Australian Government

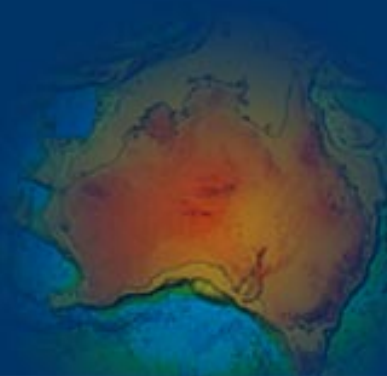
Geoscience Australia

Onshore Energy Security Initiative Planning Progress, March 2007

Dr James Johnson

Chief, Onshore Energy & Minerals Division

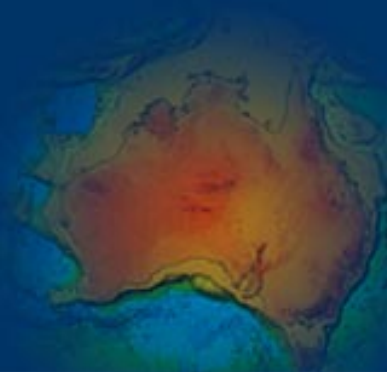
Presented to AMEC, Perth, March 2007



Ministerial Statement to Parliament on Energy Initiatives
14 August, 2006

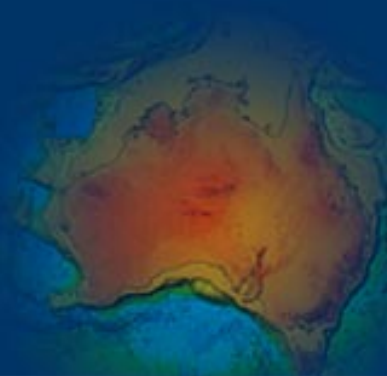
“ The Government will also commit an additional $58.9 million over five years to identify on-shore energy sources such as petroleum and geothermal energy.”

The Hon John Howard MP



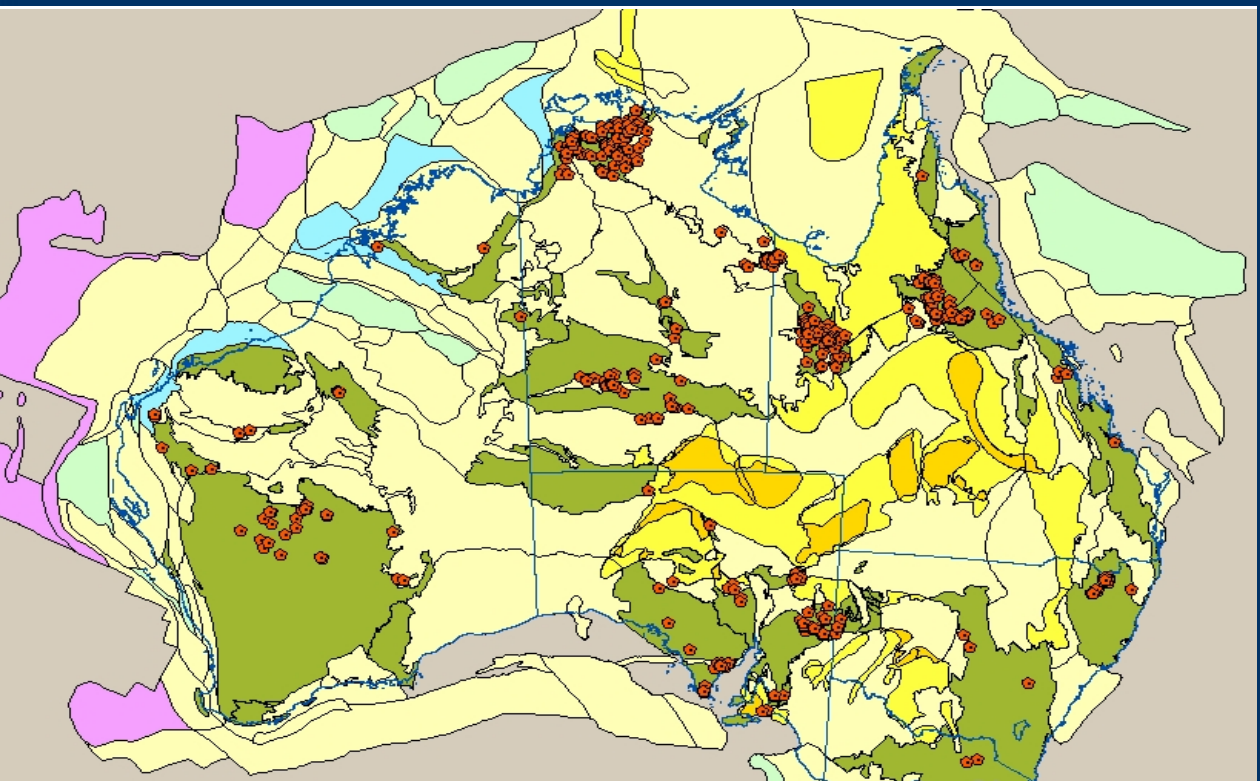
Onshore Energy Security
Breakdown of $ per financial year.

06/07	$7.4M
07/08	$14.8M
08/09	$14.8M
09/10	$12.7M
10/11	$9.2M
TOTAL	$58.9M



Provide geoscientific data to lower exploration risk and stimulate investment in exploration

To gain new insights into Australia's potential in diverse energy commodities:



Uranium deposits & occurrences
(background: basins & cratons)

Commodities

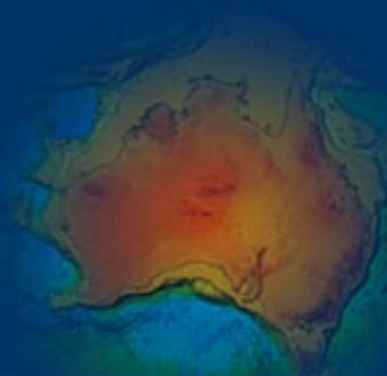
- Petroleum
- Uranium
- Geothermal
- Thorium

Tools

- Seismic
- MT
- AEM
- Radiometrics
- Magnetics
- Geochemistry
- Drilling

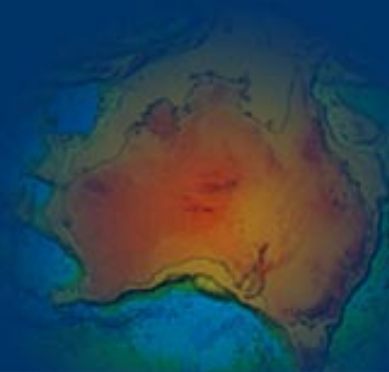
Approach

- **Scope acquisition programs**
- **Consult with State and Territory Geological Surveys**
- **Consult with Industry**
- **Refine and Implement**



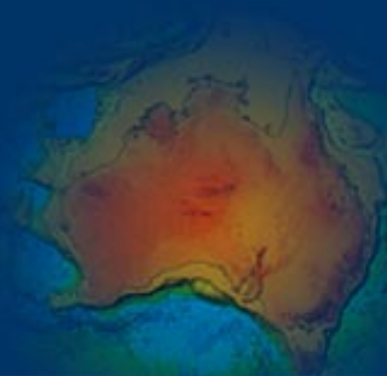
Principles

- **NGA programs**
  - **Energy Related**
  - **Projects will be of National and Strategic importance**
    - **either large survey or high priority**
  - **Collaborative with State/ Territory**
  - **Materiality – likely impact**
  - **Assists Greenfields exploration**

