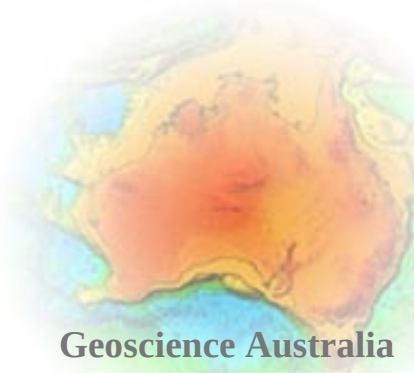
Australian Government

Geoscience Australia

Paterson AEM Survey:
Planned Acquisition and Interpretation

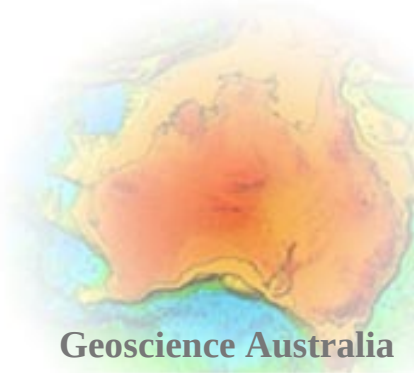
Adrian Fisher

Visit to Western Australia, August 2007



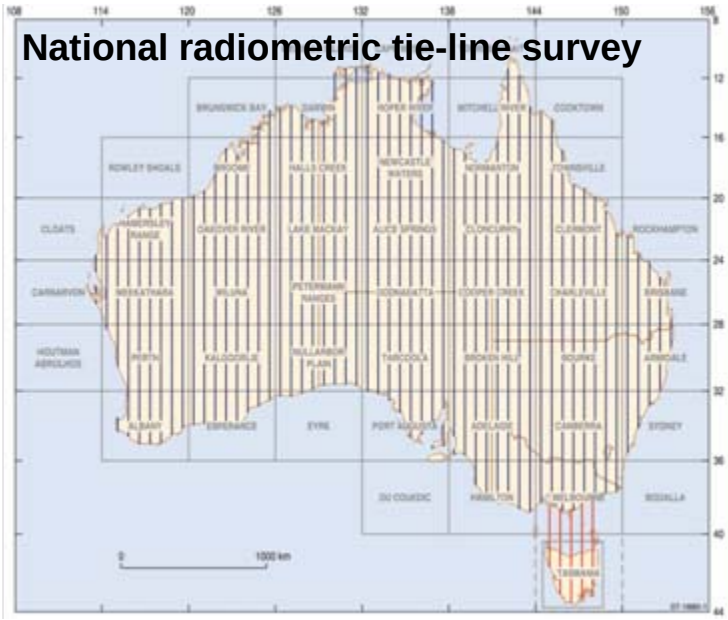
Outline

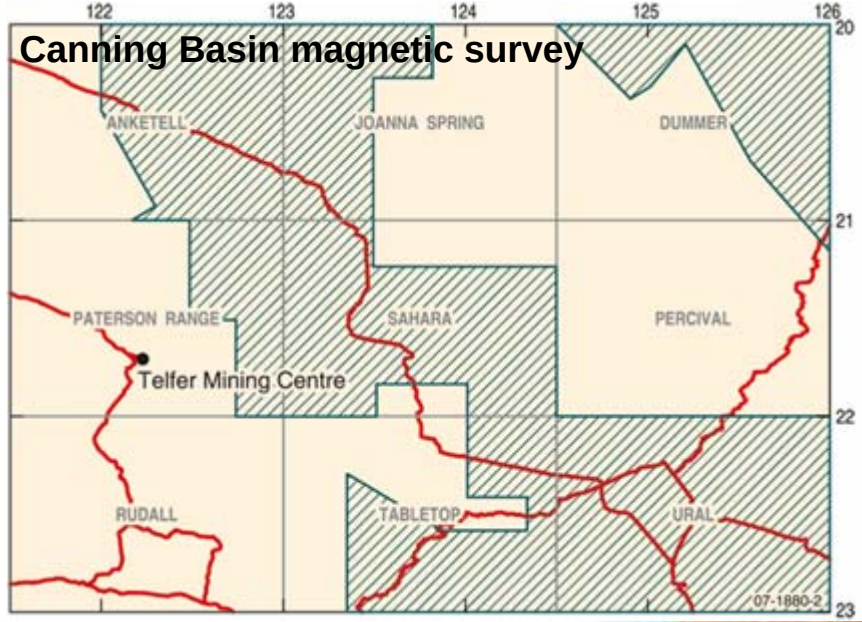
1. Onshore Energy Security Program
2. Regional AEM surveys
3. Paterson AEM Survey
4. The importance of downhole conductivity data
5. Industry collaboration



