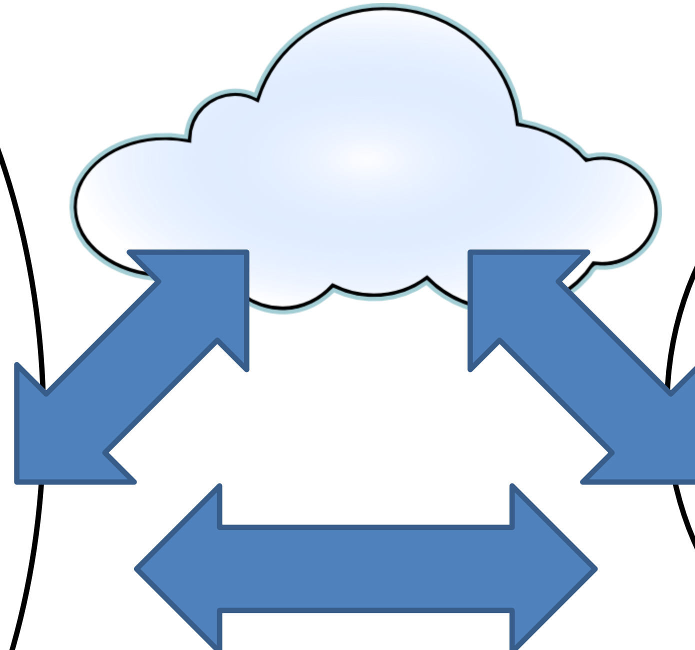
PLUS follow-up programs and further investment

Round	Holes	m	DDH Core
1	353	21,469	4,016
2	1291	96,036	20,044
3	566	54,377	5,576
4	590	35,049	9,959
5	369	50,031	11,055
6	447	38,848	5,916
TOTAL	**3616**	**295.8km**	**56.6km**
plus			
OPAL	*1183*	*19,181*	
GOMA	*4*	*1,084*	*160.6m*



Deep Exploration Technologies Cooperative Research Centre (DET CRC)

