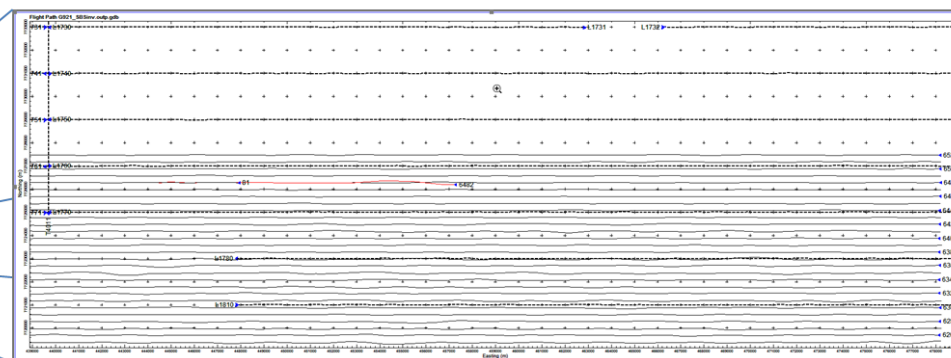
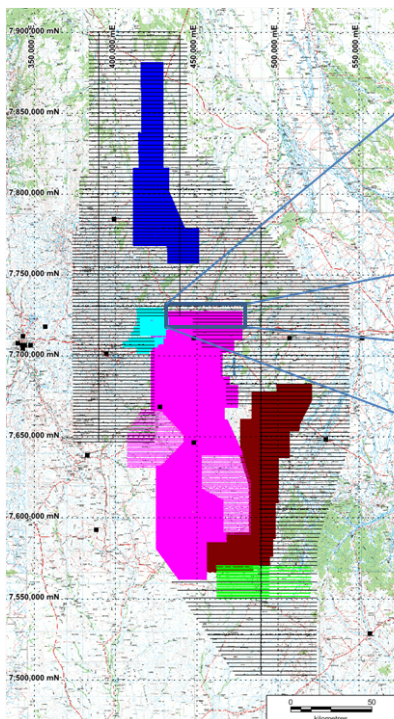


Isa Survey Area -2016 Vtem and historic data & the ANVGL



Survey 921 1997 BHP geotem survey

AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM : GEOTEMdeep 25 Hz

Pulse width : 4108 microseconds

Components : X Y and Z

Channel centres : 352,509,665,899,1212
1602,2071,2618,3321,4181,5196,6368,7774
9493,11661,14337 microseconds after
transmitter turn off

Impulse channel centres : 469,1328,2344,3438
microseconds after transmitter turn on

RECORDING INTERVAL : 0.25 sec (approx 16 m sampling)
at mean ground speed of 235 km/hour

MAGNETOMETER : Cesium Vapour optical absorption
Sensitivity : 0.01 nT

RECORDING INTERVAL : 1.0 sec (approx 65 m sampling)
at mean ground speed of 235 km/hour

DIGITAL RECORDING : Geotrex GEODAS acquisition system

NOMINAL TERRAIN CLEARANCE : Magnetometer sensor in aircraft at 105 m
EM transmitter in aircraft at 105 m
EM receiver in towed bird at 62 m

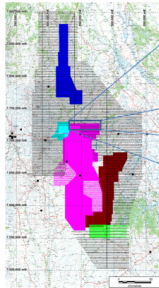
NOMINAL LINE SPACING : Traverse lines 300m / 900m