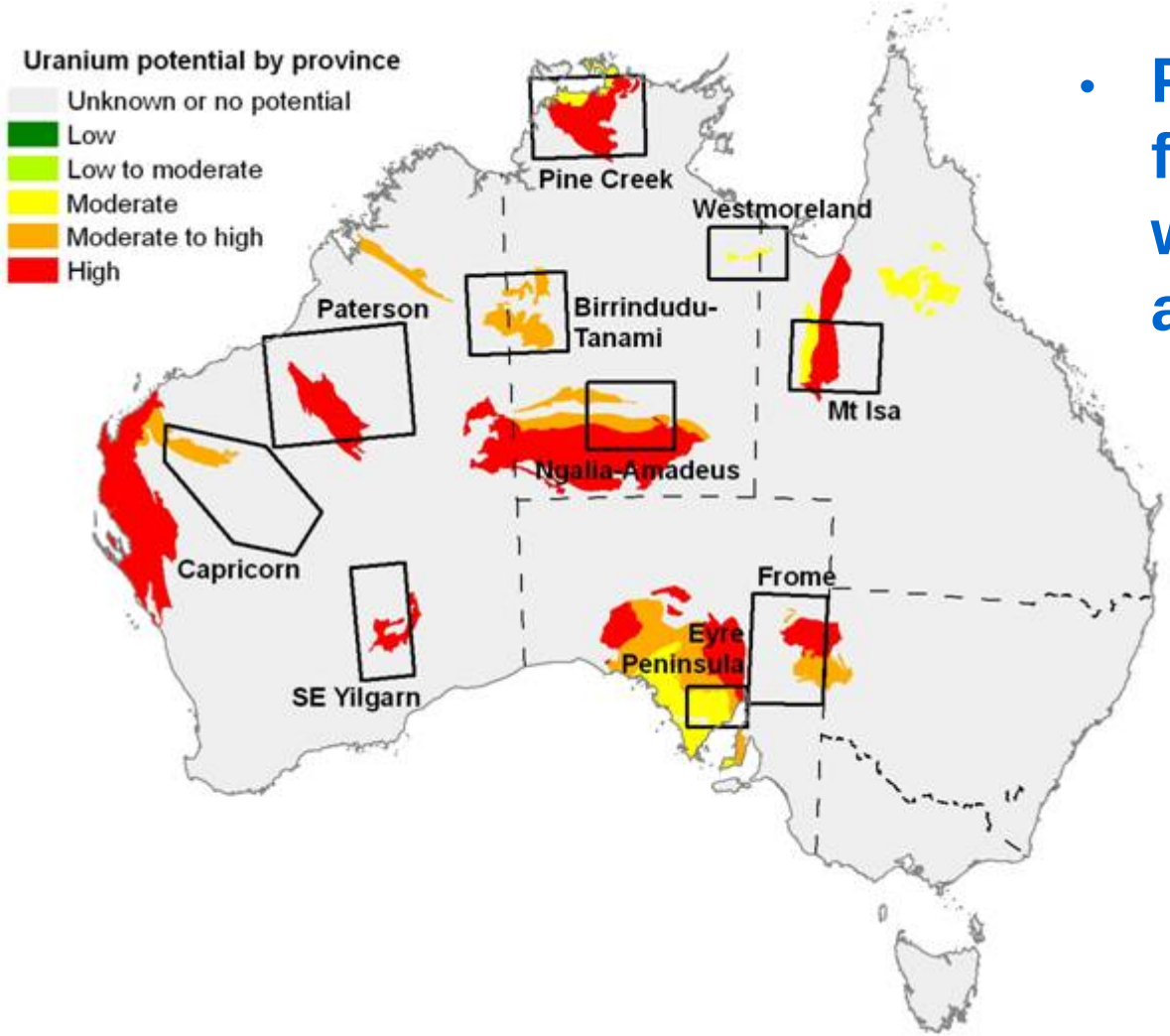
Onshore Energy Security Program

- **Designed to promote exploration for energy commodities**
- **Acquisition of pre-competitive geophysical data including radiometrics, magnetics, seismic and AEM**

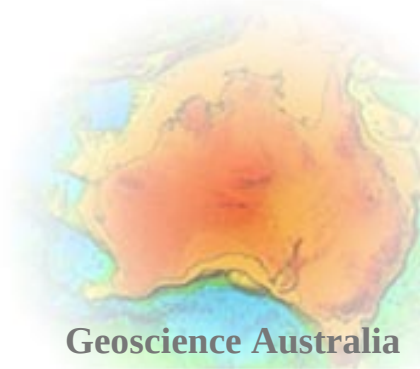




Regional AEM Surveys

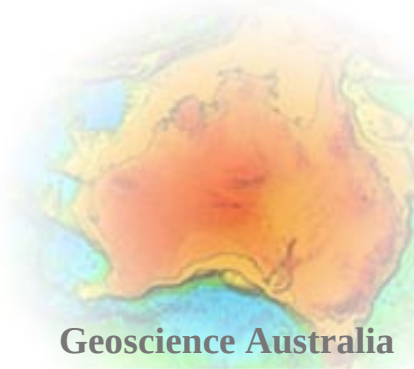


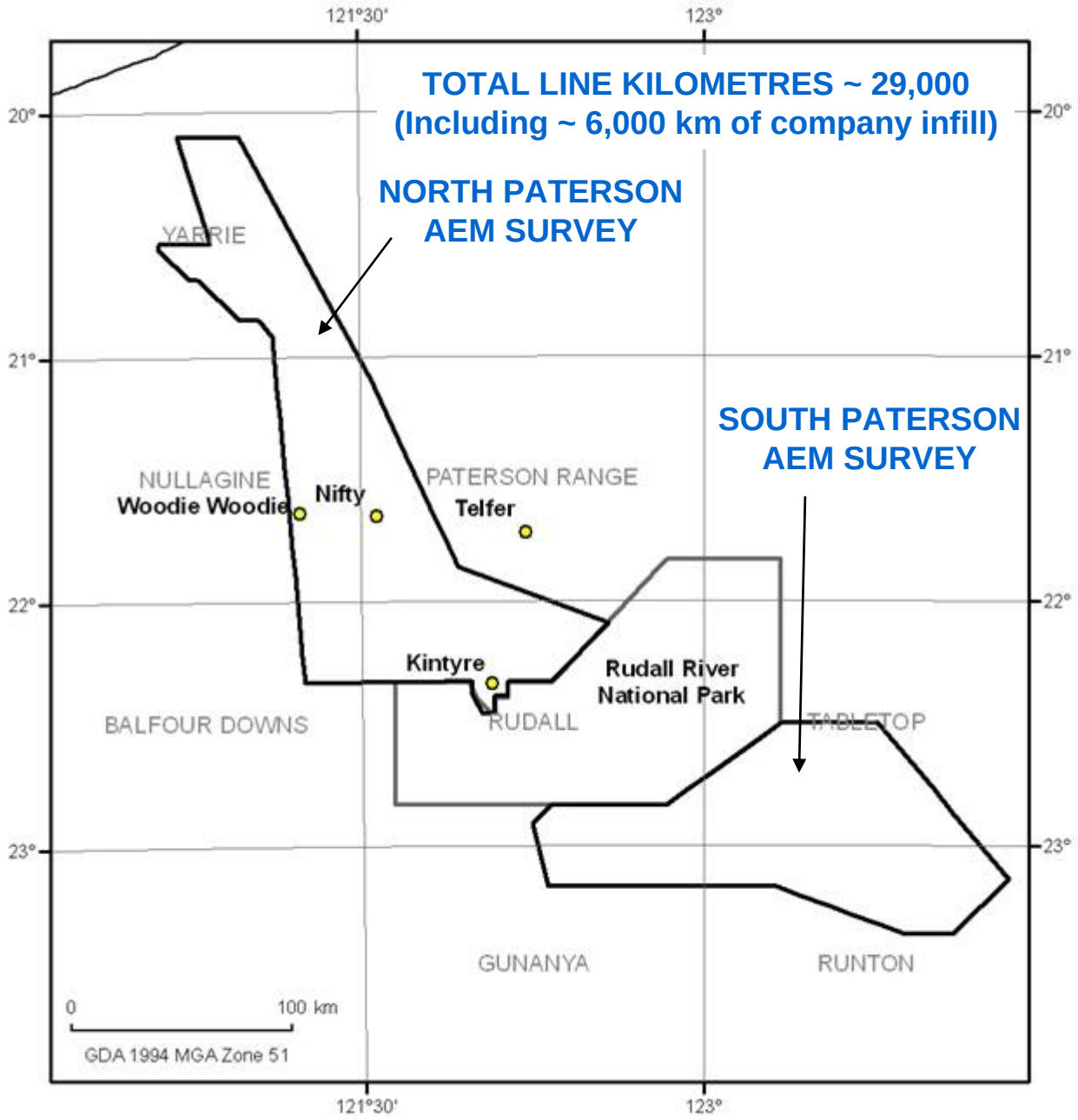
- **Proposed regions for AEM surveys were chosen according to:**
  - **uranium potential**
  - **the presence of suitable targets for AEM**
  - **various logistical reasons**