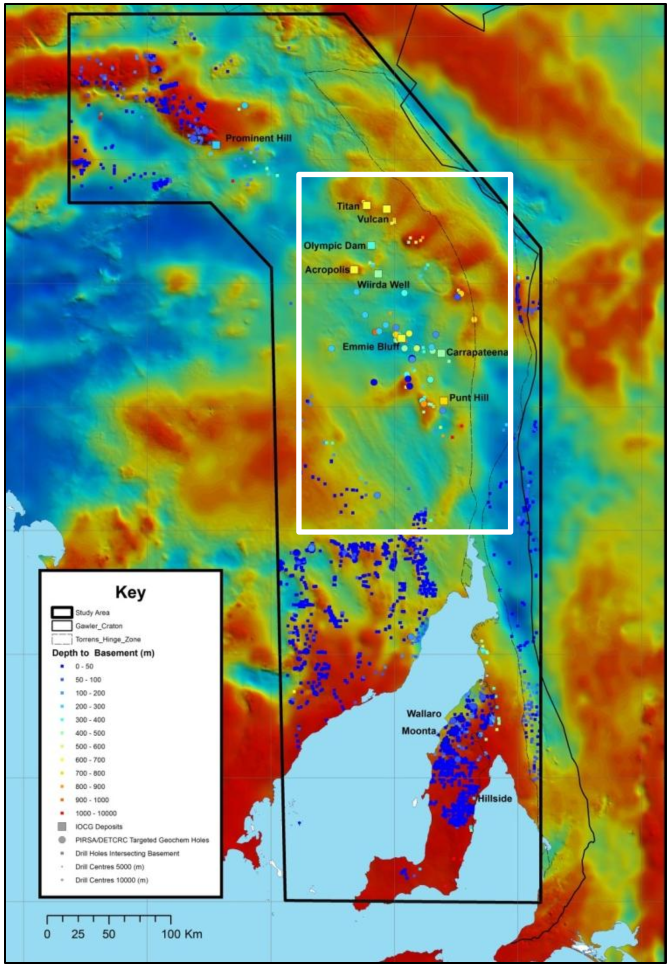


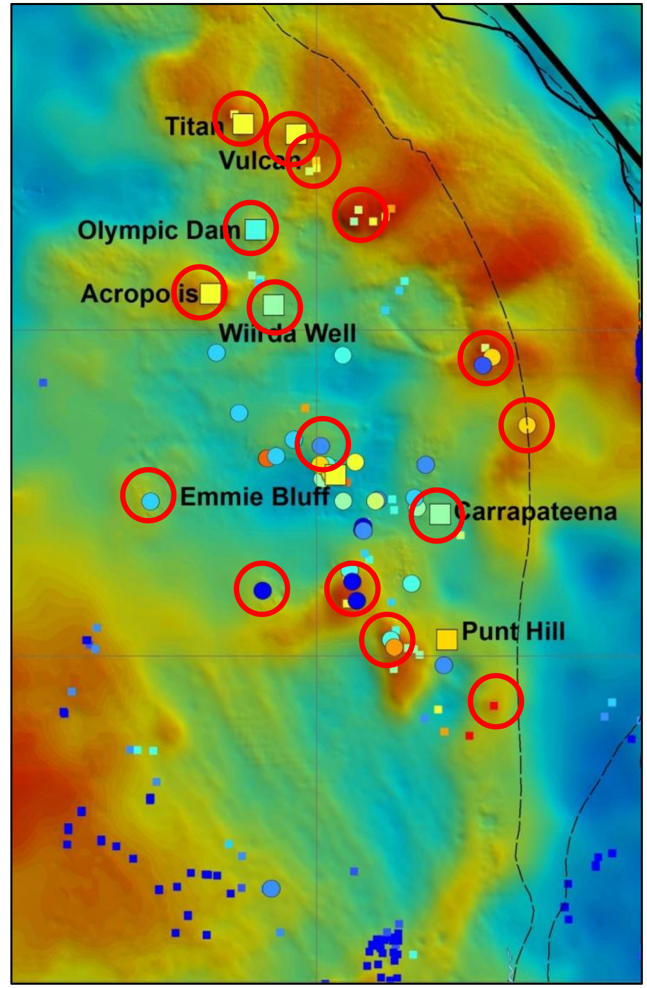


Technologies will enable 'Prospecting Drilling'

Deep Exploration: Current Practice

- IOCGs, Gawler Craton, SA
- Drill through deep cover based on grav & mag anomalies alone
- Many false +ves
- Many anomalies tested by one hole
- Sparse data collected with little knowledge to inform follow-up drilling