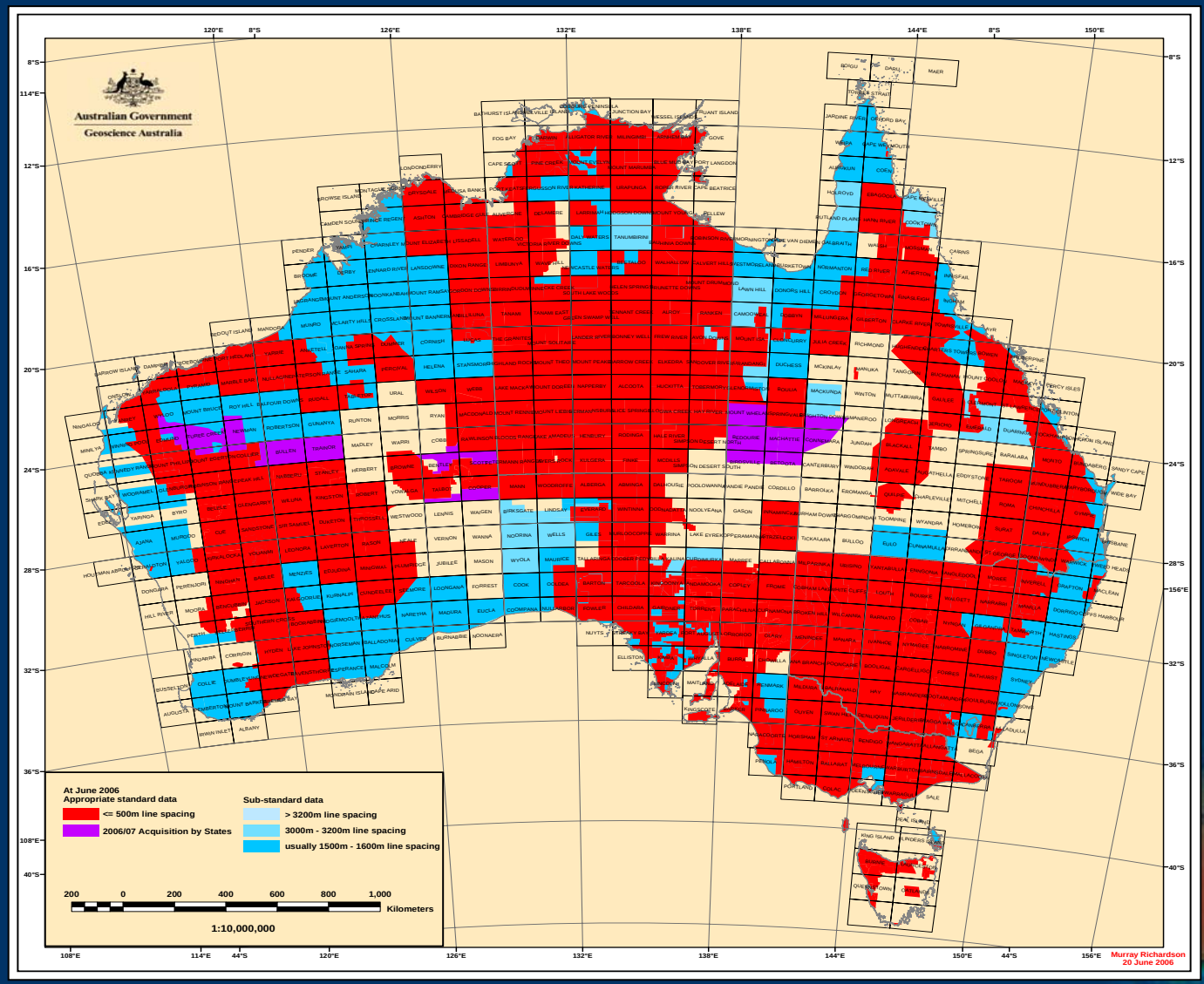


Focus of Presentation

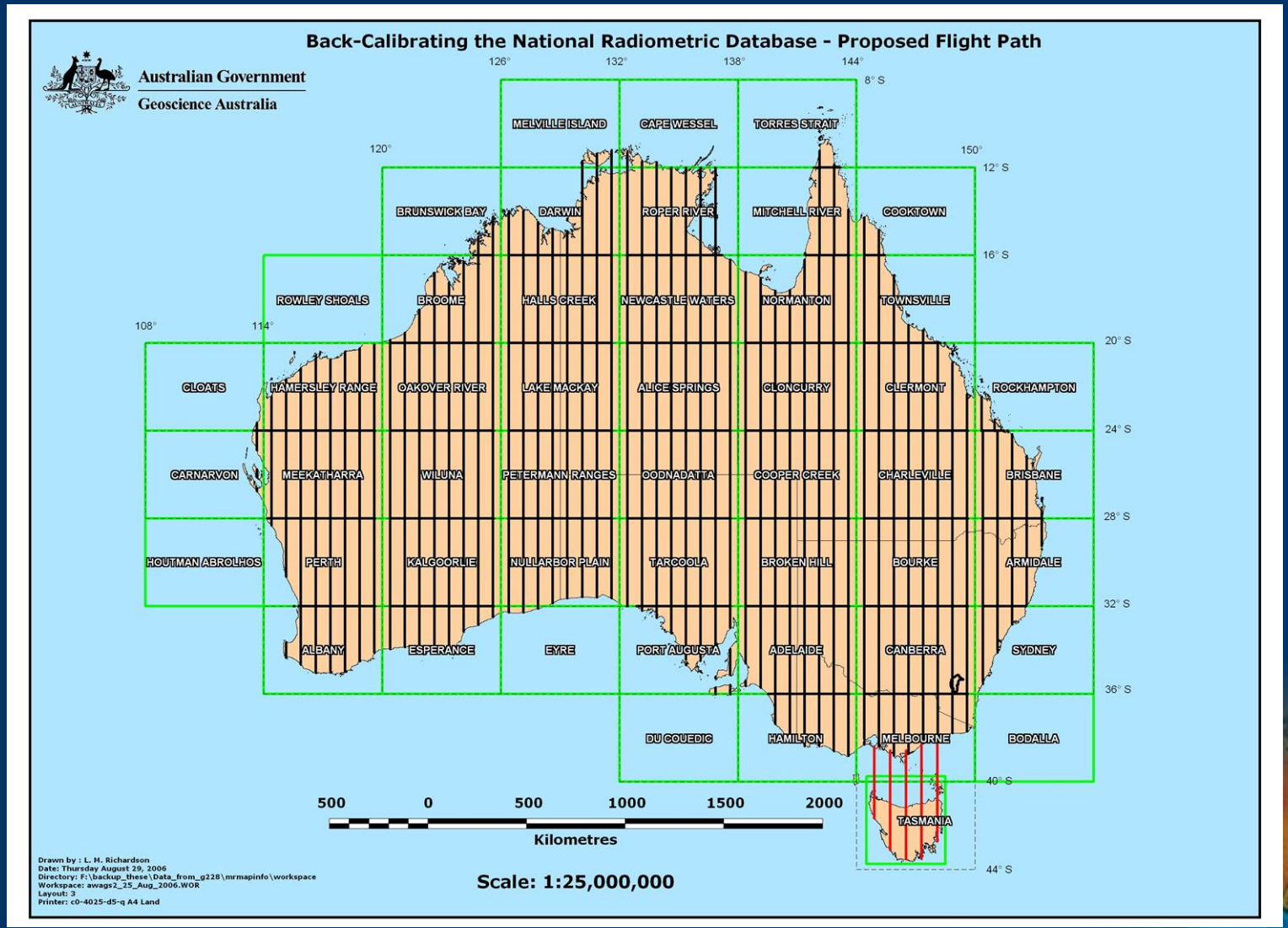
- Will address each of the energy themes
- National Projects
  - AWAGS
  - Geochemical Baselines
- Targeted regional projects
  - Mineral Energy Program - Uranium
  - Geothermal Energy Program
  - Onshore Petroleum Program



Radiometrics - The Problem

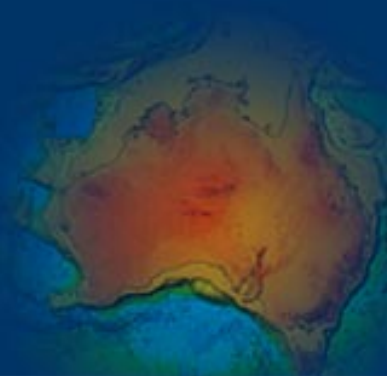


National Radiometrics Datum



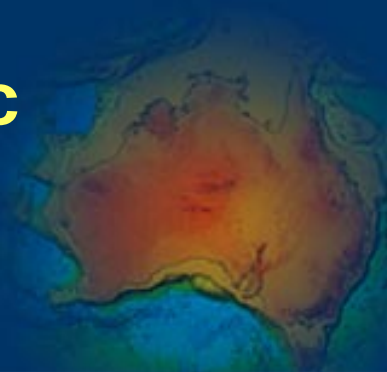
AWAGS Project Timing

Project Scoping	Sept 2006
Call for Tenders	Sept 2006
Evaluation of Tenders	Nov 2006
Survey Commences	Feb 2007
Survey Completed	May 2008
Databases upgraded	Nov 2008



Science Drivers

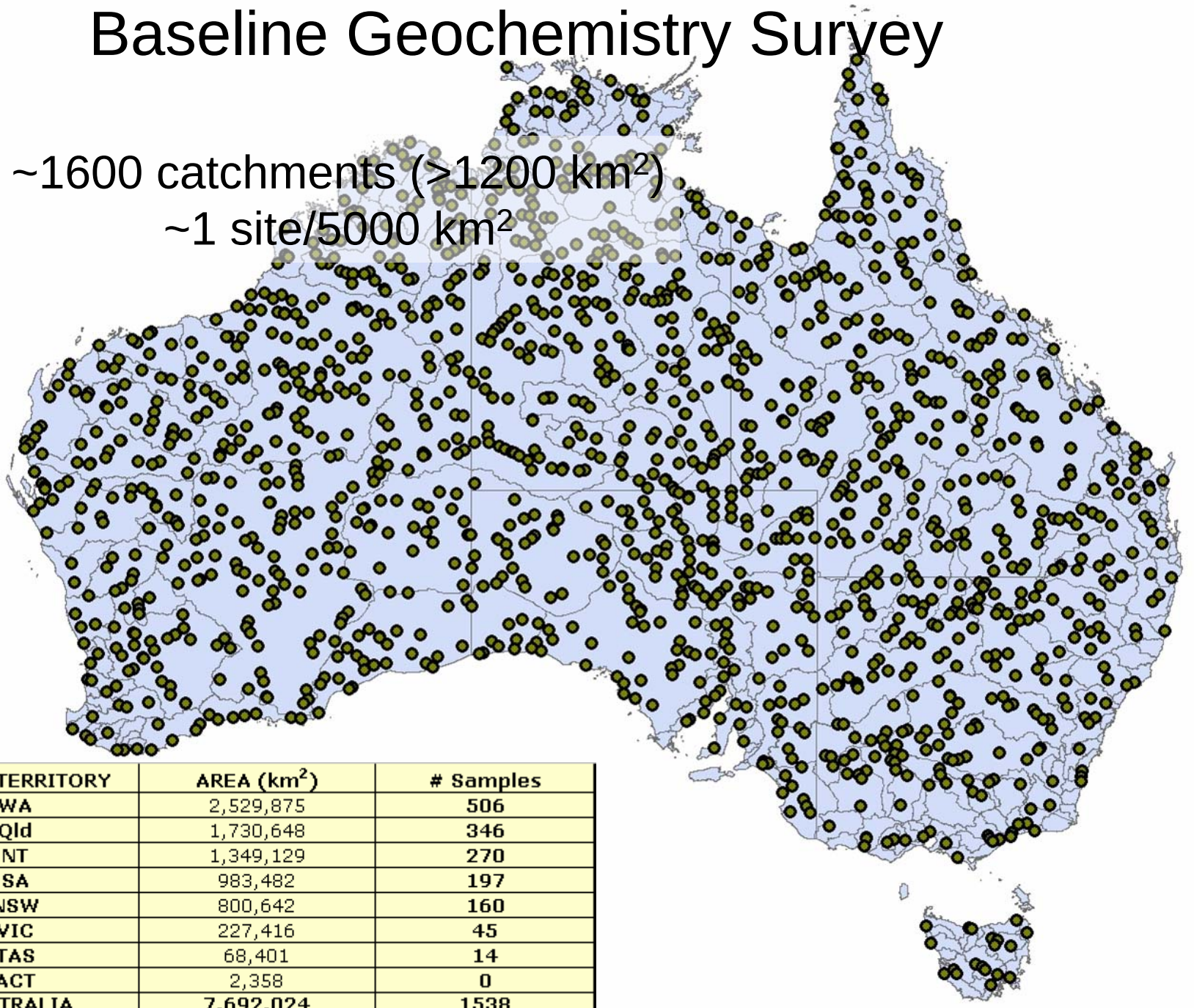
- **Radiometrics**
  - **Uranium and Thorium Exploration**
  - **Heat Flow Studies – Geothermal**
  - **Radiation Risk Mapping**
  - **Geological Mapping @ surface - regolith,**
- **Magnetics**
  - **Lower crustal studies – structure, composition & thermal regime**
  - **Petroleum resources –modelling sedimentary basins**
  - **Accurate Regional Field for magnetic modelling**
  - **Crustal accretion & evolution,**