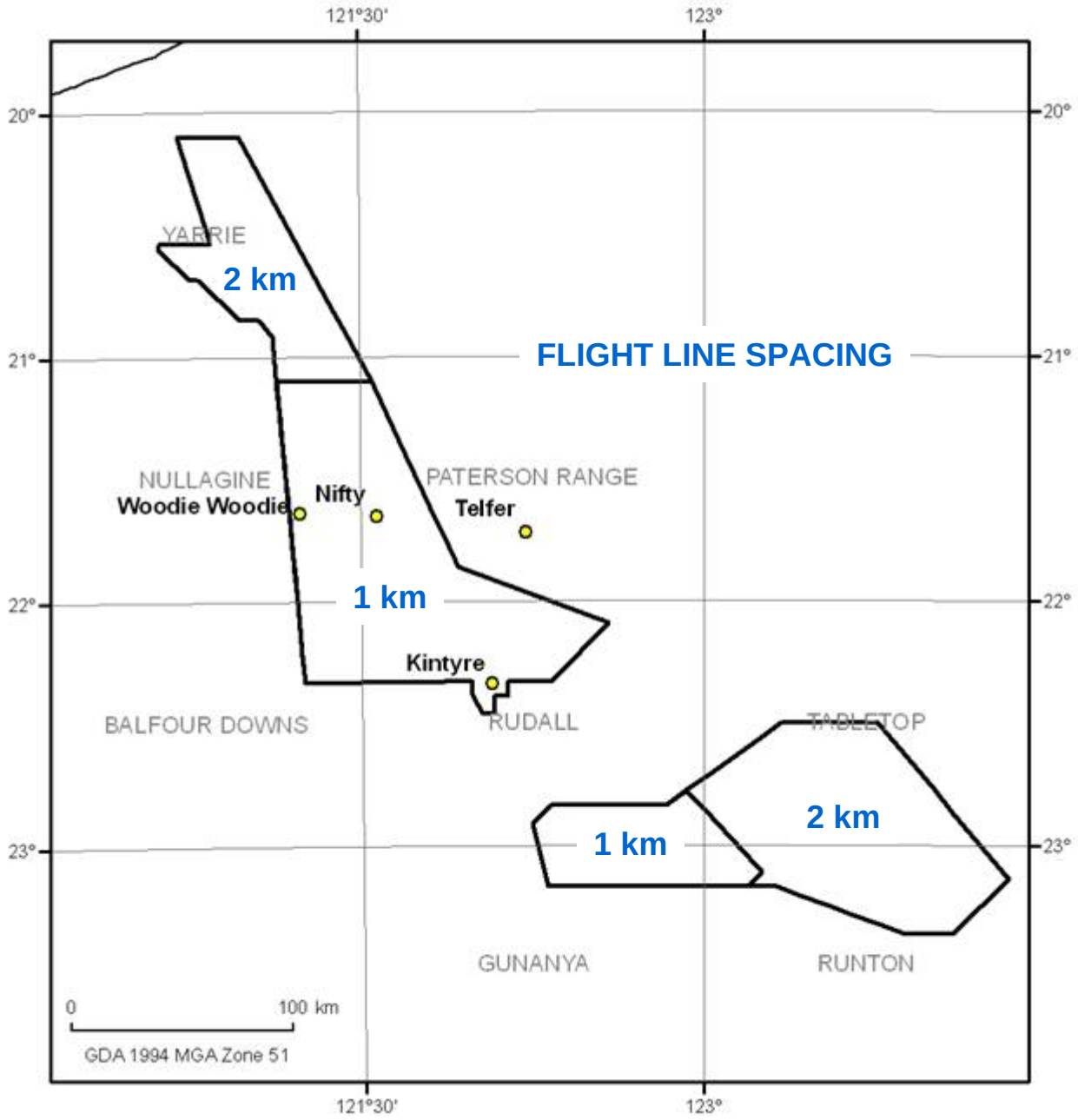


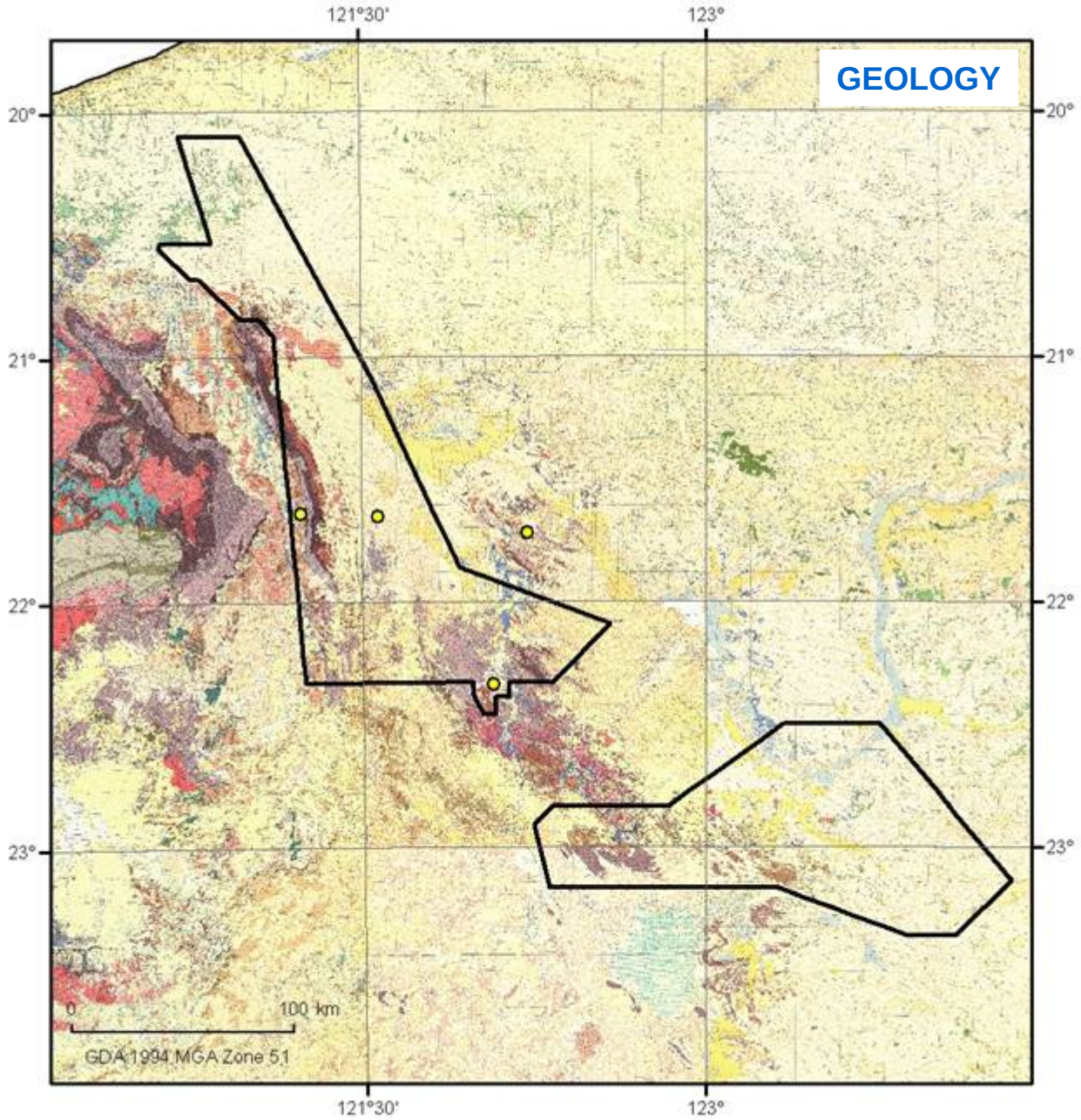
Paterson AEM Survey

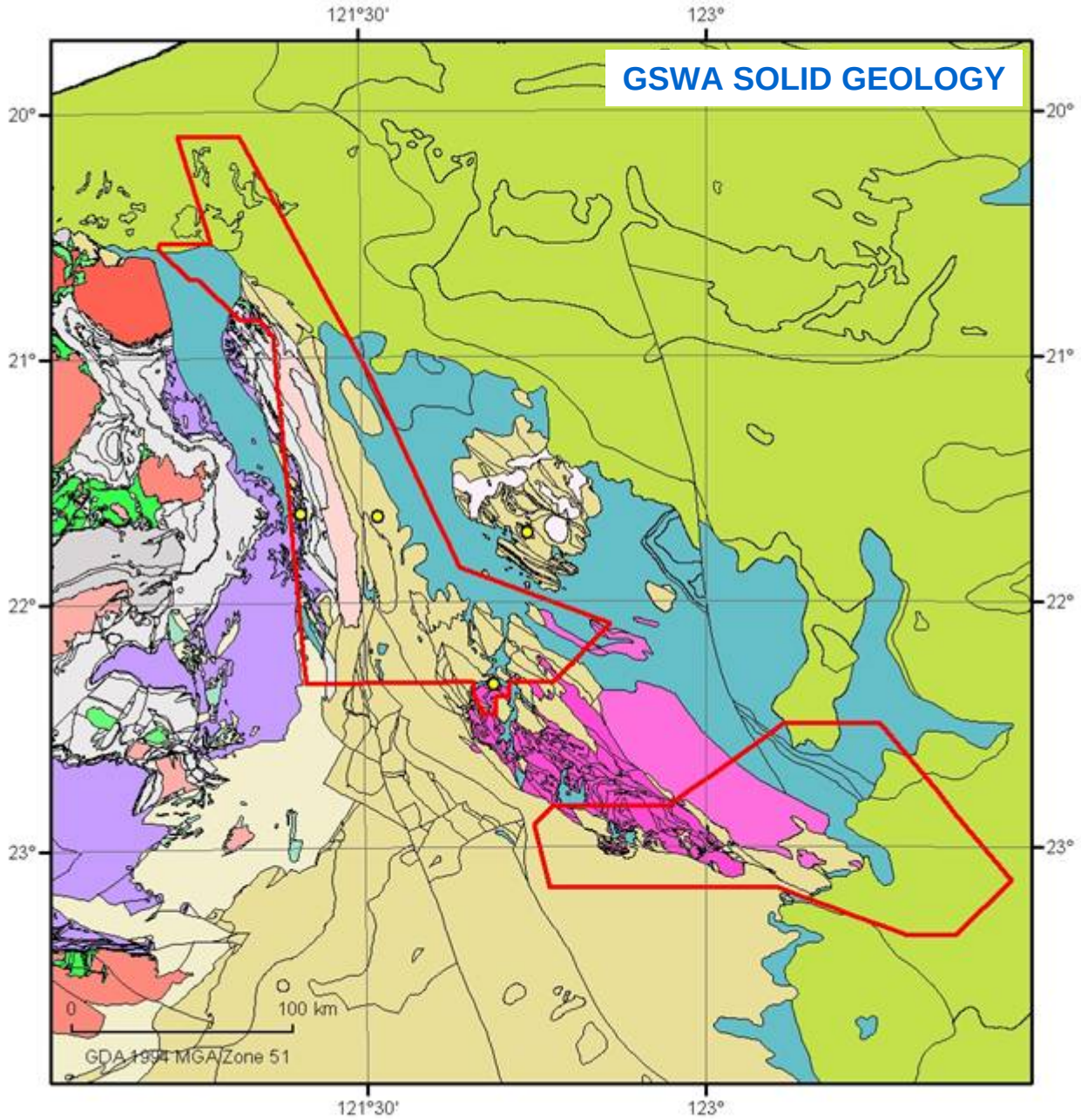
- The survey area was designed to cover as much of the Paterson Province as possible
- The main technical limiting factor was depth of covering Canning Basin sediments
- No data will be acquired over the Rudall River National Park
- East west flight lines with variable spacing:
  - Areas of lower risk: 1 km
  - Areas of higher risk: 2 km
  - Company paid infill areas: 200-400 m