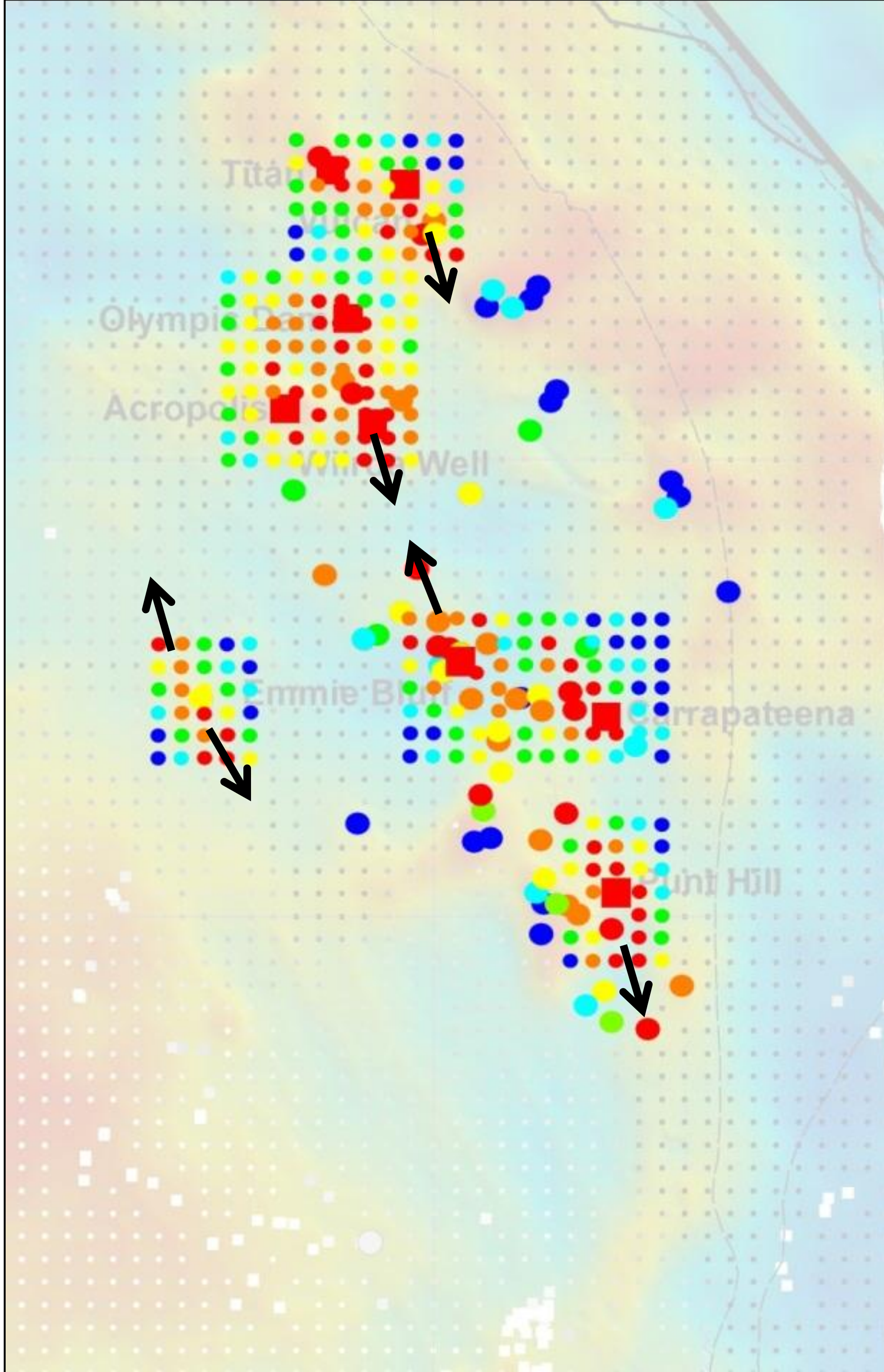




DEEP EXPLORATION TECHNOLOGIES CRC
Uncovering the future

Deep Exploration: Prospecting Drilling

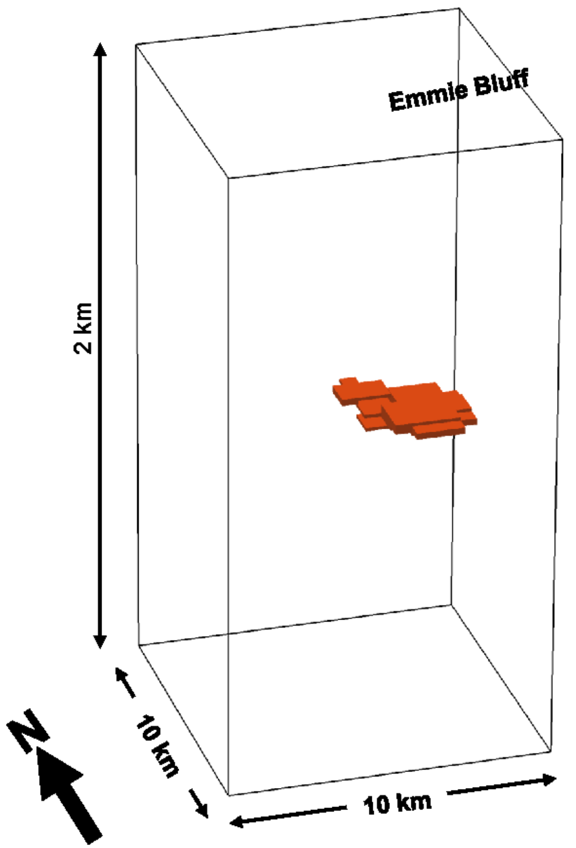
- Build out from initial targets using 5-10 km coiled tubing drilling array and resampling prior holes for consistent geochemical data
- Downhole & lab-at-rig tools define petrophysics and geochemical halos real-time
- Anomalies re-modelled and followed up during same campaign
- Targets based on broad bandwidth of geophysical and geochemical data reduces false +ves and allows recognition of new deposit types
- Start to map entire mineralising system with regional scale vector potential



DEEP EXPLORATION TECHNOLOGIES CRC
Uncovering the future

Mapping buried mineral systems: enlarging buried target and provides framework for next drillhole

Emmie Bluff 3D Model Copper Shell (0.8%)



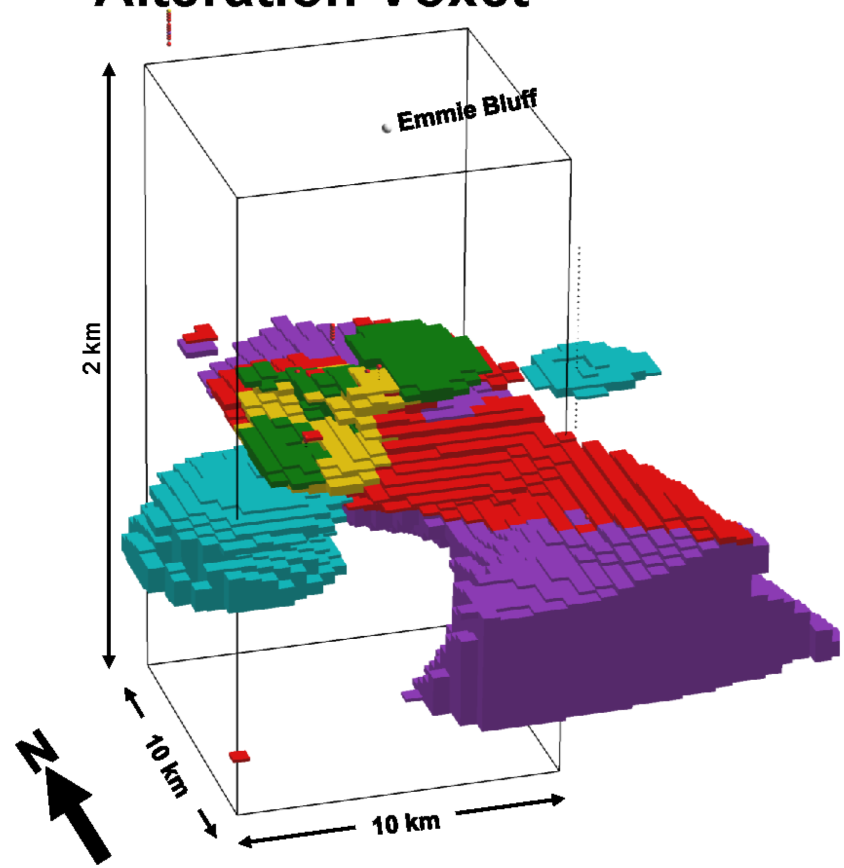
500 m x 500 m x 10 m cell size

10x vertical exaggeration

Key

- Hematite
- Magnetite
- Hematite – Magnetite
- Albite
- K-Feldspar
- Sericite
- Sericite – Chlorite
- Chlorite
- Copper Shell

Emmie Bluff 3D Model Alteration Voxet



500 m x 500 m x 10 m cell size

10x vertical exaggeration

DEEP EXPLORATION TECHNOLOGIES CRC
Uncovering the future

Mineral System Drilling

Mineral System Drilling Vision

PACE-type Contract to drill 130,000m on a 10km x 10km array through cover for basement and/or unconformity sample

$50/m = $6.5M

(excluding where basement > 1km)