NOMINAL LINE DIRECTION : Traverse lines 090/270

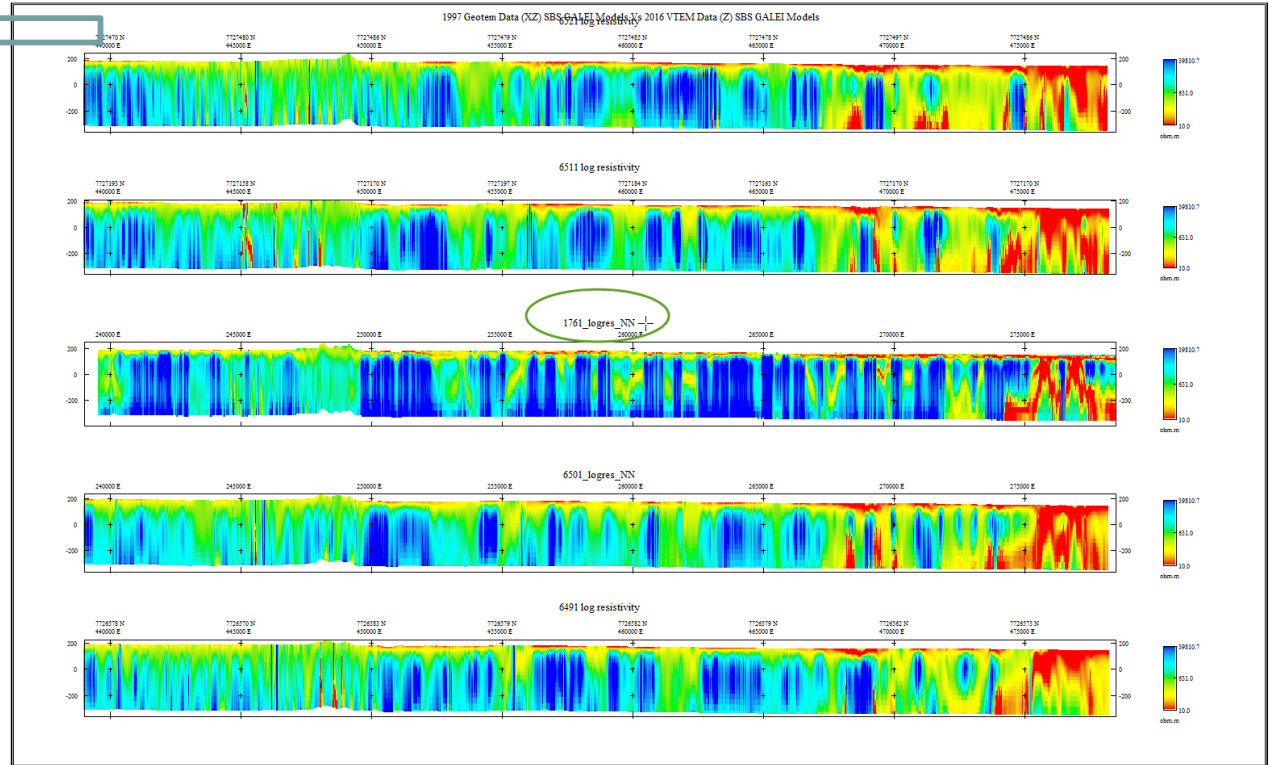
FLIGHT PATH NAVIGATION : SERCEL NR103 and Fugro Starfix Omnistar Plus
real time satellite differential GPS system

FLIGHT PATH RECORD : XY coordinates computed from WGS84 lat/long
coordinates recorded by Fugro Starfix
Omnistar Plus real time satellite
differential GPS system

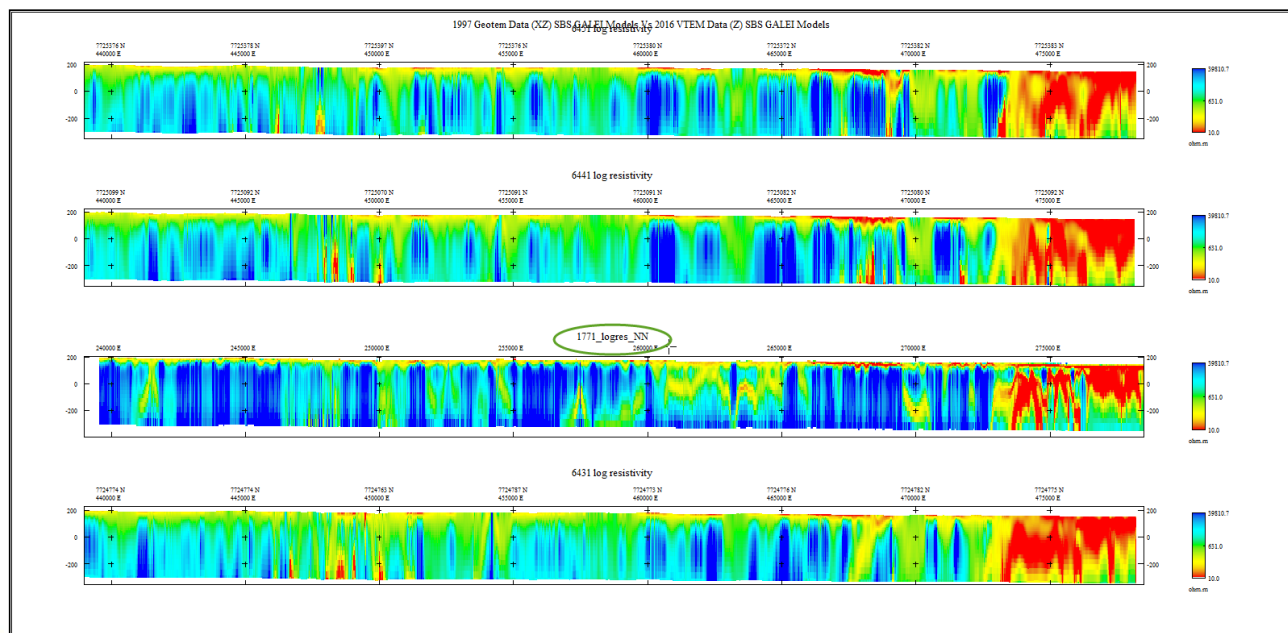
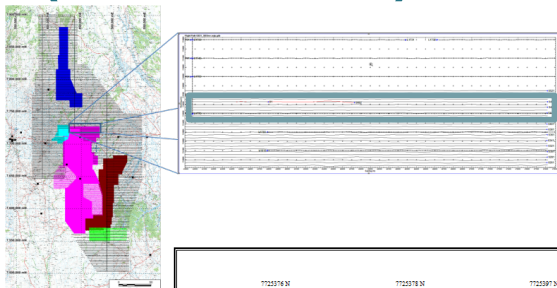
Common Line Models (vtem 1761)