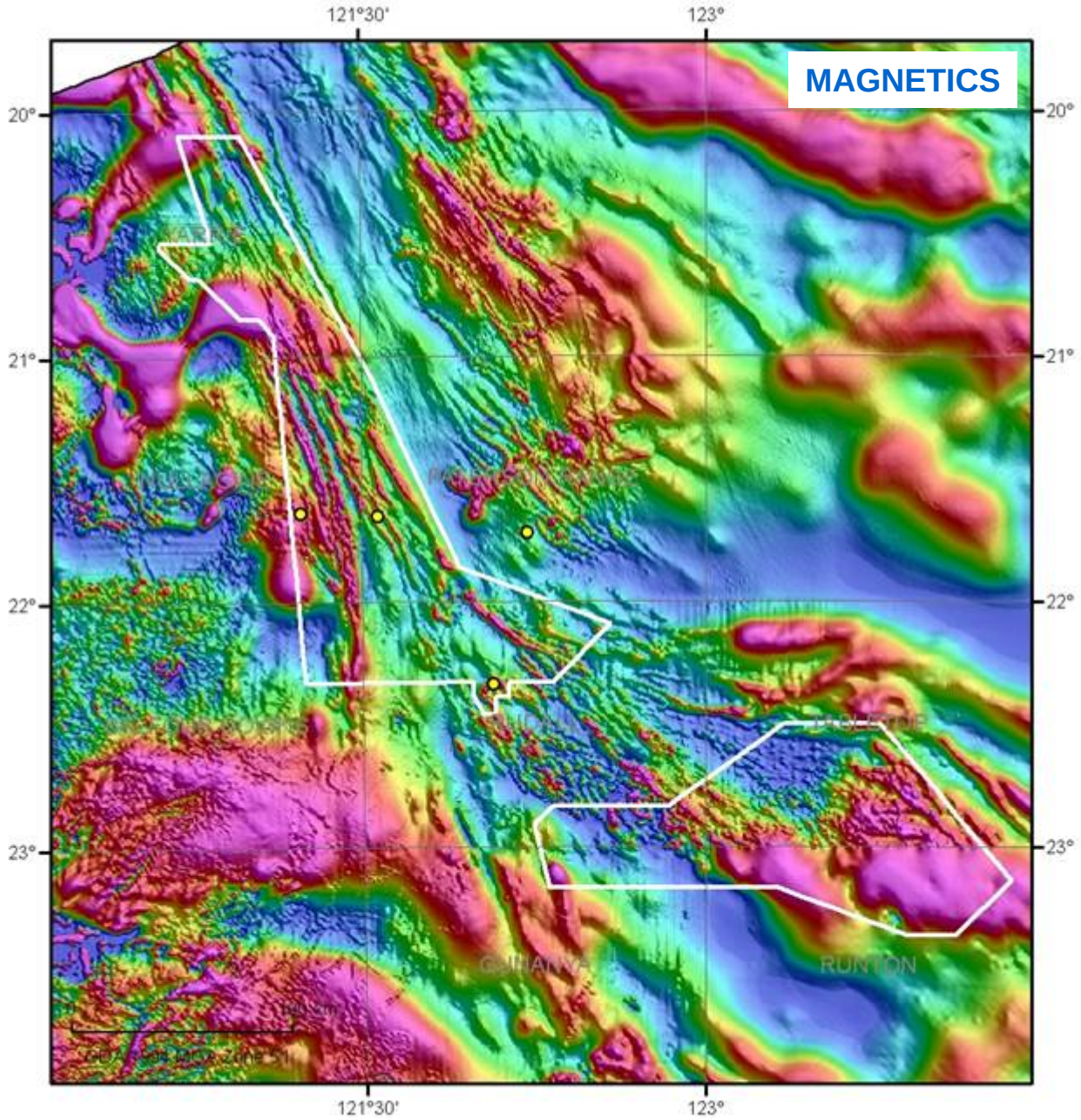


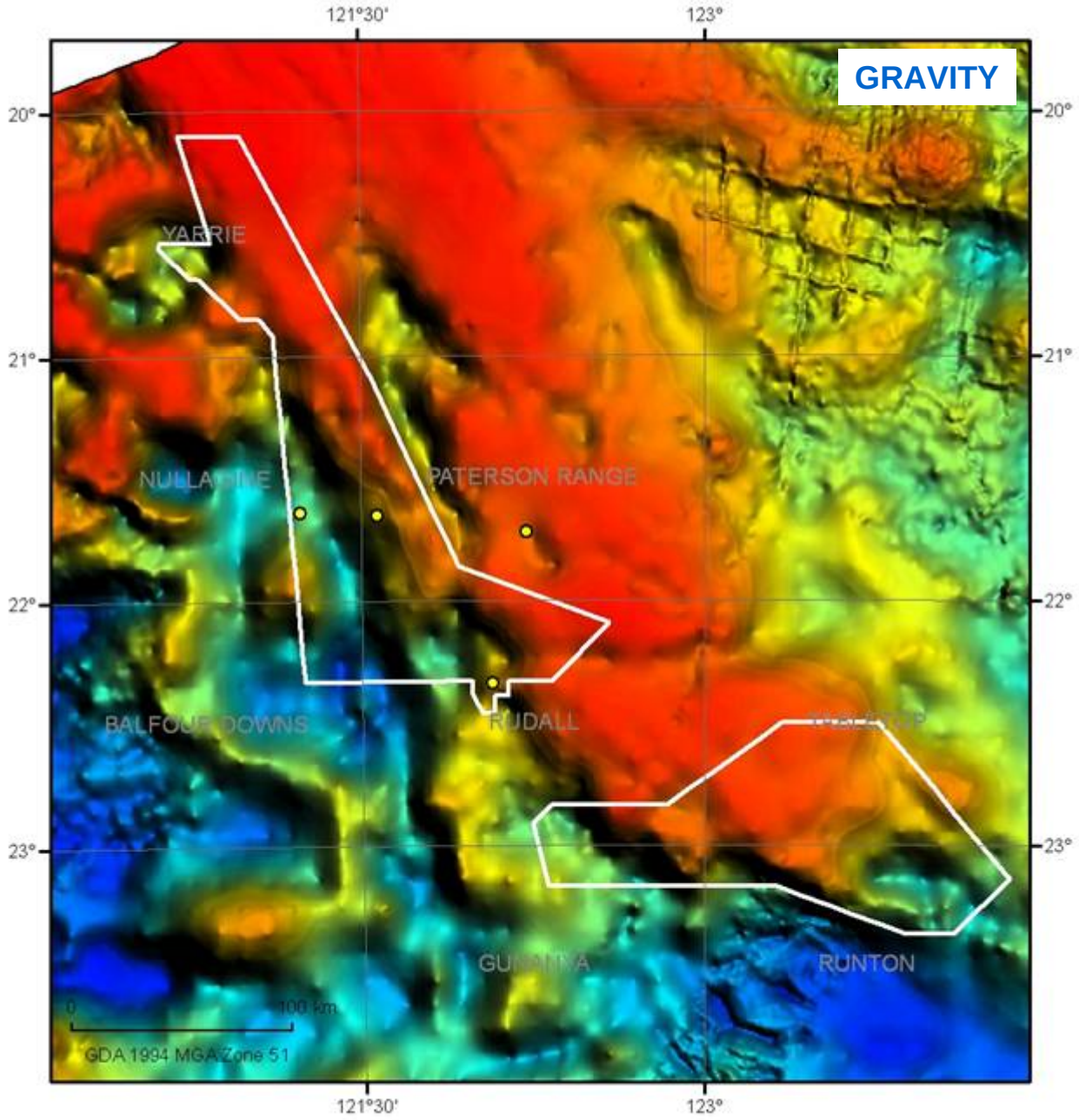

TOTAL LINE KILOMETRES ~ 29,000
(Including ~ 6,000 km of company infill)
NORTH PATERSON
AEM SURVEY
SOUTH PATERSON
AEM SURVEY
121°30'
123°
20°
21°
22°
23°
YARRIE
NULLAGINE
Woodie Woodie
Nifty
PATERSON RANGE
Telfer
Kintyre
Rudall River
National Park
BALFOUR DOWNS
RUDALL
TABLETOP
GUNANYA
RUNTON
0
100 km
GDA 1994 MGA Zone 51


121°30'
123°
20°
21°
22°
23°
YARRIE
2 km
FLIGHT LINE SPACING
NULLAGINE
Woodie Woodie
Nifty
PATERSON RANGE
Telfer
1 km
Kintyre
BALFOUR DOWNS
RUDALL
TABLETOP
2 km
1 km
GUNANYA
RUNTON
0
100 km
GDA 1994 MGA Zone 51