Baseline Geochemistry Survey

~1600 catchments (>1200 km^2)

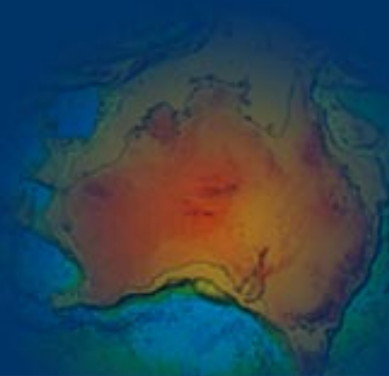
~1 site/5000 km^2



STATE/TERRITORY	AREA (km^2)	# Samples
WA	2,529,875	506
Qld	1,730,648	346
NT	1,349,129	270
SA	983,482	197
NSW	800,642	160
VIC	227,416	45
TAS	68,401	14
ACT	2,358	0
AUSTRALIA	7,692,024	1538

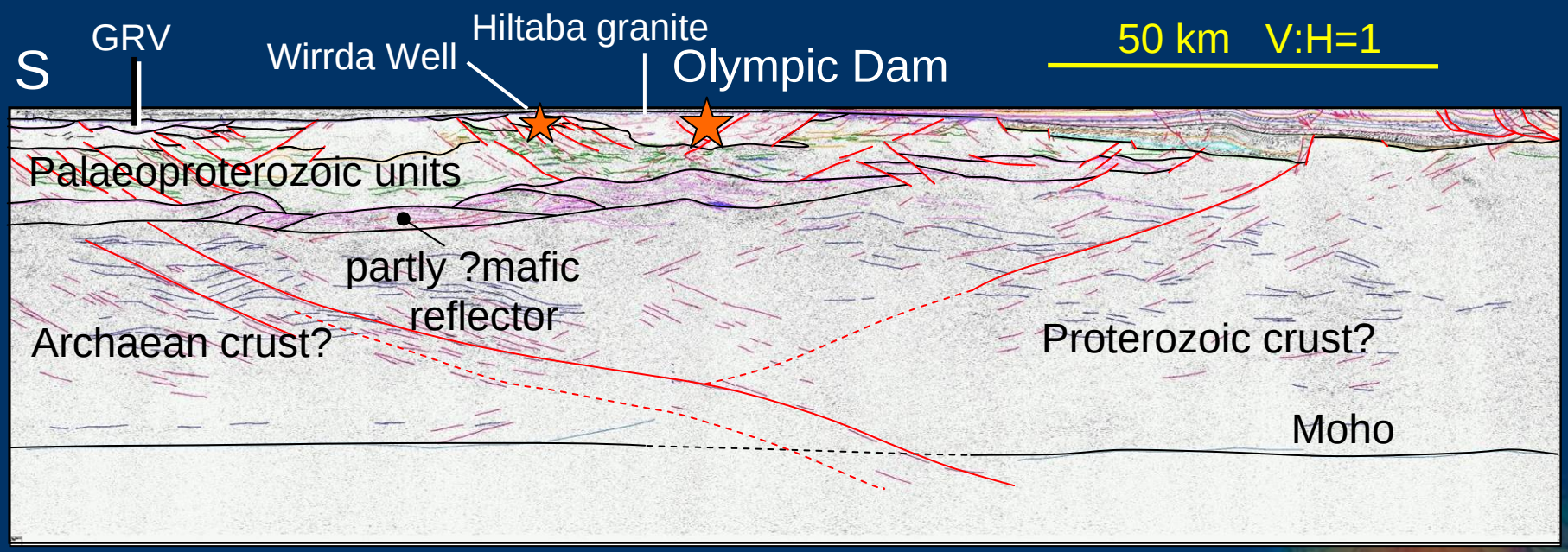
Mineral Energy Program
Uranium - Initiative

- Deposit Types
  - What are the potential unifying themes
- IOCG-U deposits
  - eg Olympic Dam
- Unconformity related deposits
  - Proterozoic
    - Arnhem Land, Paterson
- Palaeo-channel deposits
  - Post-Permian systems
    - Close to hot granites