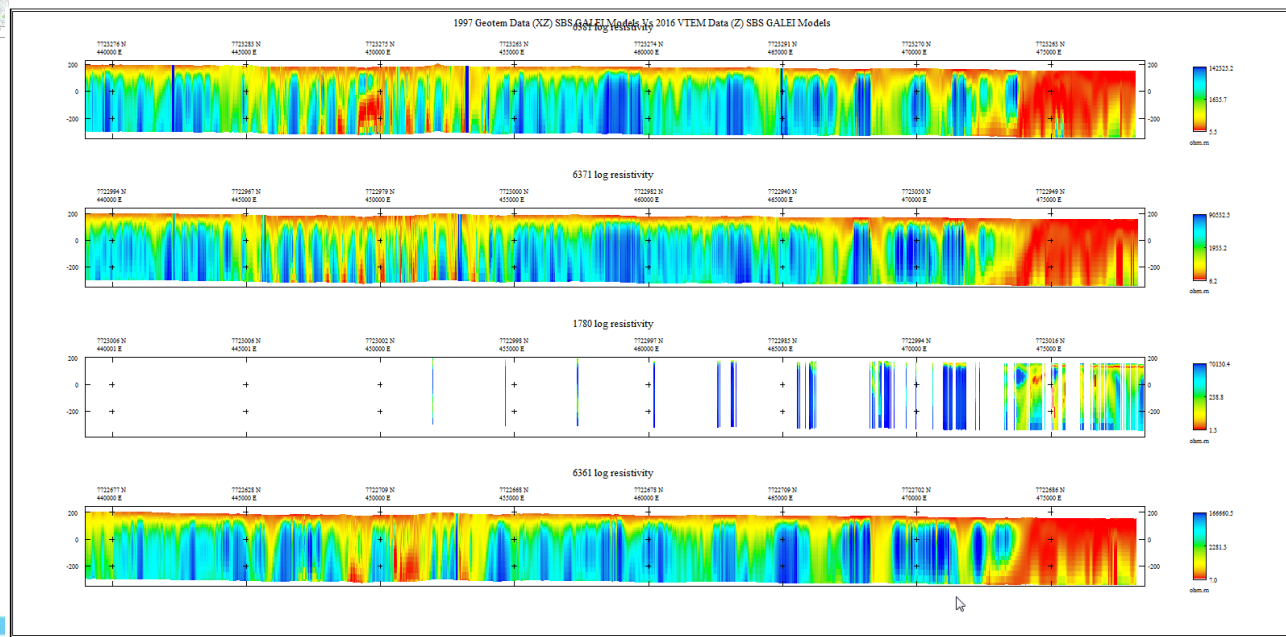
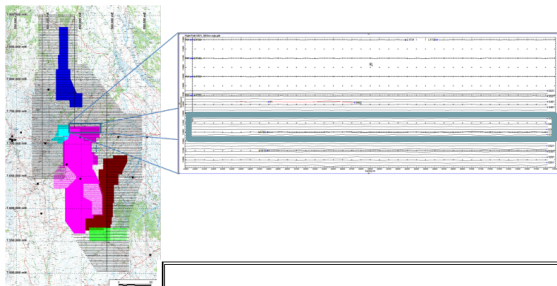
Line ID	Start E	End E	Start N	End N
1761	240000	270000	440000	450000
6501	240000	270000	440000	450000
6491	240000	270000	440000	450000