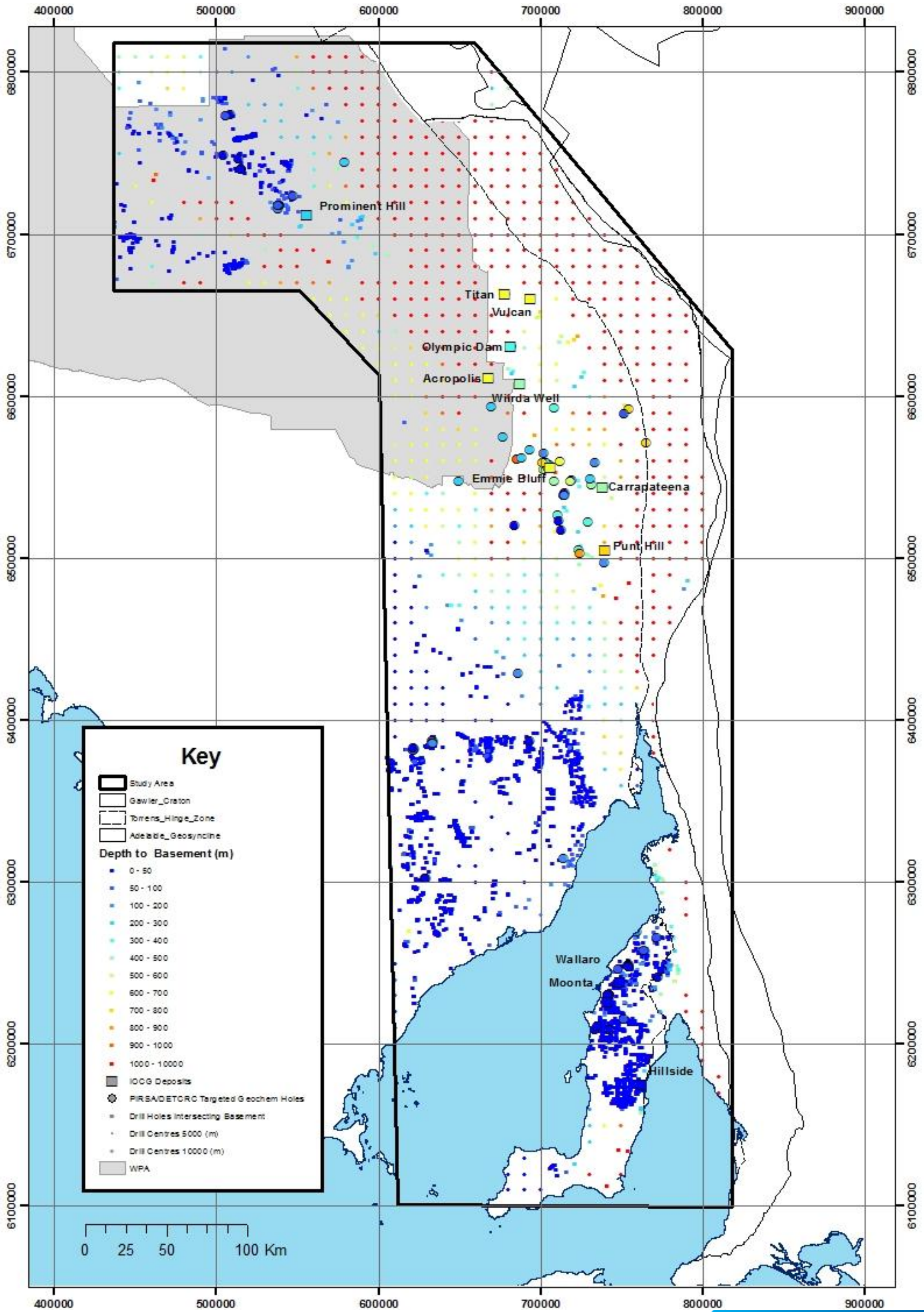
PACE Frontiers: $2.0M (2014-15 FY)

$200/m = 10,000m drilling

average hole ~ 500m = ~20 holes

+ plus industry co-investment opportunities

DEEP EXPLORATION TECHNOLOGIES CRC
Uncovering the future



Regional Deep Cover Workflows – Eastern Gawler Craton

- Atlas of Open File Resources
- Enhanced Gravity and Magnetics Data
- Hardrock Seismic Pilot Study (HiSeis)
- Ongoing Magnetotelluric surveys (University of Adelaide)
- Alteration Characterisation (GSSA Geochemistry and HyLogger)
- Geochemistry / Biogeochemistry Pilot Study (GSSA)
- Regional Exploration Virtual Laboratory (REVL) (CSIRO)
- **Regional Mineral System Drilling** (2015 – DET CRC and collaborators)