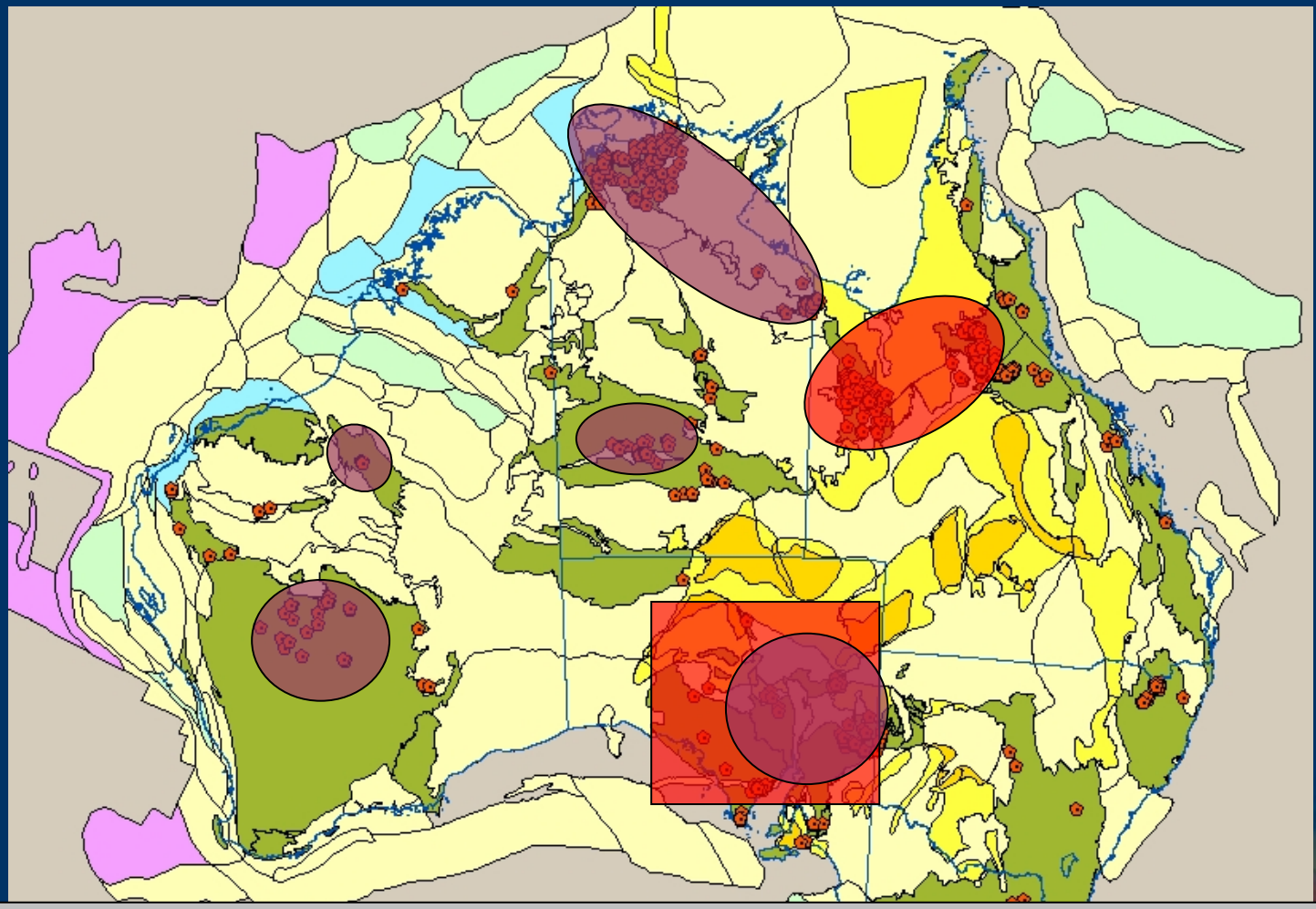
IOCG-U plays

Seismic and MT - Crustal Structure & Petroleum Potential



Olympic Dam above suture

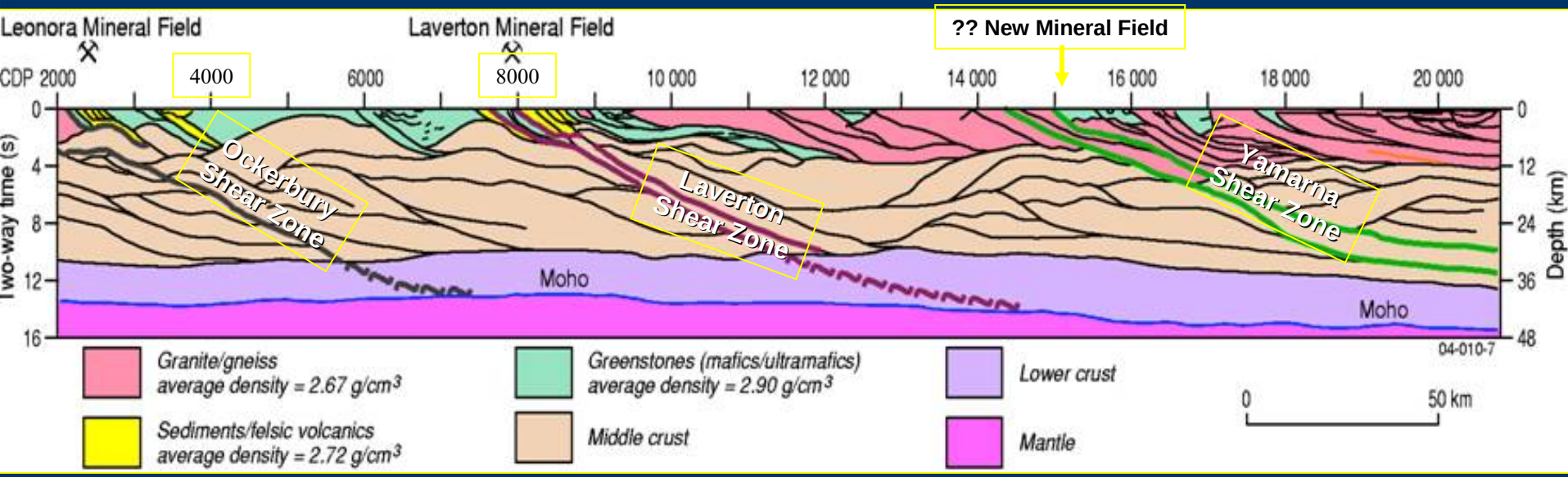
Uranium deposits & occurrences



Unconformity-related U; sandstone-hosted U, Calcrete U

U-rich iron oxide Cu-Au (IOCG) & basin-related U

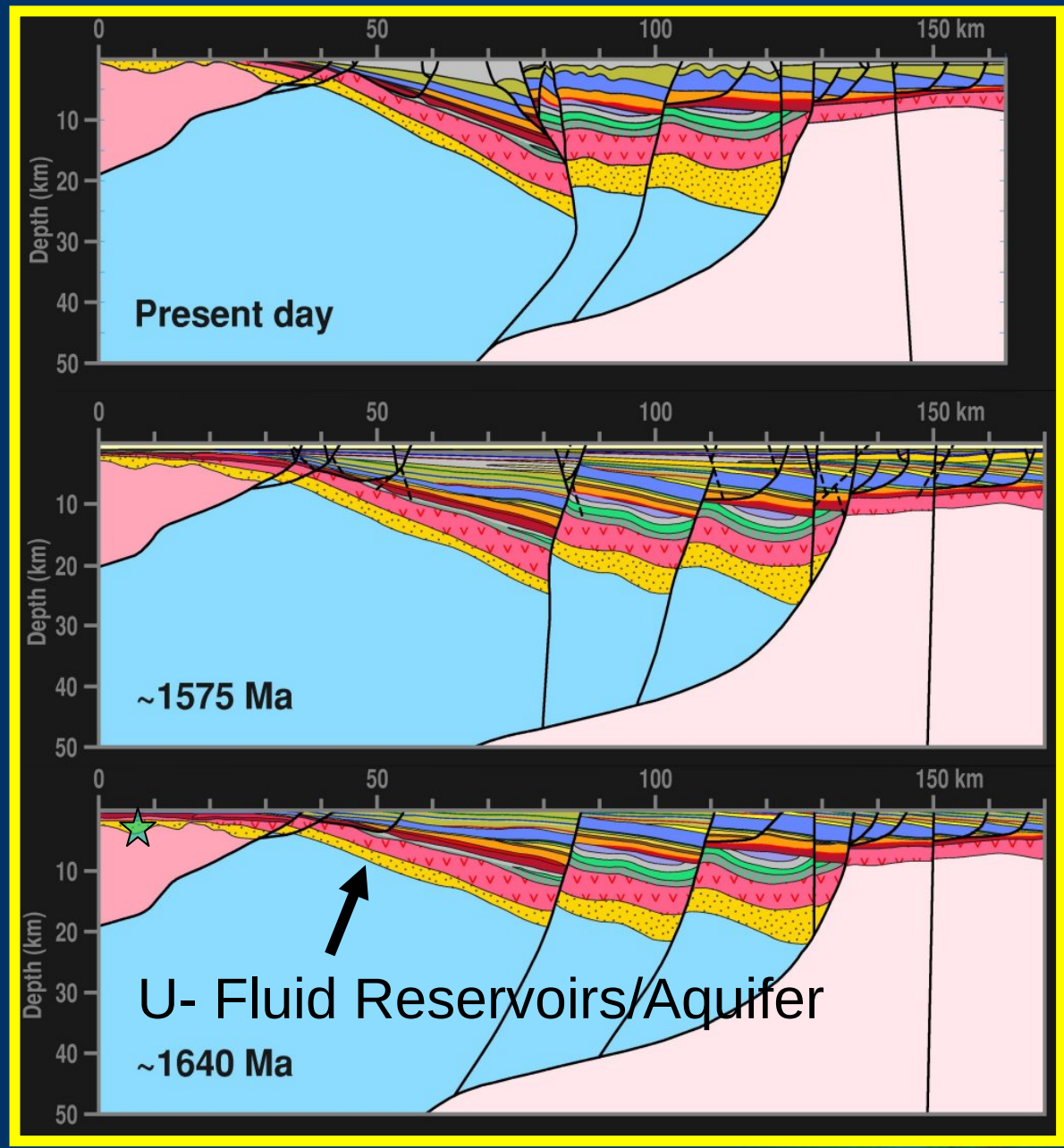
Relevance of seismic to Minerals



Reconstruction of Basin Shape and Sediment Architecture

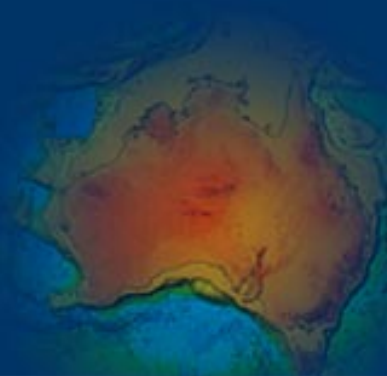
Unconformity-related

Paleoproterozoic
Northern Australia

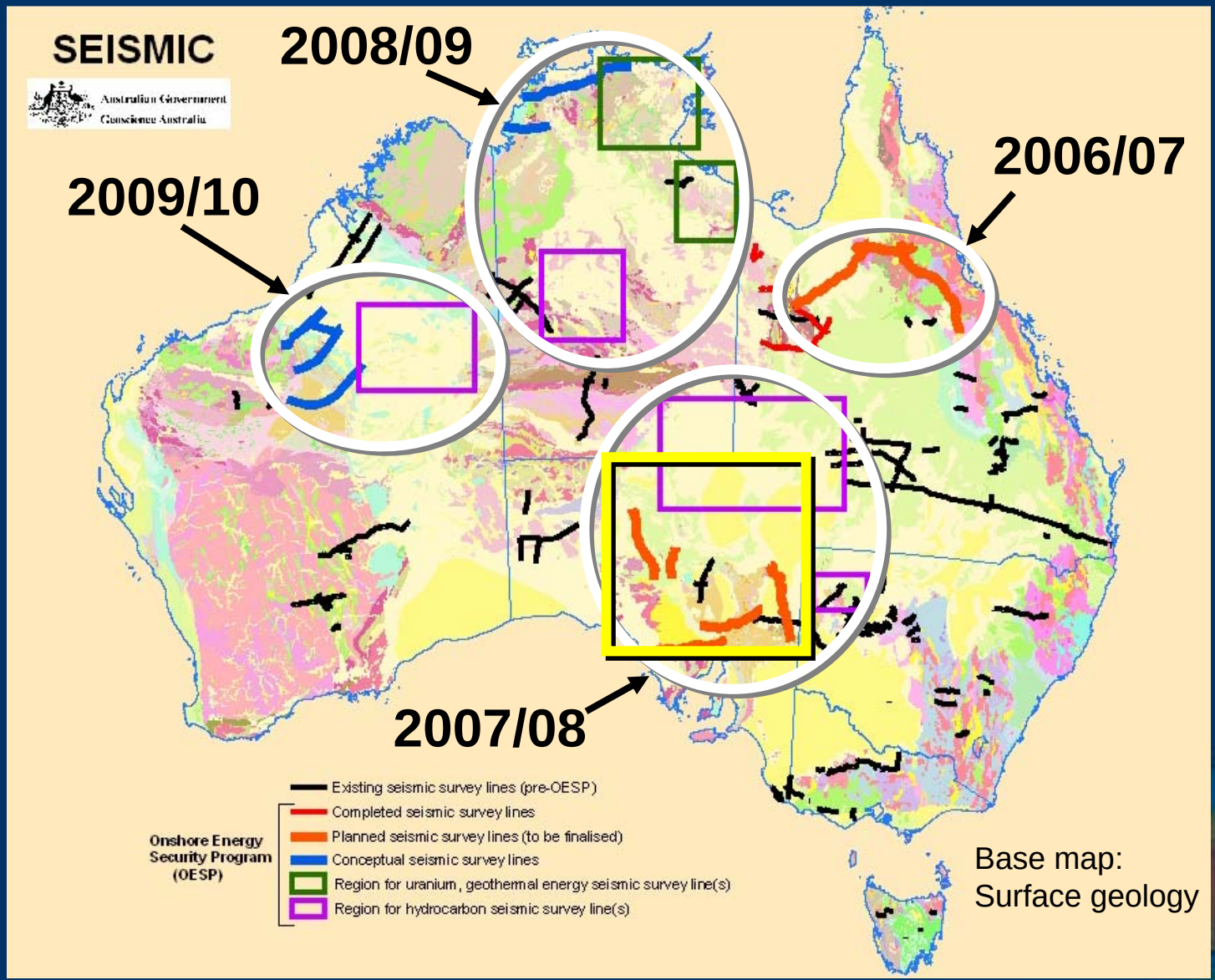


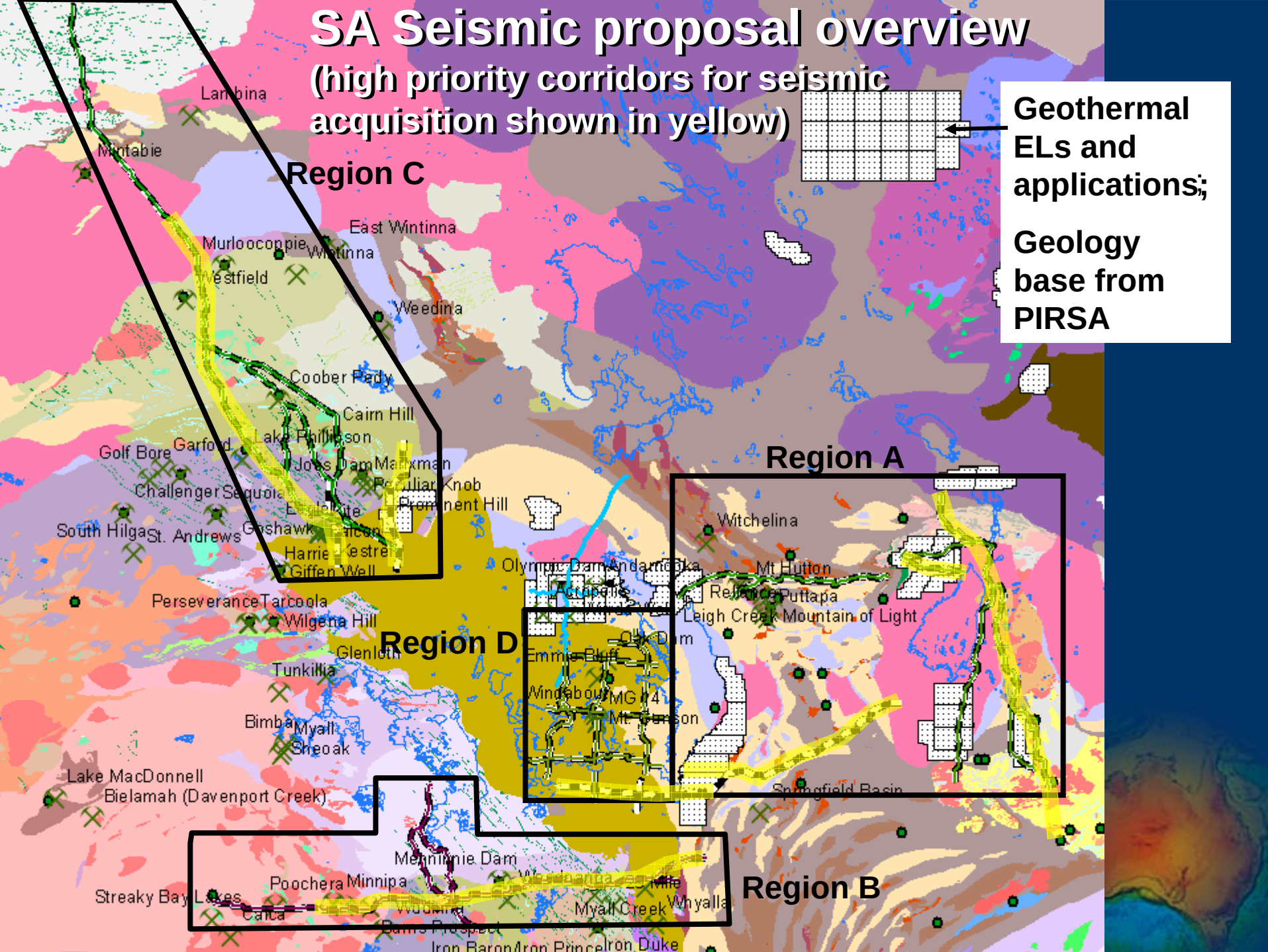
Seismic

- **Reprocessing of (GA) Deep Crustal and key industry petroleum data**
- **Energy Related Minerals & Geothermal**
  - **Crustal architecture**
    - **Controls on IOCG-U deposits**
    - **Location of HHP Granites**
    - **Basin architecture for U-fluid sandstone reservoirs**



Seismic acquisition by Year of OESP

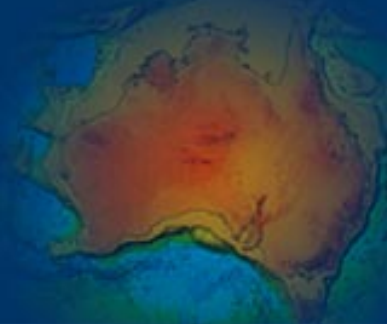



SA Seismic proposal overview
(high priority corridors for seismic acquisition shown in yellow)
Geothermal ELs and applications;
Geology base from PIRSA
Region C
Region A
Region D
Region B
Lambina
Mintabie
East Wintinna
Murlooconpie
Wintinna
Westfield
Weedina
Coober Pedy
Cairn Hill
Lake Phillipson
Golf Bore
Garford
Challenger
South Hilga
St. Andrews
Goshawk
Harrie
Giffen Well
Witchelina
Mt Hutton
Puttapa
Leigh Creek
Mountain of Light
Olympic Dam
Andamooka
Perseverance
Tarcoola
Wilgena Hill
Glenloth
Tunkillia
Emmie Bluff
Windabout
MG 14
Mt Gunson
Bimbay
Myall
Sheoak
Lake MacDonnell
Bielamah (Davenport Creek)