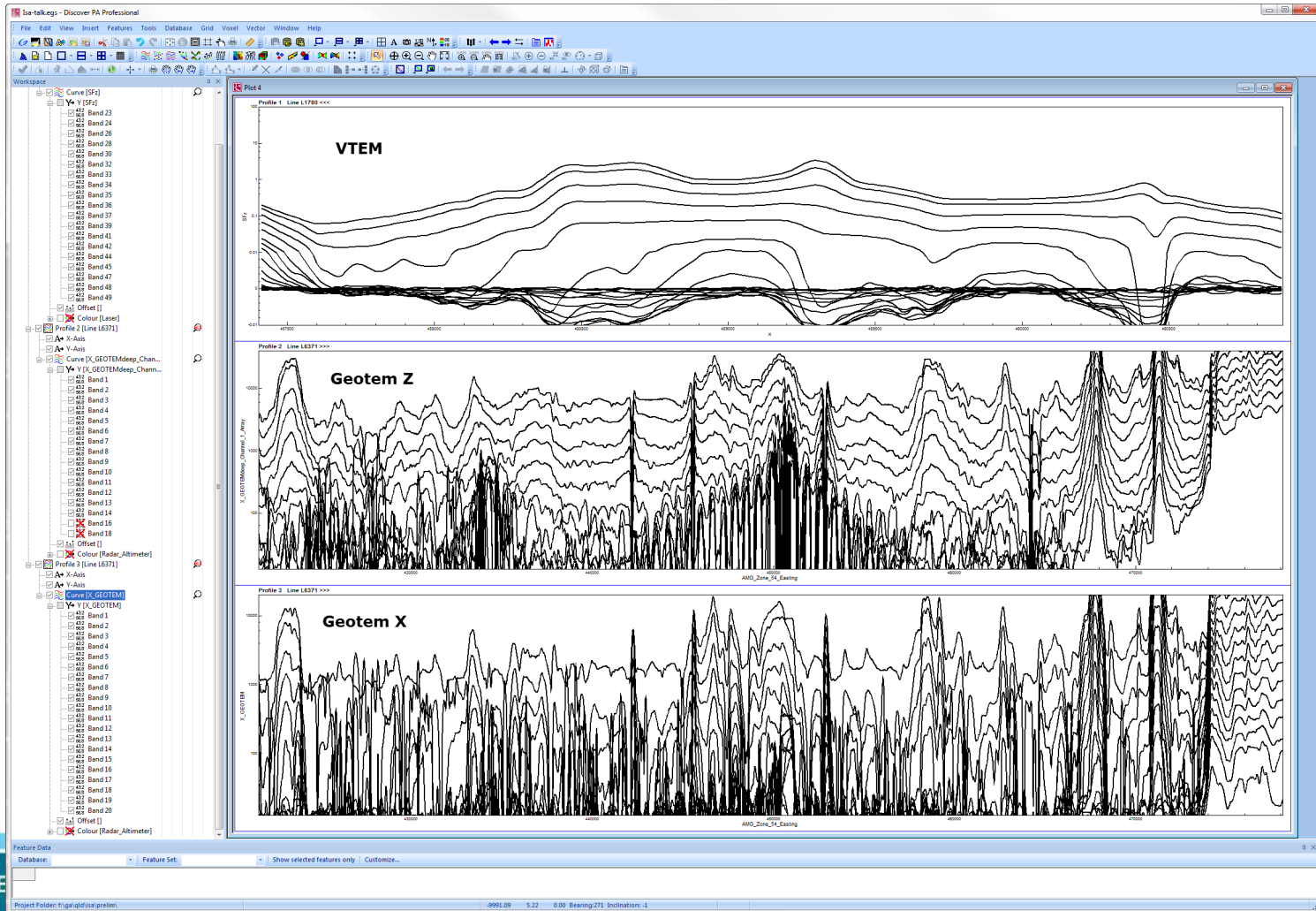
Common Line Models (vtem 1771)



Common Line Models (vtem 1780)



VTEM Vs GeoTem (IP effects





Australian Government
Geoscience Australia



Australian National Virtual Geophysics Laboratory (ANVGL)



David McInnes

David.McInnes@ga.gov.au



Big Data

There is an estimated **3 Petabytes** of publically funded geoscience data in Australia, and the majority of this data is held by Geoscience Australia.