GEOLOGY
121°30'
123°
20°
21°
22°
23°
0
100 km
GDA 1994 MGA Zone 51

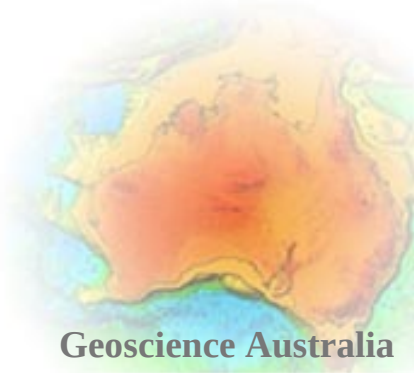

GSWA SOLID GEOLOGY
121°30'
123°
20°
21°
22°
23°
0
100 km
GDA 1994 MGA Zone 51


MAGNETICS
121°30'
123°
20°
21°
22°
23°
RUNTON

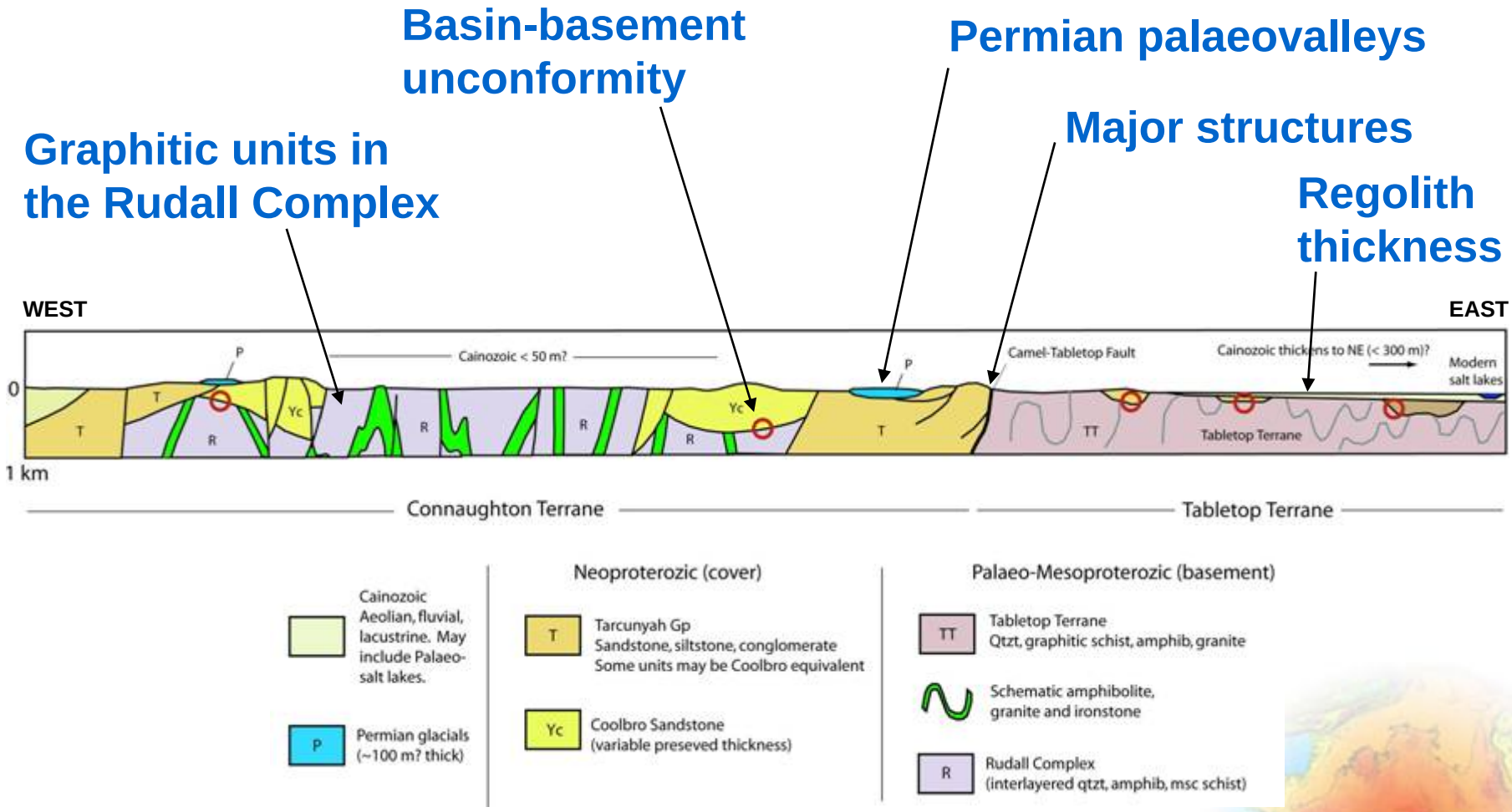

GRAVITY
121°30'
123°
20°
21°
22°
23°
YARRIE
PATERSON RANGE
RUDALL
BALFOUR DOWNS
RUNTON
0
100 km
GDA 1994 MGA Zone 51

Objectives of the AEM Survey

- The survey will map the conductivities of different geological units under cover
- It will help improve our understanding of the regions geology and mineral potential
- The data will assist with interpretations regarding:
  - the presence of graphitic units in the Rudall Complex
  - the nature of the basin-basement unconformity
  - the location of major structures
  - the extent of Permian palaeovalleys and other regolith materials



Schematic cross section

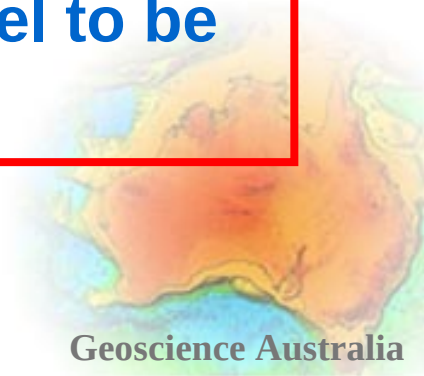


AEM Survey Products

- **Data will be released in stages:**
  - **First release: Regional AEM data**