Springfield Basin
Menninnie Dam
Poochera
Minnipa
Streaky Bay Lakes
Calca
Myall Creek
Whyalla
Iron Baron
Iron Prince
Iron Duke

Objectives of new seismic (1)

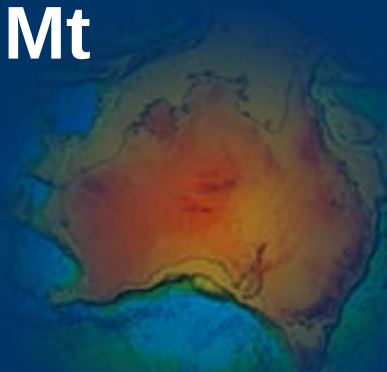
IOCG-U mineralising systems:

- What distinguishes architecture of U-rich from U-poor IOCG systems?
- Can we trace the crustal boundary & “bland zone” beneath OD to NW and to SE?
- Is architecture of Benagerie Ridge in Curnamona Province similar to OD area?



Objectives of new seismic (2)

- **Unconformity and other basin U systems:**
  - **Is Cariewerloo Basin (Pandurra Fm) prospective for unconformity U? *Need to know geometry of basin.***
  - **What is architecture of pre-syn-GRV basins (Corunna Cong., Blue Range Beds?)**
  - **Geometry of upper crustal faults in Mt Painter-Beverly 4 Mile area?**



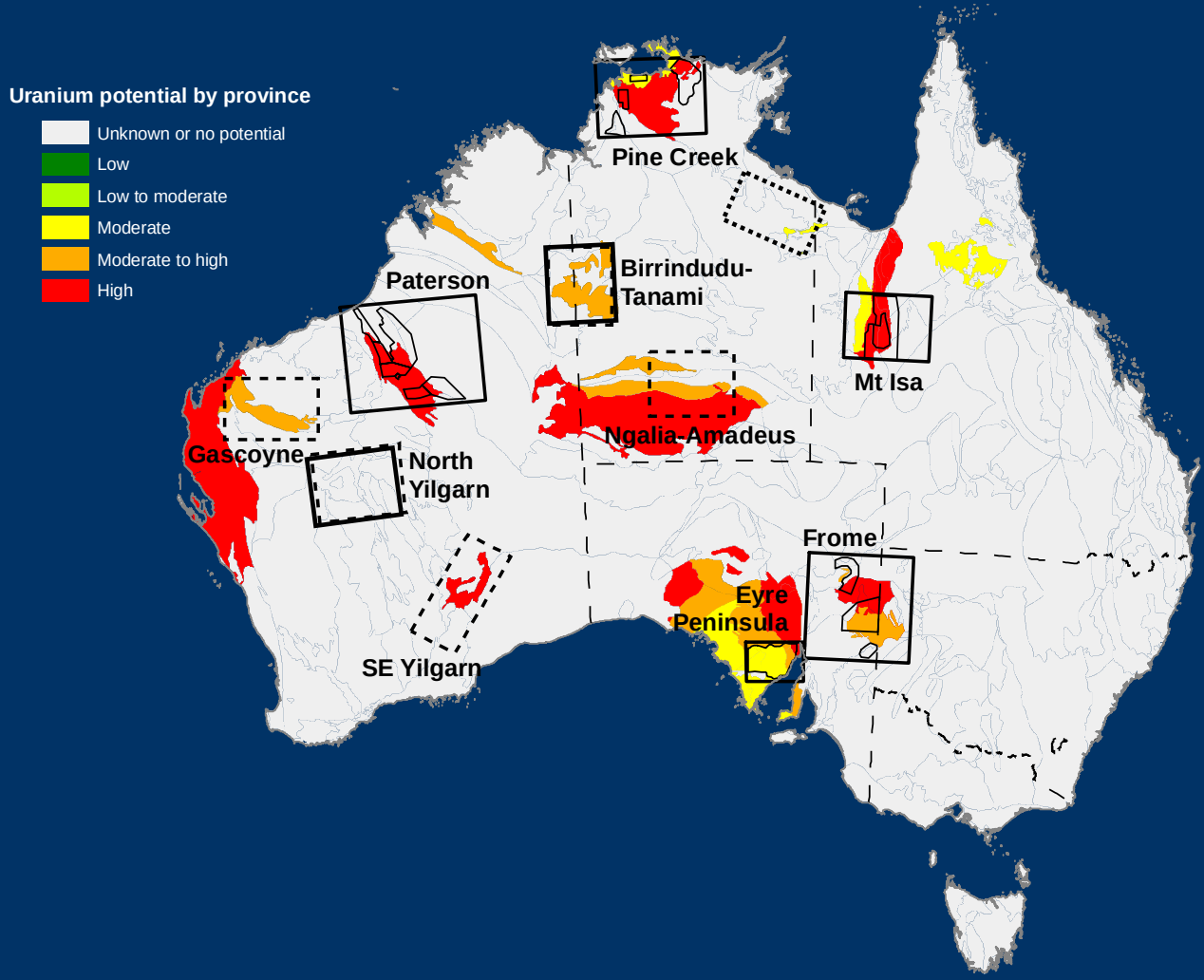
Products - Uranium

- Seismic data, sections and interpretation
- 2D maps showing predicted “high potential” areas; regional and national scale
- 3D maps of crustal structure for IOCG(U)s, & basin architecture for unconformity U, & paleo-channels for sandstone U
- GIS of U prospective areas, with U mineral systems criteria contained
- Reports on U potential in all areas new data acquired
- Publications on new regional synthesis

AEM program

- Map and define using surveys with 1-5 km wide line spacing
  - depth to basement,
  - major paleochannel systems
  - graphitic rocks in basement and reductants in potential sandstone (U) reservoirs
- Map palaeochannel systems and possible graphitic rocks in more detail in proximity to provinces with hot granites (~1km line spacing)