In terms of geophysics this includes nationwide datasets of:

- Gravity
- Magnetics
- Radiometrics
- Seismic
- Magnetotellurics
- Airborne Electromagnetics (AEM)
- Satellite derived data

ANVGL?

Provides:

High Powered Computing

&

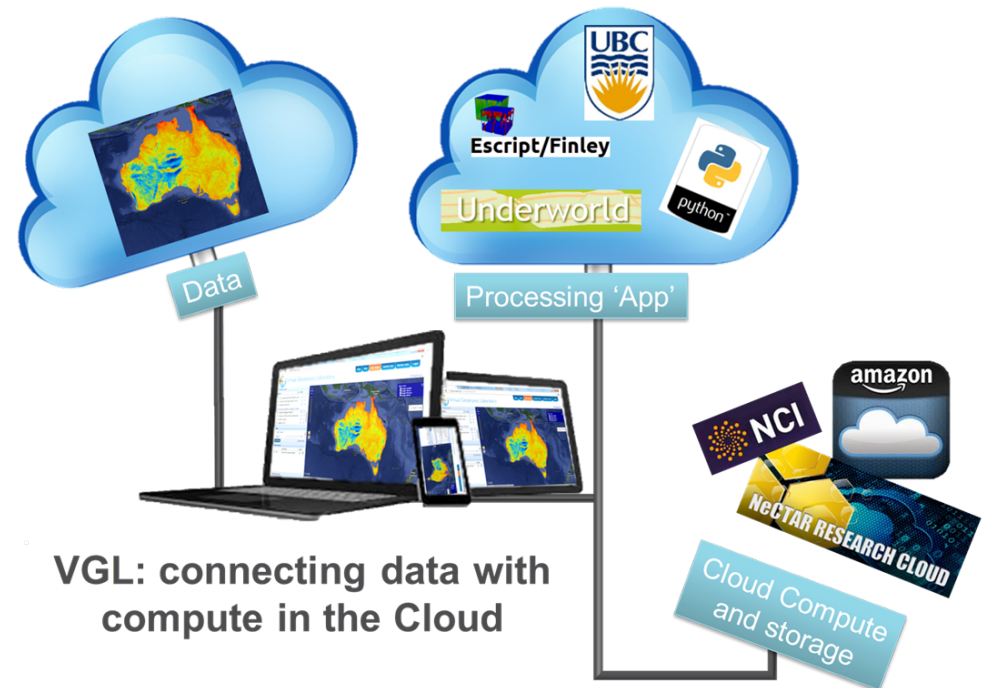
Leading Edge Software

for our Stakeholders

True Interactive Cloud Computing

Key ANVGL features

- Access to precompetitive **geophysical data** online
- Ability to upload proprietary datasets.
- Access to **cloud computing** and **storage**
- Access to geophysical data **workflows** ('apps')
- Capture **Metadata**
 - (ISO 19115) 'provenance record' enabling transparency of the results.
 - Share your results and search for other published results.



Australian National Virtual Geophysics Laboratory (what it looks like)

The screenshot displays the Australian National Virtual Geophysics Laboratory web interface. The main map shows Australia with various geophysical data overlays. The left sidebar contains a 'Featured' section with a search bar and a list of layers. The 'Service Information' window in the bottom right provides details for the selected layer.