- Extension and Application to northern Curnamona Province…

Fraser Institute Policy Potential Index - Global

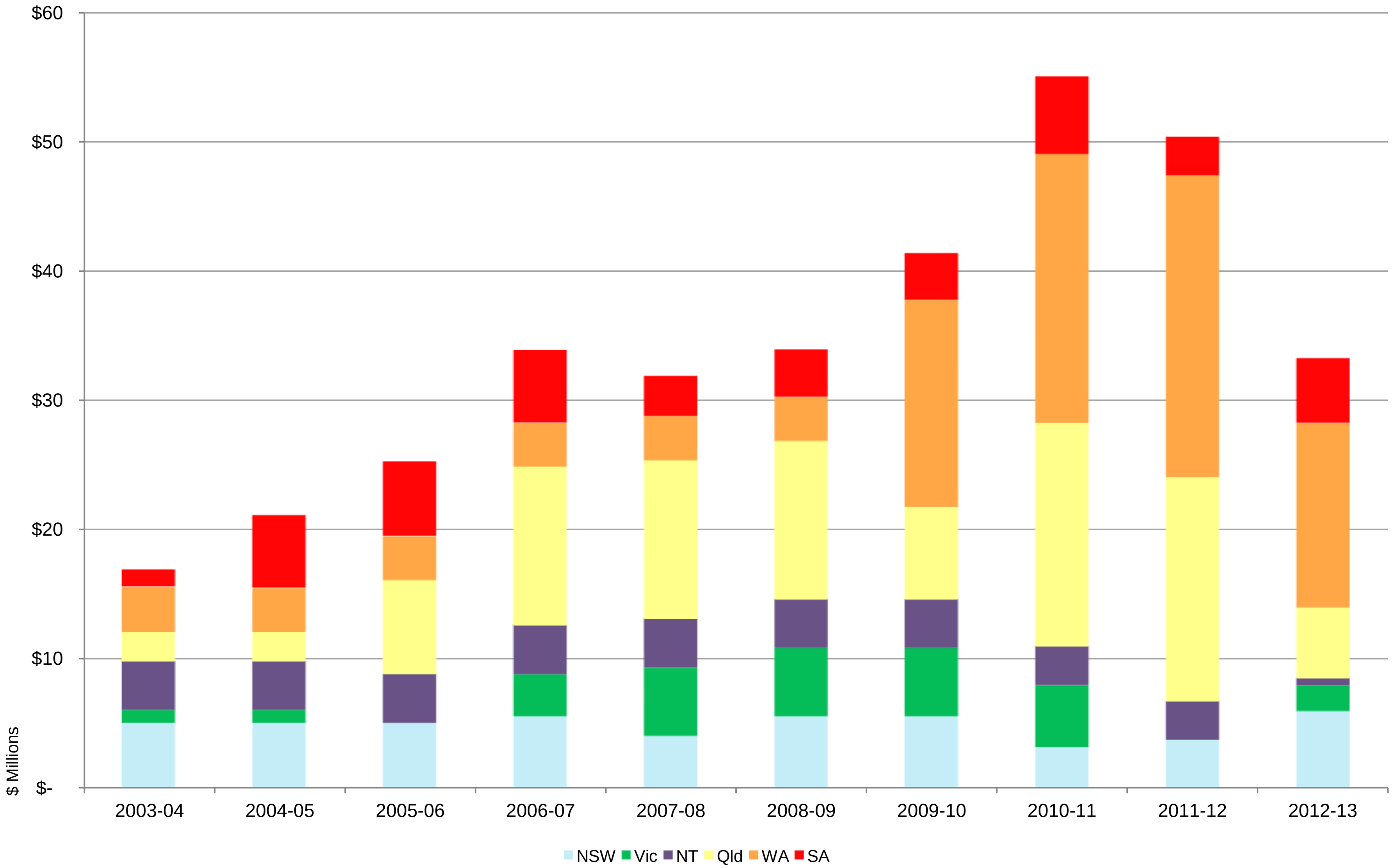
RANKING TOP 25

		2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010 UPDATE	2010/11	2011/12	2012/13	2013
Nr jurisdictions		53	64	64	65	68	71	72	51	79	93	96	112
	1	Nevada	Nevada	Nevada	Manitoba	Quebec	Quebec	Quebec	Alberta	Alberta	New Brunswick	Finland	Sweden
	2	Chile	Ireland	Alberta	Alberta	Nevada	Wyoming	New Brunswick	Finland	Nevada	Finland	Sweden	Finland
	3	South Australia	Manitoba	Manitoba	Nevada	Finland	Nevada	Finland	Quebec	Saskatchewan	Alberta	Alberta	Alberta
	4	Tasmania	Utah	Chile	Utah	Alberta	Alberta	Alberta	Yukon	Quebec	Wyoming	New Brunswick	Ireland
	5	New South Wales	Saskatchewan	Quebec	South Australia	Manitoba	Newfoundland and Labrador	Nevada	Saskatchewan	Finland	Quebec	Wyoming	Wyoming
	6	Manitoba	Spain	Mexico	New Brunswick	Chile	New Brunswick	Saskatchewan	Chile	Utah	Saskatchewan	Ireland	Western Australia
	7	Alberta	Quebec	Saskatchewan	Quebec	Utah	Manitoba	Chile	Newfoundland and Labrador	Sweden	Sweden	Nevada	New Brunswick
	8	Quebec	Ontario	Arizona	Queensland	Wyoming	Chile	Newfoundland and Labrador	Botswana	Chile	Nevada	Yukon	Nevada
	9	Queensland	Alberta	Ontario	Tasmania	Ireland	Saskatchewan	Manitoba	Alaska	Manitoba	Ireland	Utah	Newfoundland and Labrador
	10	Saskatchewan	Tasmania	Utah	Saskatchewan	Sweden	Ontario	South Australia	Nevada	Wyoming	Yukon	Norway	Norway
	11	Brazil	Arizona	Western Australia	Yukon	Botswana	Utah	Yukon	Manitoba	South Australia	Northern Territory	Quebec	South Australia
	12	Northern Territory	Western Australia	New South Wales	Victoria	Saskatchewan	Nova Scotia	Sweden	Wyoming	Greenland	Western Australia	Nova Scotia	Saskatchewan
	13	Victoria	Idaho	Alaska	New Mexico	New Brunswick	Sweden	Wyoming	Utah	Newfoundland and Labrador	Ontario	Saskatchewan	Northern Territory
	14	New Brunswick	Chile	South Australia	New South Wales	Arizona	Finland	Northern Territory	Mexico	Botswana	Greenland	Greenland	New Zealand
	15	Western Australia	South Australia	Tasmania	Northern Territory	South Australia	Yukon	Utah	South Australia	Yukon	Nova Scotia	Western Australia	Minnesota
	16	Ontario	New Brunswick	Ireland	Wyoming	Yukon	South Australia	Nova Scotia	Peru	Ireland	Newfoundland and Labrador	Ontario	Utah
	17	Ireland	Mexico	Finland	Nova Scotia	Nova Scotia	Alaska	Ireland	Arizona	Western Australia	Botswana	Botswana	Michigan
	18	Nova Scotia	Queensland	New Brunswick	Western Australia	Ontario	Botswana	Alaska	Colombia	Ontario	Chile	Newfoundland and Labrador	France
	19	Mexico	New South Wales	Brazil	Ontario	British Columbia	Norway	Western Australia	Brazil	Nova Scotia	South Australia	Alaska	Yukon
	20	Peru	India	Northern Territory	Arizona	Tasmania	Northern Territory	New South Wales	Ontario	New South Wales	Manitoba	South Australia	Arizona
	21	Argentina	Wyoming	Yukon	Spain	Northern Territory	Western Australia	Botswana	Ghana	Alaska	Utah	Manitoba	Quebec
	22	Bolivia	Sweden	Wyoming	Newfoundland and Labrador	Newfoundland and Labrador	Spain	Ontario	Nunavut	Norway	Minnesota	Northern Territory	Alaska
	23	Turkey	Victoria	British Columbia	Idaho	Ghana	New South Wales	Tasmania	Tanzania	New Brunswick	Michigan	Chile	Greenland
	24	Alaska	Finland	Argentina	South Dakota	Mexico	British Columbia	Queensland	Namibia	Burkina Faso	Norway	Victoria	Queensland
	25	New Zealand	Northern Territory	Turkey	Alaska	Western Australia	Queensland	Arizona	New Zealand	Arizona	Alaska	Morocco	Botswana
									British Columbia				
									Zambia				
									Western Australia				