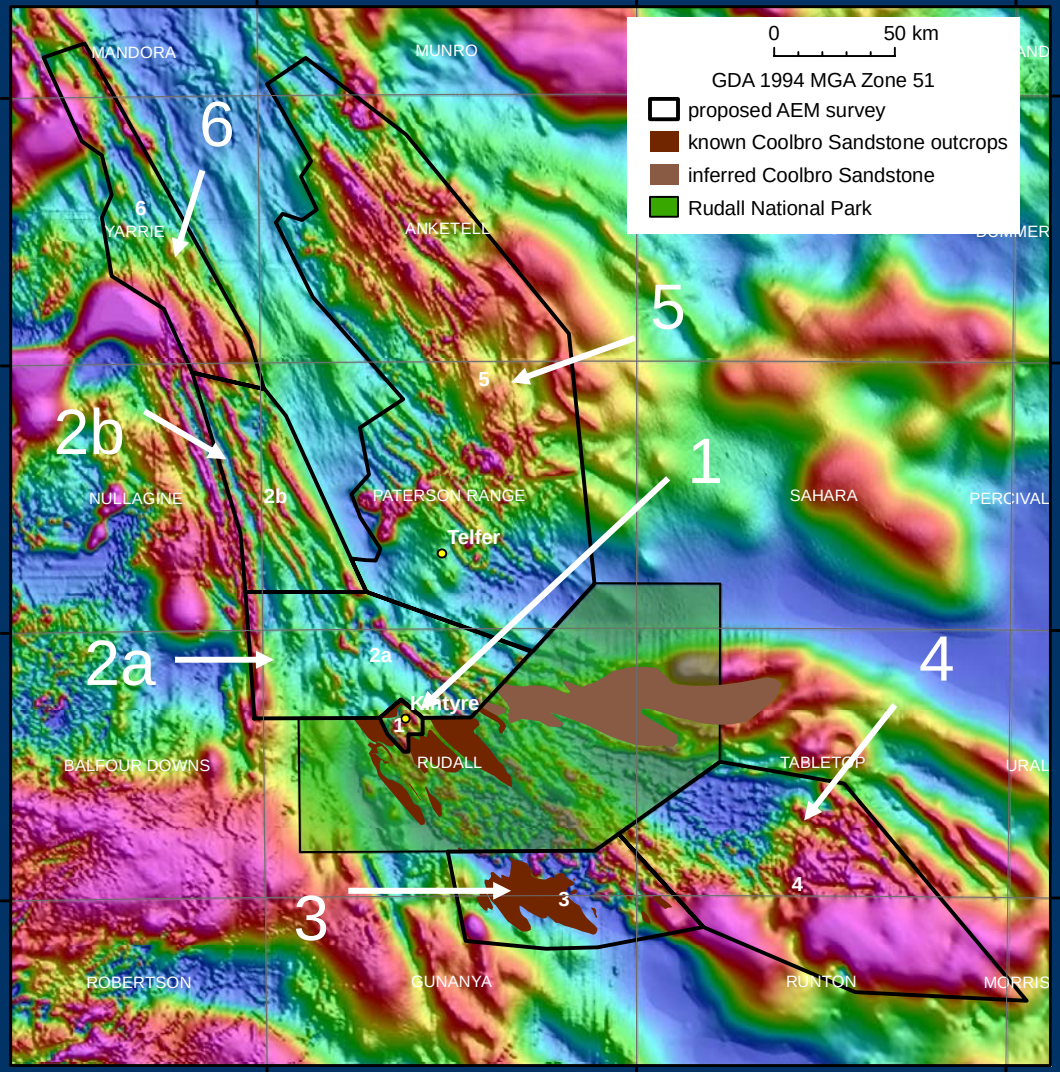
Potential AEM projects – U



1/ Paterson
2/ Frome
3/ Pine Creek
4/ Birrindudu/Tanami
5/ Eyre Peninsula
6/ Mt Isa
7/ Nth Yilgarn

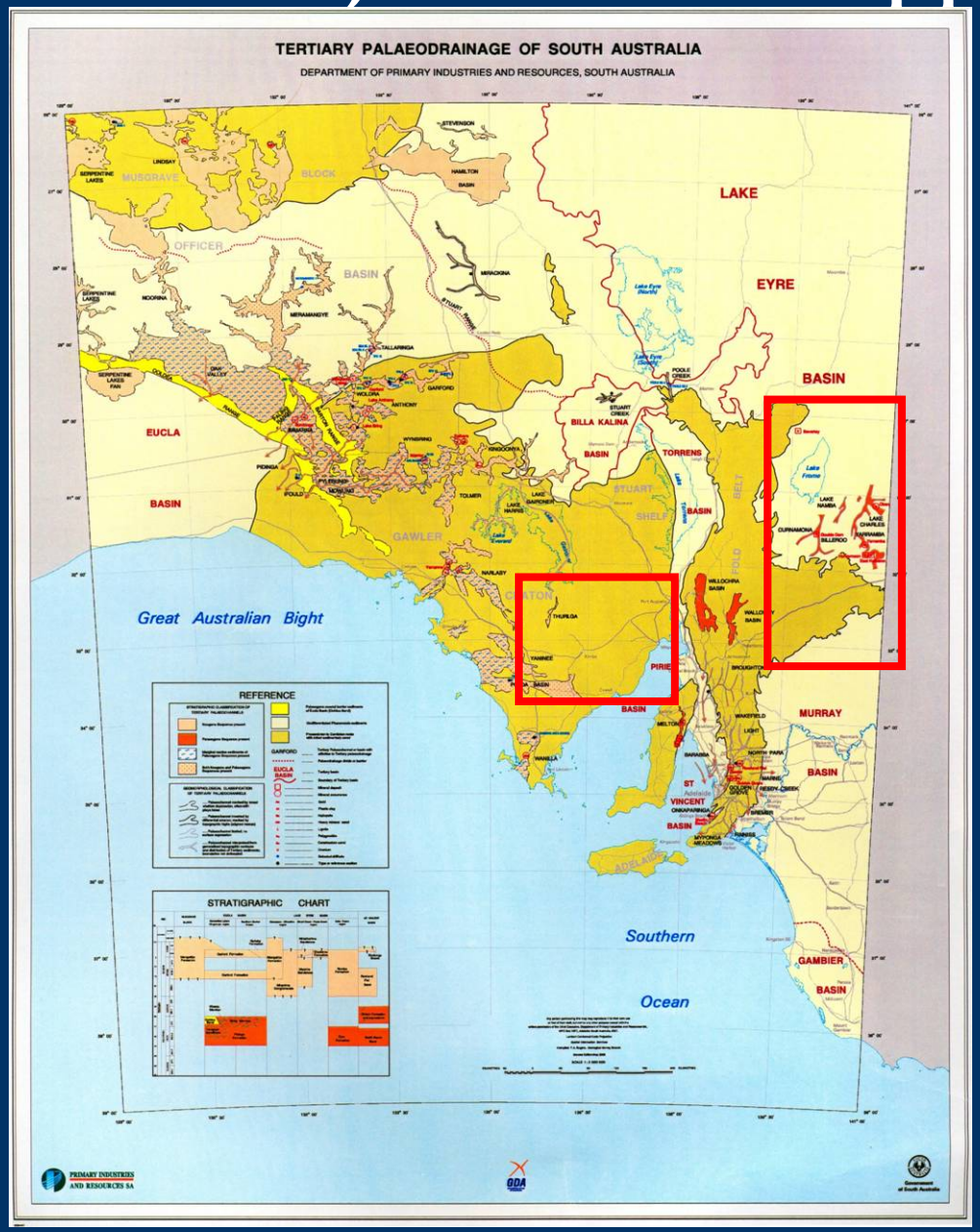
Gascoyne
Westmoreland
Amadeus-Ngalia
Sth Yilgarn

Paterson Airborne EM Survey



Area #	Line Spacing	Line kms
1	0.5	436
2a	1	4,825
2b	1	3,353
3	1	3,462
4	2	4,418
6	2	3,827
5	2	8,888

SA Projects workshopped with PIRSA

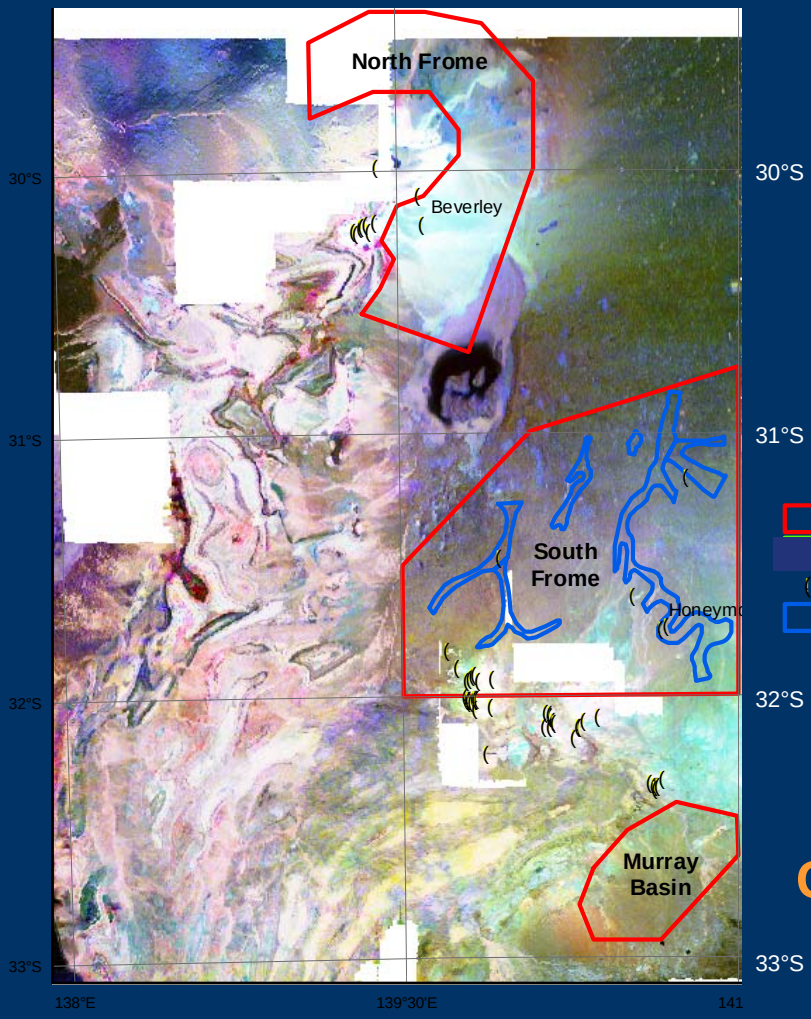


1/ Frome Embayment-Murray Basin

2/Eyre Peninsula

Frome embayment

Proposed AEM acquisition



Frome

- palaeochannel deposits in Eyre Fm (eg. Honeymoon)
- palaeochannel deposits in Namba Fm (eg. Beverley)
- roll front / groundwater fracture controlled deposits (eg. Beverley 4 Mile)
- North Frome 7,231 km^2
- South Frome 17,789 km^2
- Murray Basin 2,582 km^2
- Total 27,602 km^2