Featured

Search: View by ▼

Geological Survey of Western Australia (11 items)

- 400m Gravity Merged Grid (2016 v1)
- 20m Magnetic Merged Grid (2014 v1)
- 40m Magnetic Merged Grid - 1st Vertical Derivativ...
- 40m Magnetic Merged Grid (2014 v1)
- 80m Magnetic Merged Grid - 1st Vertical Derivativ...
- 80m Magnetic Merged Grid - Reduced to Pole (20...
- 80m Magnetic Merged Grid (2014 v1)
- 80m Radiometric Merge (K)
- 80m Radiometric Merge (Dose Rate)
- 80m Radiometric Merge (Th)
- 80m Radiometric Merge (U)

Geoscience Australia Coverages (4 items)

- MagMap V5 2010
- Onshore and Offshore Gravity Anomaly Geodetic
- Onshore Only Bouguer Geodetic

WMS Properties

Opacity:

Add layer to Map Options ▼

- RadMap Totaldose

Geoscience Australia (5 items)

- Australian Point Gravity
- GOCAD Models

Service Information

NetCDF Subset Service (1 Item)

onshore_only_Bouguer_geodetic
http://dapds00.nci.org.au/thredds/ncss/rr2/geophysics/gravityMap/onshore_only_Bouguer_geodetic_fixed2.nc
onshore_only_Bouguer_geodetic

OGC Web Map Service 1.1.1 (1 Item)

onshore_only_Bouguer_geodetic
http://dapds00.nci.org.au/thredds/wms/rr2/geophysics/gravityMap/onshore_only_Bouguer_geodetic_fixed2.nc
onshore_only_Bouguer_geodetic

Geological Survey of Western Australia **EXPLORATION**

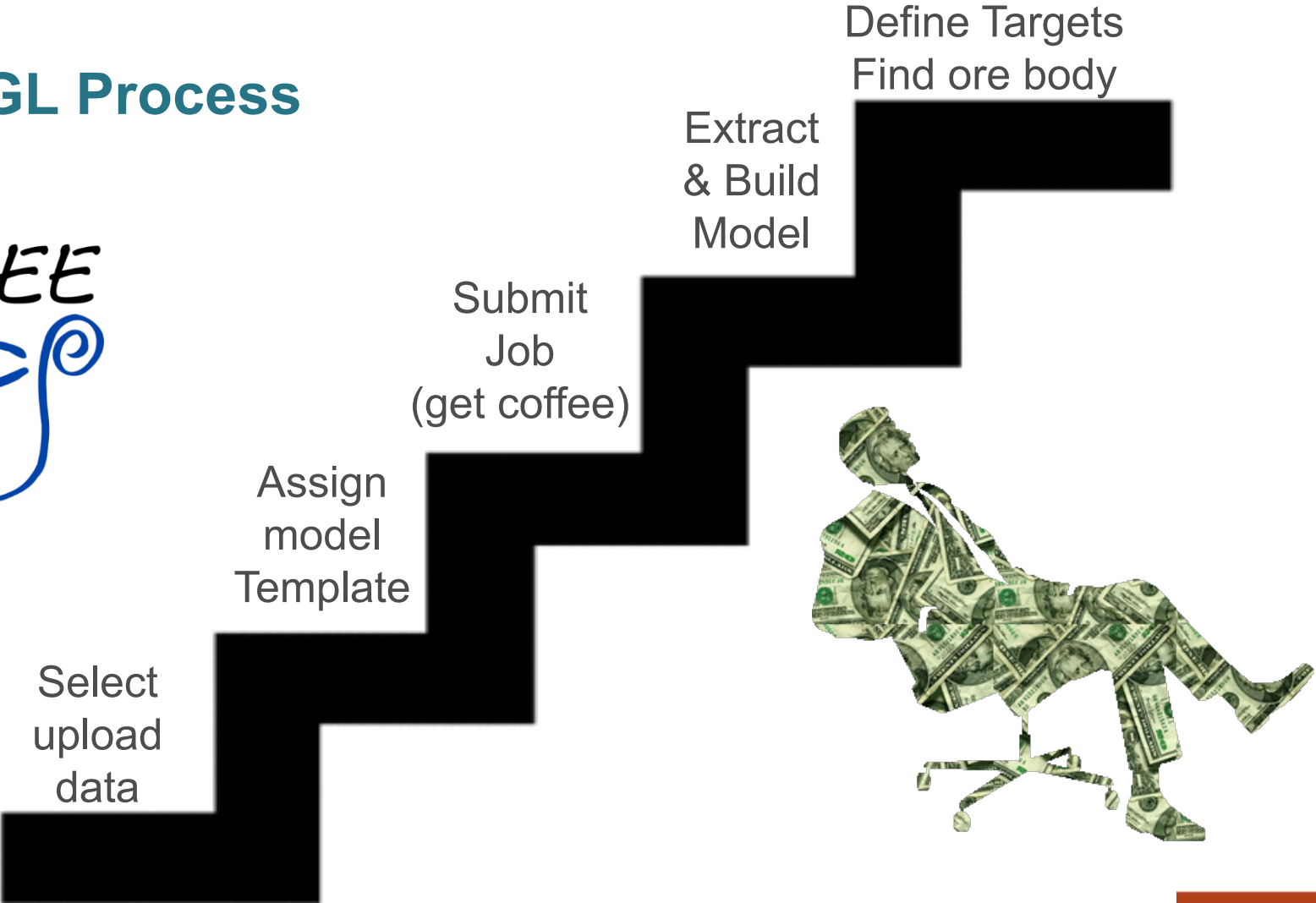
Big Compute: National Computational Infrastructure