2004 PACE

2009 WA EIS Scheme

Government Exploration Initiatives Expenditure by State in Australia 2003-04 to 2012-13

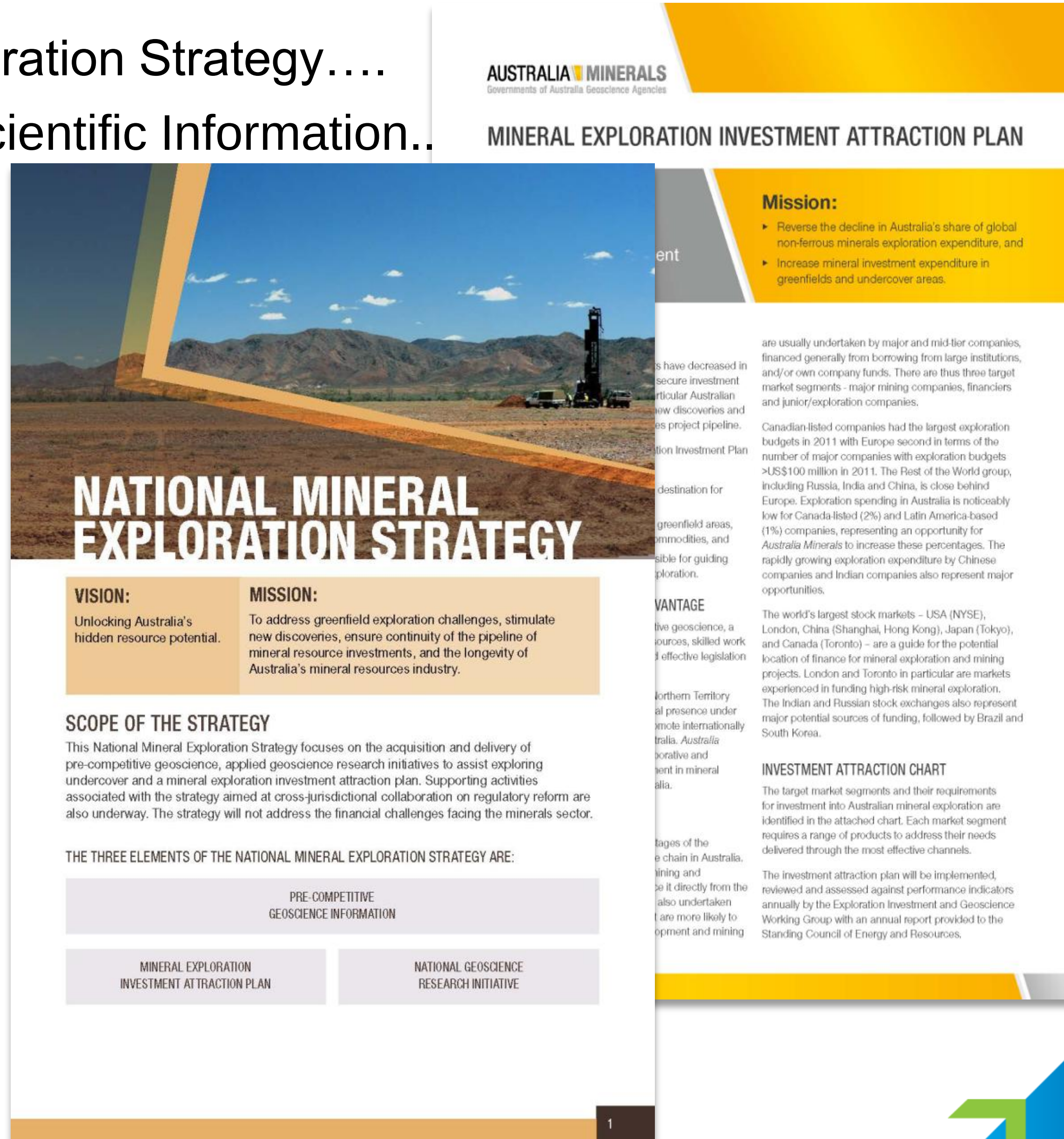


National Priorities for Earth Science

National Mineral Exploration Strategy….