Proposed AEM survey

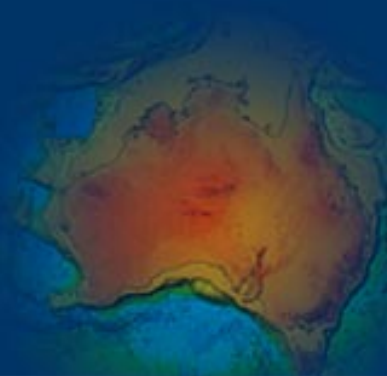
Uranium occurrences

Palaeochannels (PIRSA)

Backdrop
Gamma-ray data

Geothermal Project

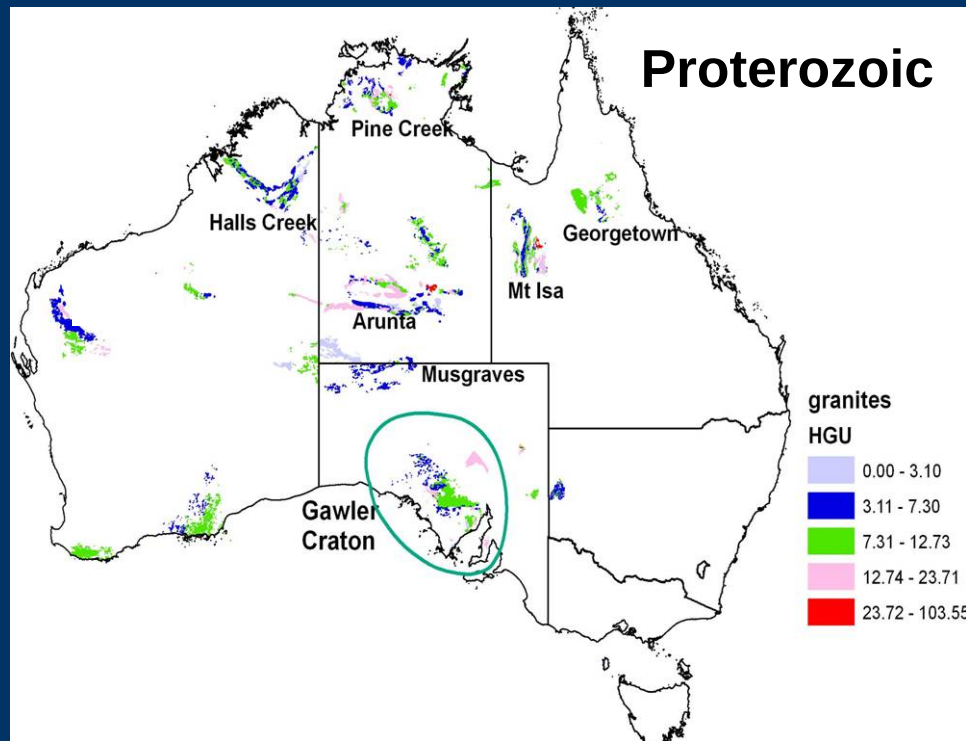
- **Geothermal Power**
  - **Map of HHP Granites from OZCHEM**
  - **Geophysical models for volumes**
  - **Thermal conductivities for sediment blankets**
  - **Prospectivity maps**
- **Geothermal for cities**



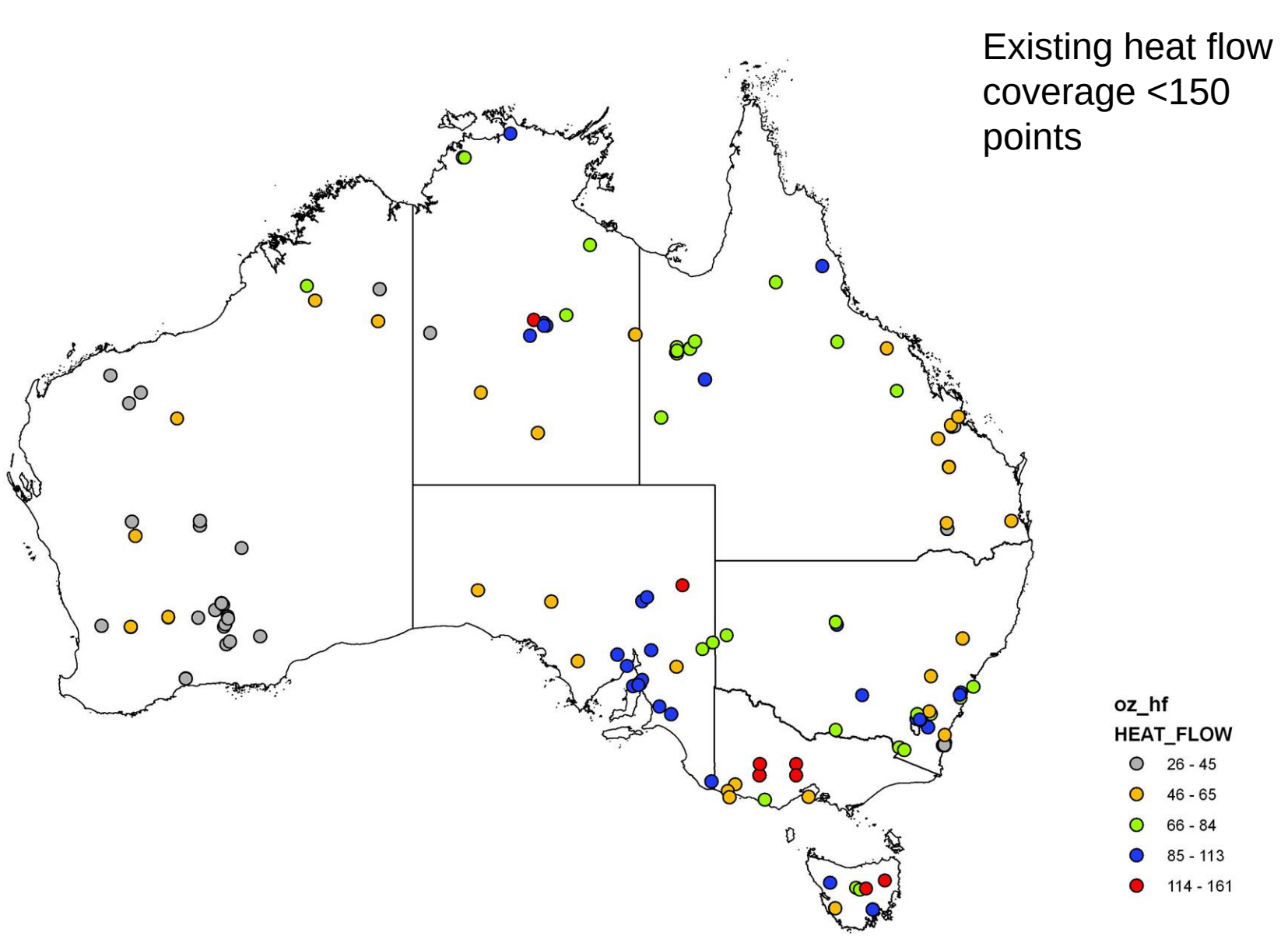
Geothermal Project

Source map

- Granites attributed
  - Show High Heat Producing Granites and
  - Predict which buried granites are HHP; tools - chemistry, inversion modelling, seismic
- High U & Th sediments
- Compile attributes of sedimentary basins, including depth, thermal conductivities, porosity/permeability



Geothermal Project – heat map

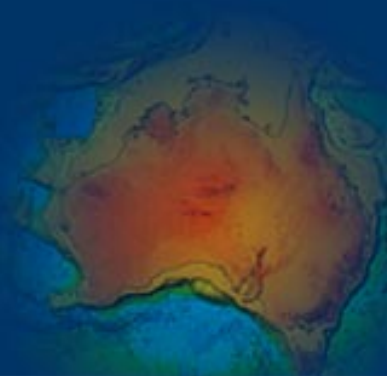


Onshore Petroleum Program

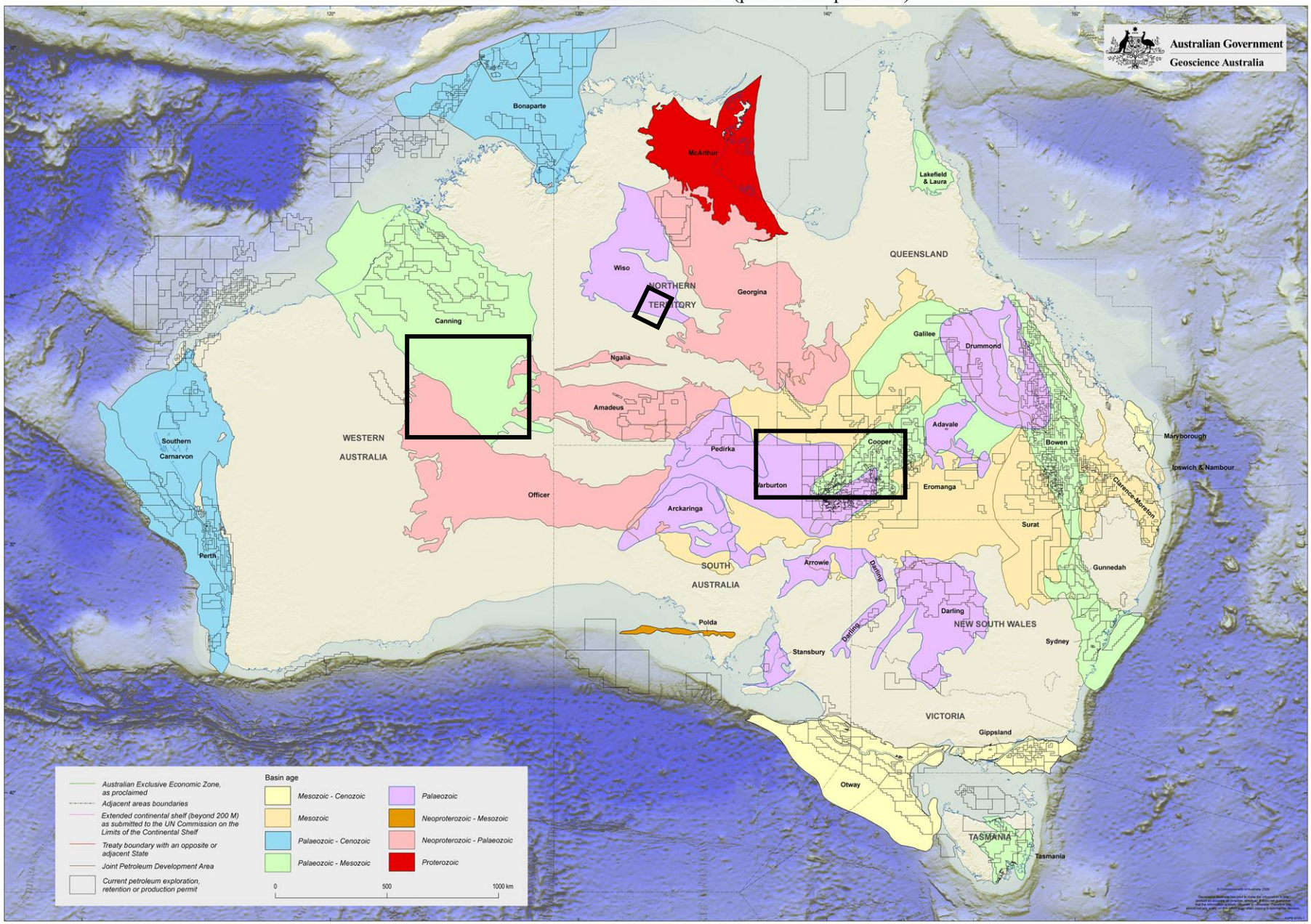
- **Aims & Objectives:**
  - **Make a significant and material difference**
    - **Focus on greenfield regions with high potential and known source rocks**
    - **Basin framework studies to place known producing plays in a whole of basin and crustal context**
  - **What are the critical datasets that will make a difference?**
  - **What are the fundamental impediments to exploration in these areas?**