  - **After 1 year remaining confidential: Company infill AEM data**
- **Other products that require complementary data are:**
  - **Geoscience Australia Layered Earth Inversions (LEI)**
  - **Geological interpretations (maps and reports)**

Making inversions less ambiguous:

- **Many different conductivity models can fit the data**
- **Borehole conductivity data allows the model to be assessed and improved**



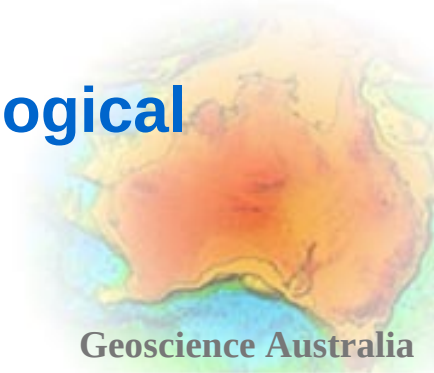
How is borehole conductivity data used?

1. **Borehole conductivities provide a better basis for processing AEM data (they help establish a realistic conductivity reference model)**

2. **They allow the inversion result to be assessed against an independent dataset**

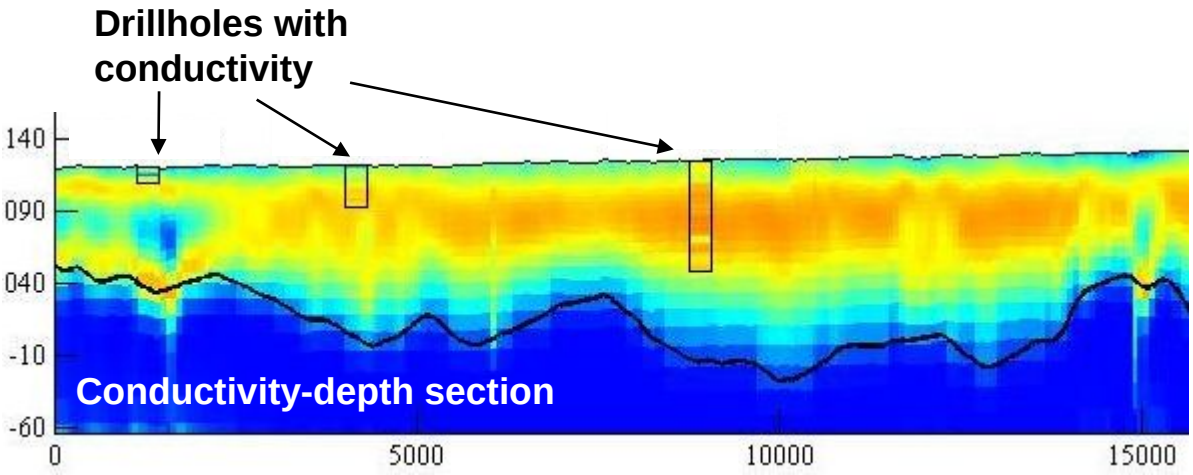
3. **They provide downhole relationships between conductivity and geology, which assists interpretation**

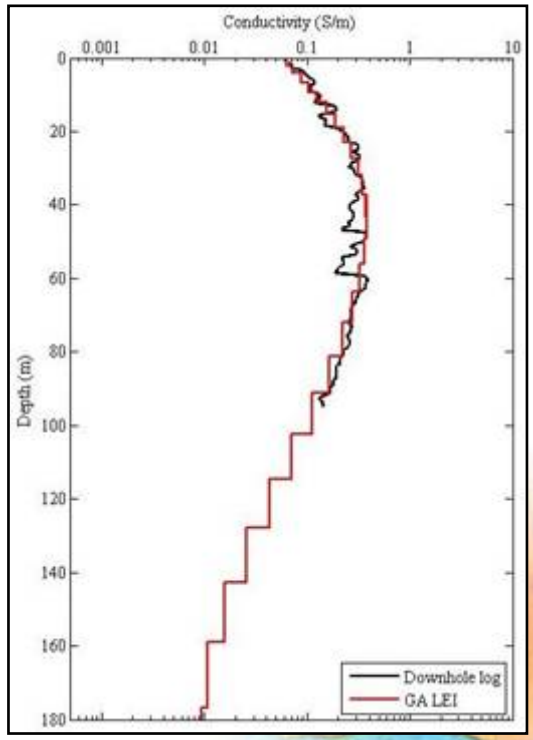
4. **They allow the development of a 3D geological framework to improve processing**