Pre-competitive Geoscientific Information..

…


AUSTRALIA MINERALS
Governments of Australia Geoscience Agencies

MINERAL EXPLORATION INVESTMENT ATTRACTION PLAN

Mission:

- Reverse the decline in Australia's share of global non-ferrous minerals exploration expenditure, and
- Increase mineral investment expenditure in greenfields and undercover areas.

are usually undertaken by major and mid-tier companies, financed generally from borrowing from large institutions, and/or own company funds. There are thus three target market segments - major mining companies, financiers and junior/exploration companies.

Canadian-listed companies had the largest exploration budgets in 2011 with Europe second in terms of the number of major companies with exploration budgets >US$100 million in 2011. The Rest of the World group, including Russia, India and China, is close behind Europe. Exploration spending in Australia is noticeably low for Canada-listed (2%) and Latin America-based (1%) companies, representing an opportunity for *Australia Minerals* to increase these percentages. The rapidly growing exploration expenditure by Chinese companies and Indian companies also represent major opportunities.

The world's largest stock markets – USA (NYSE), London, China (Shanghai, Hong Kong), Japan (Tokyo), and Canada (Toronto) – are a guide for the potential location of finance for mineral exploration and mining projects. London and Toronto in particular are markets experienced in funding high-risk mineral exploration. The Indian and Russian stock exchanges also represent major potential sources of funding, followed by Brazil and South Korea.

INVESTMENT ATTRACTION CHART

The target market segments and their requirements for investment into Australian mineral exploration are identified in the attached chart. Each market segment requires a range of products to address their needs delivered through the most effective channels.

The investment attraction plan will be implemented, reviewed and assessed against performance indicators annually by the Exploration Investment and Geoscience Working Group with an annual report provided to the Standing Council of Energy and Resources.

NATIONAL MINERAL EXPLORATION STRATEGY

VISION:
Unlocking Australia's hidden resource potential.

MISSION:
To address greenfield exploration challenges, stimulate new discoveries, ensure continuity of the pipeline of mineral resource investments, and the longevity of Australia's mineral resources industry.

SCOPE OF THE STRATEGY

This National Mineral Exploration Strategy focuses on the acquisition and delivery of pre-competitive geoscience, applied geoscience research initiatives to assist exploring undercover and a mineral exploration investment attraction plan. Supporting activities associated with the strategy aimed at cross-jurisdictional collaboration on regulatory reform are also underway. The strategy will not address the financial challenges facing the minerals sector.

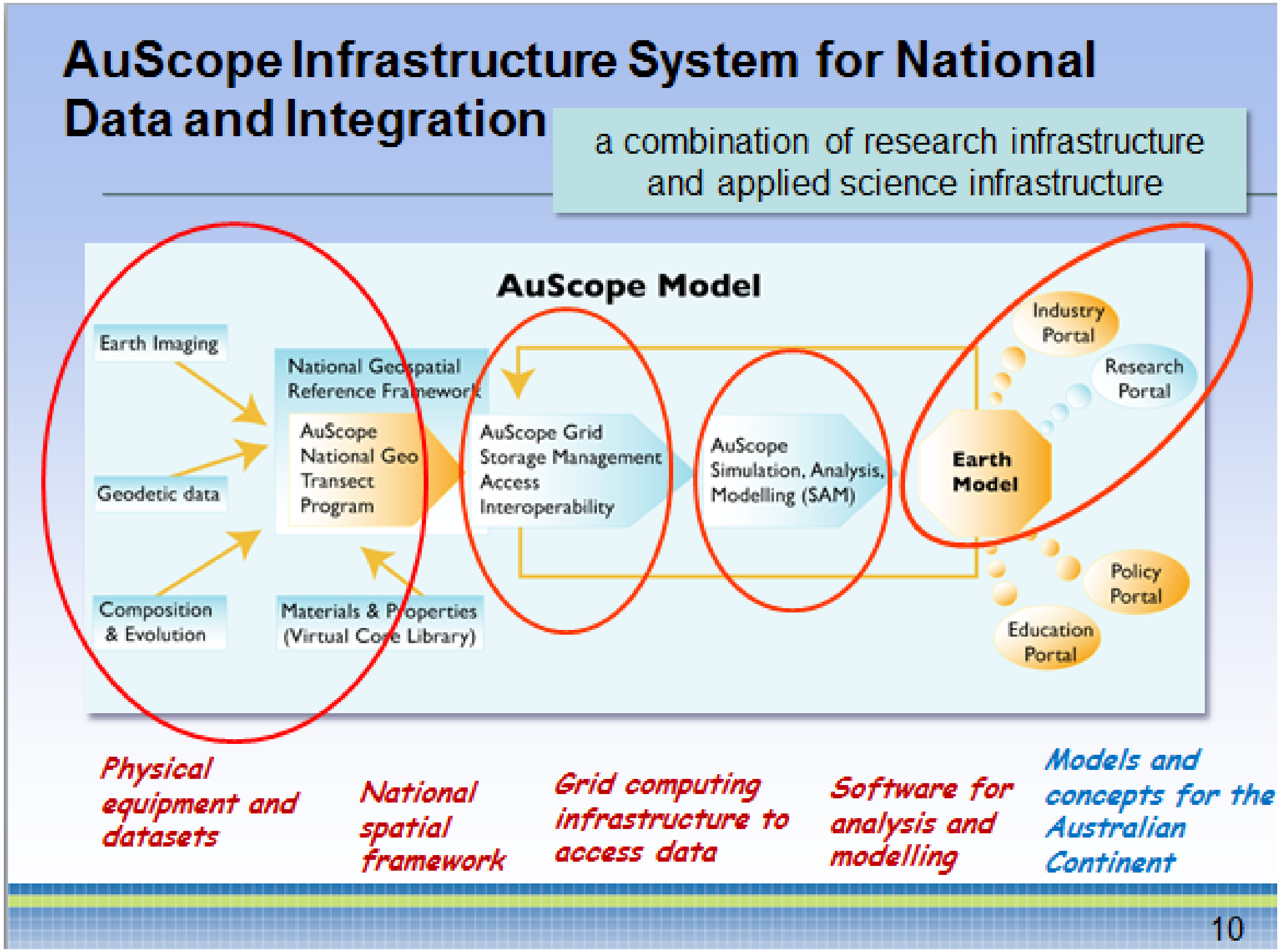
THE THREE ELEMENTS OF THE NATIONAL MINERAL EXPLORATION STRATEGY ARE:

PRE-COMPETITIVE GEOSCIENCE INFORMATION

MINERAL EXPLORATION INVESTMENT ATTRACTION PLAN

NATIONAL GEOSCIENCE RESEARCH INITIATIVE

1


AuScope Infrastructure System for National Data and Integration
a combination of research infrastructure and applied science infrastructure
AuScope Model
Earth Imaging
National Geospatial Reference Framework
AuScope National Geo Transect Program
Geodetic data
Composition & Evolution
Materials & Properties (Virtual Core Library)
AuScope Grid Storage Management Access Interoperability
AuScope Simulation, Analysis, Modelling (SAM)
Earth Model
Industry Portal
Research Portal
Policy Portal
Education Portal
Physical equipment and datasets
National spatial framework
Grid computing infrastructure to access data
Software for analysis and modelling
Models and concepts for the Australian Continent
10

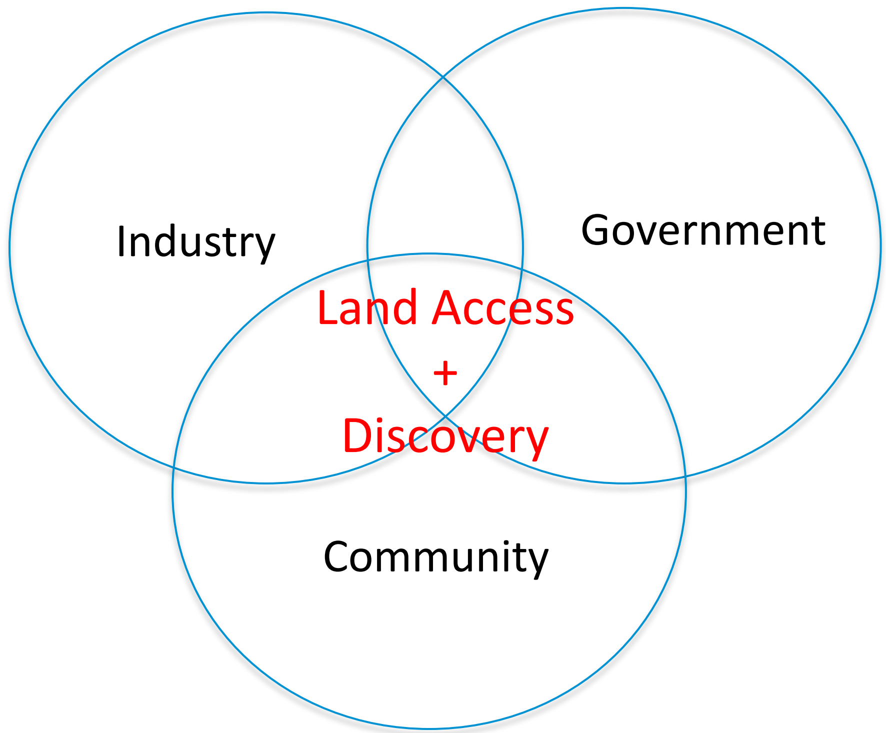
It's a three legged race now and investment is required

Access to capital

Costs escalating

Market driven timeframes

Public Private Partnerships (draw on Collaborative Drilling success)



Royalties

Local industry

Regional communities

Facebook

CRC Approach

Auscope Approach

Ok if it is somewhere else
Compliance
Overall Community Benefit
Royalties For Regions

Conclusion

- Australia has a the grand challenge supplying food and resources to the world
- Australia is losing global market position in exploration expenditure
- It's a global game and needs a national approach
- The UNCOVER framework is perfectly timed to fit this imperative
- It's a three legged race now: Community, Industry and Government are linked
- Bold Innovative funding Models needed