Onshore Petroleum

- Continent-wide assessment of potential basins and prioritisation
- Sub-salt plays
  - Kidson sub basin, Canning Basin, WA
- Basin framework and crustal architecture studies –
  - Pedirka, Warburton, Eromanga and Cooper Basins, SA, Qld, NT
- Middle Cambrian Source
  - Lander Trough, NT



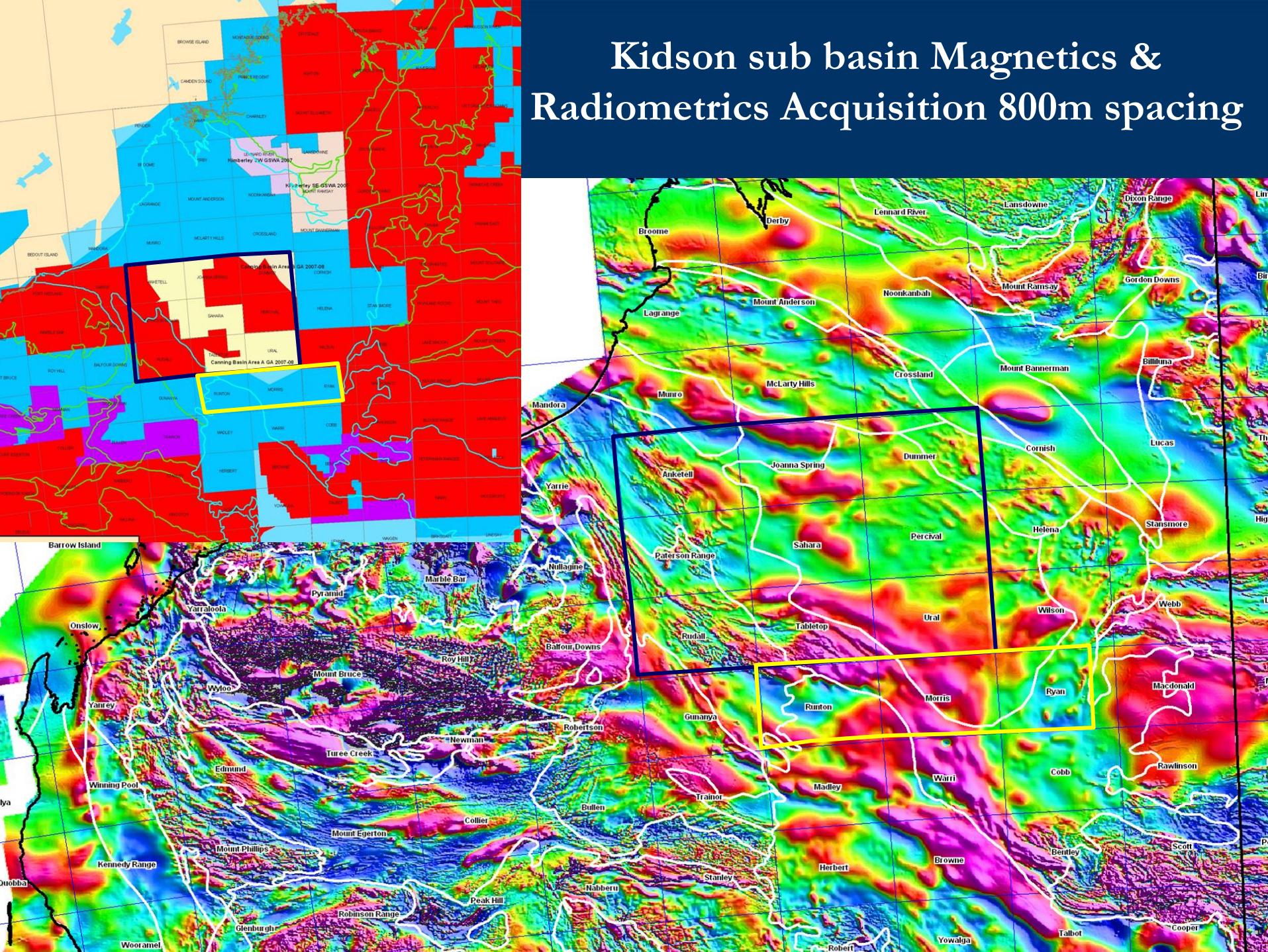
Australian Onshore Petroleum Basins (proven and potential)



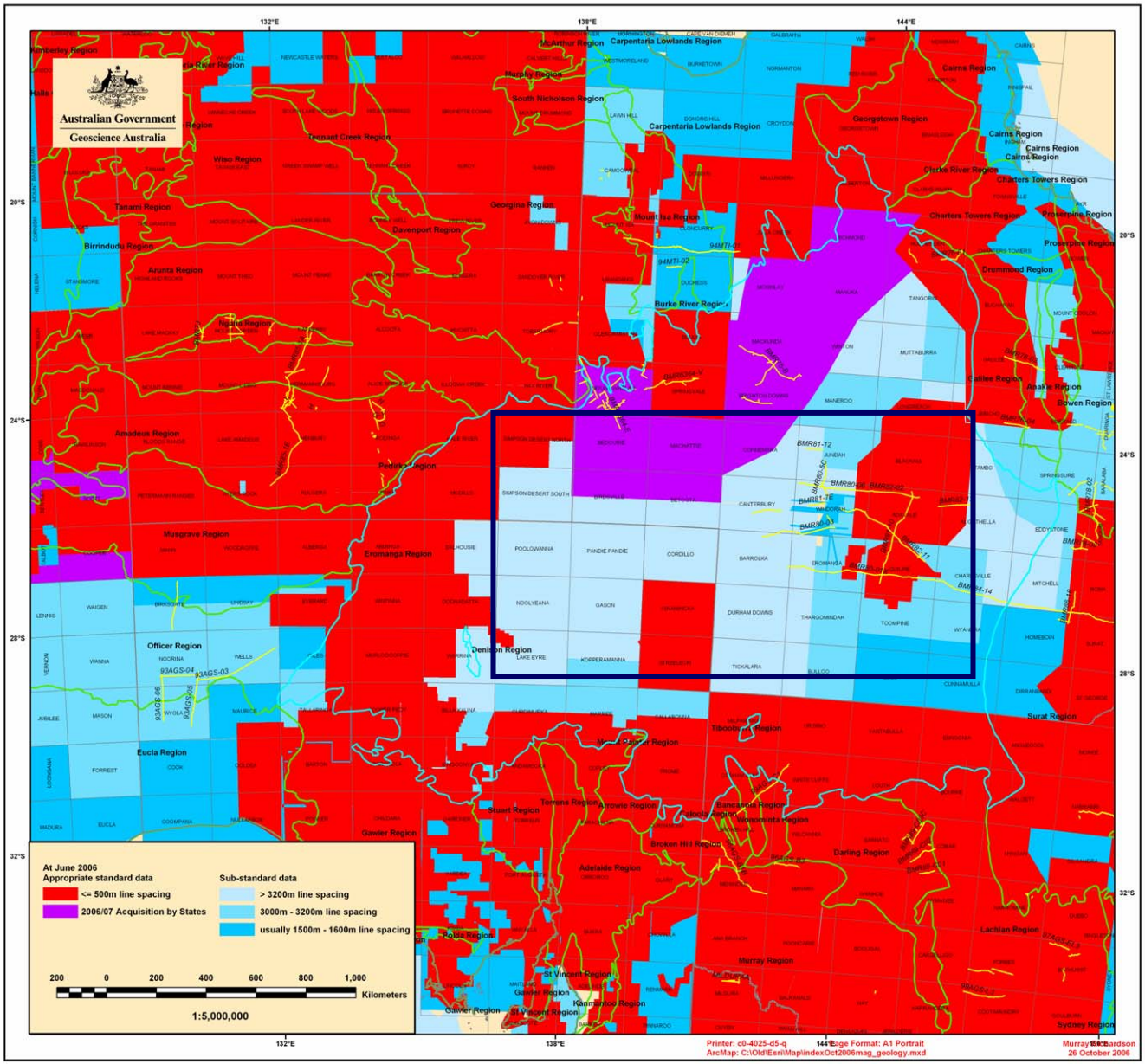
Acquisition Stages for a Potential Petroleum Program in Greenfields Regions (WA and NT/Qld/SA border)

- **Magnetics**
  - **Acquire magnetics in areas of > 1,500m line spacing**
  - **Interpretation of magnetics**
- **Seismic**
  - **Line location based on integrated studies including airborne magnetic interpretations**
  - **Interpret seismic to confirm structures and basin architecture**
- **Focussed seismic acquisition program**
- **Potential for targeted stratigraphic drilling**

Kidson sub basin Magnetics & Radiometrics Acquisition 800m spacing



Airborne Line Survey Spacing
Eromanga, Cooper, Pedirka and Warburton Basins



Potential Program

Magnetics 800m line spacing and or Gravity

Regional Seismic

Questions