The inversion process

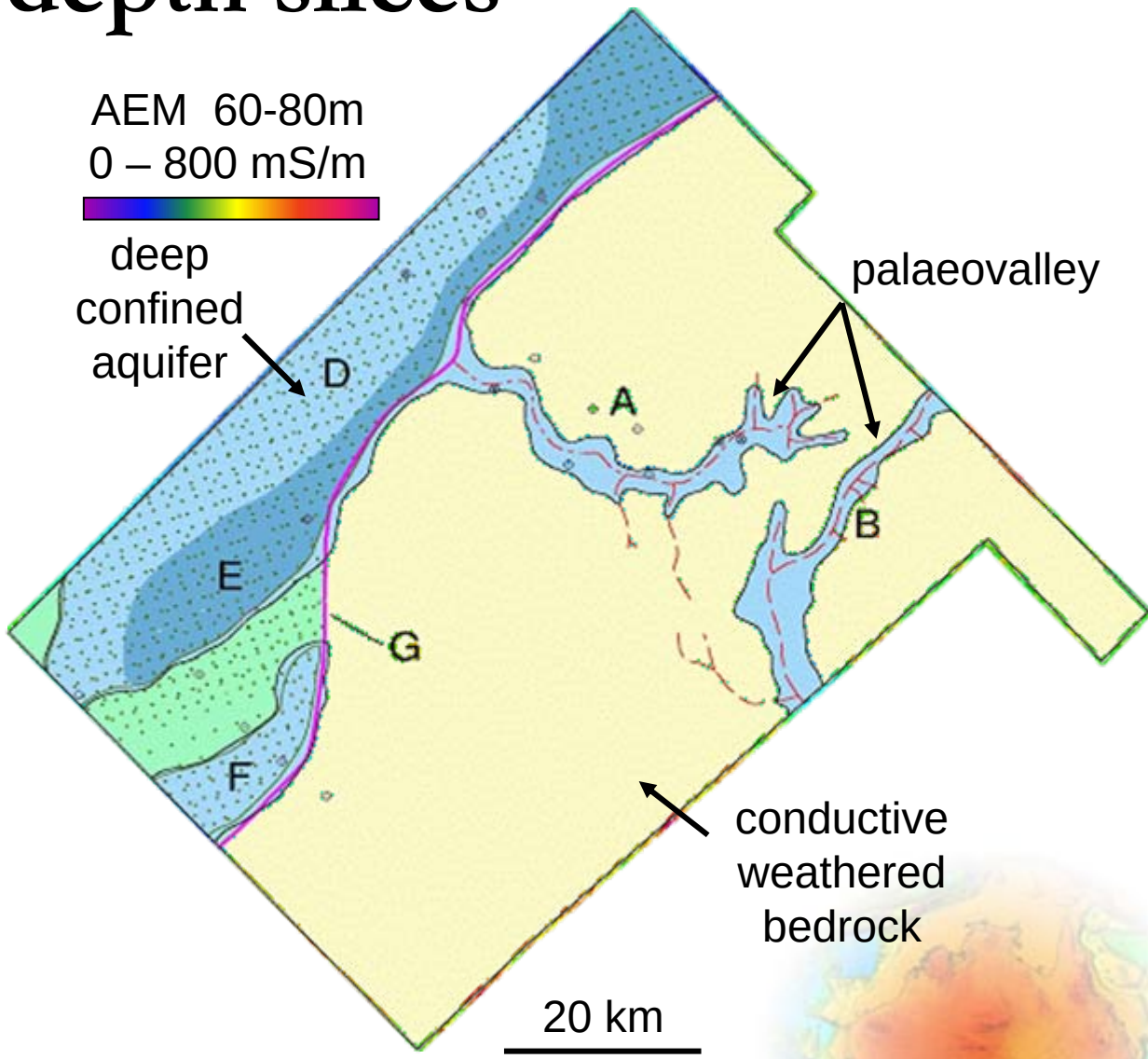
- Run the inversion and assess the result (conductivity model) against downhole conductivity logs
- Then change the parameters of the inversion and re-run
- Continue to iteratively run inversions until the model and the downhole conductivities correspond





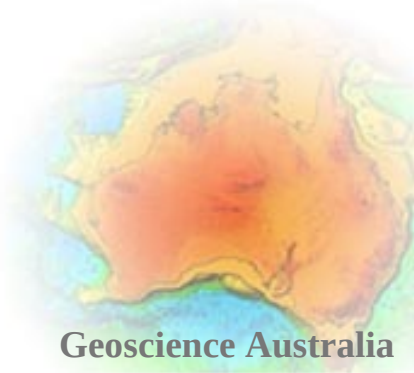
Conductivity depth slices

- **Example dataset from the Lower Balonne AEM survey in south east QLD**
- **Borehole data improved the inversion result**
- **The data was then able to map the distribution of geological features at the correct depths**



Complementary Data - Geology

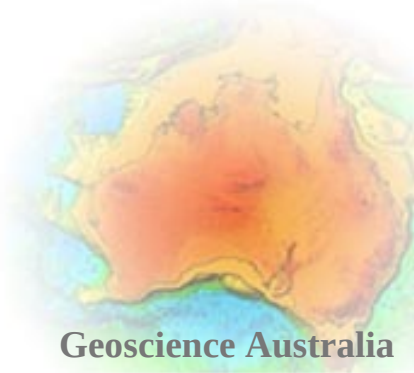
- **Geological information is also required to interpret the data and inversion results:**
  - **Downhole lithological descriptions and gamma-ray logs**
  - **Depth to the water table and presence of aquifers**
  - **Salinity of groundwater**
- **Coincident geological and conductivity information is best in providing a direct relationship**
- **Boreholes lacking conductivity logs are also very useful for interpretation**
- **Sufficient borehole density will allow the construction of 3D geological maps**



Industry Collaboration

- **Stages of collaboration:**
  1. Offer for infill flying
  2. Request for industry data – existing AEM and drillhole data
  3. Release of AEM data
  4. Collaborative geophysical logging program
  5. Collaborative drilling program
  6. Discussion with industry on geological interpretations
  7. Release of final products

- **Collaboration will result in:**
  - improved AEM inversions
  - better geological interpretations and products
  - a regional synthesis



Future work

- **Northern WA Project**
  - **Project Leader: Richard Blewett**
  - **Geological interpretations of the Paterson Province**
  - **Build on AEM data and previous GA work (Paterson Project)**

- **Uranium Project**
  - **Project Leader: Roger Skirrow**
  - **Investigate the uranium systems present in the Paterson Province**
  - **Build on AEM interpretations**