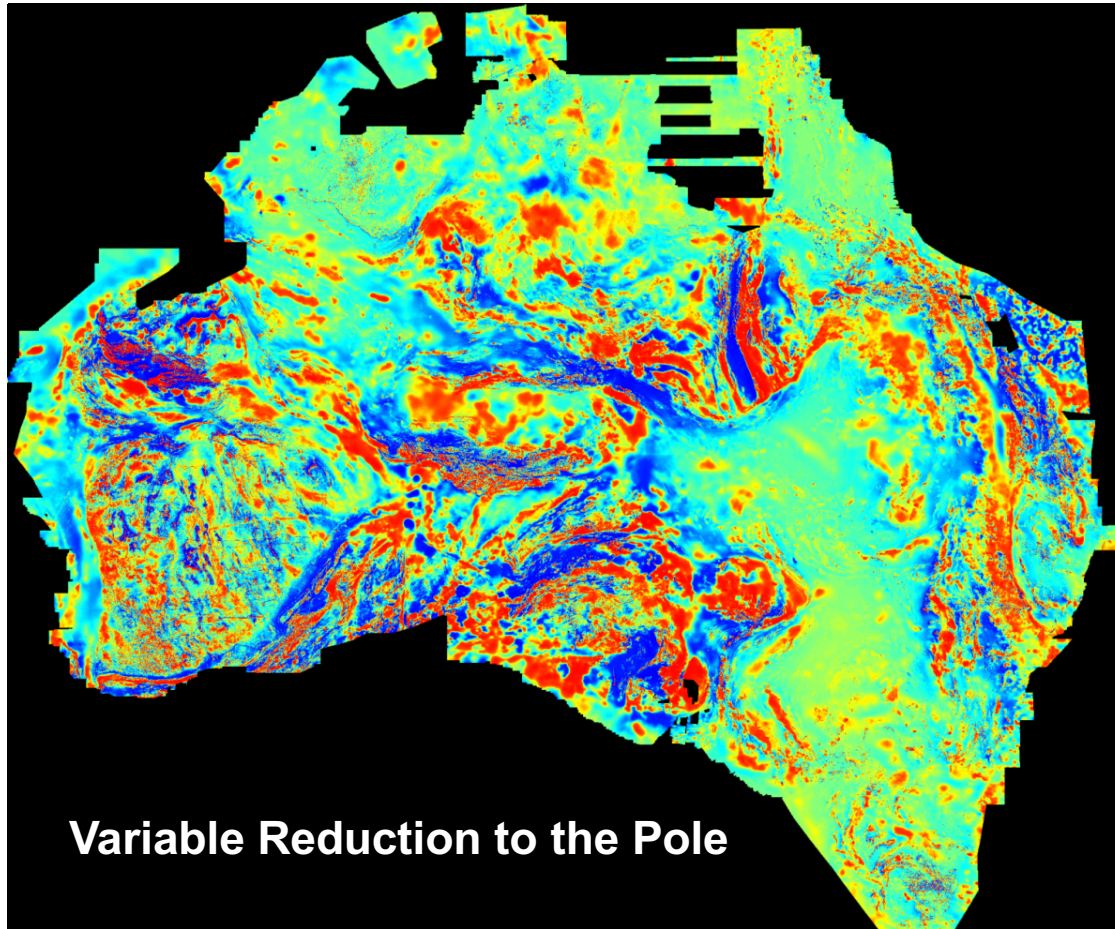
RAIJIN

- 57,472 computer cores
- > 10 petabytes Research Data Storage Infrastructure (RDSI)
- Peak performance of 1.2 PFlops
- Ranked 38th most powerful computer system in the world
- Virtual labs (VLs)

The ANVGL Process

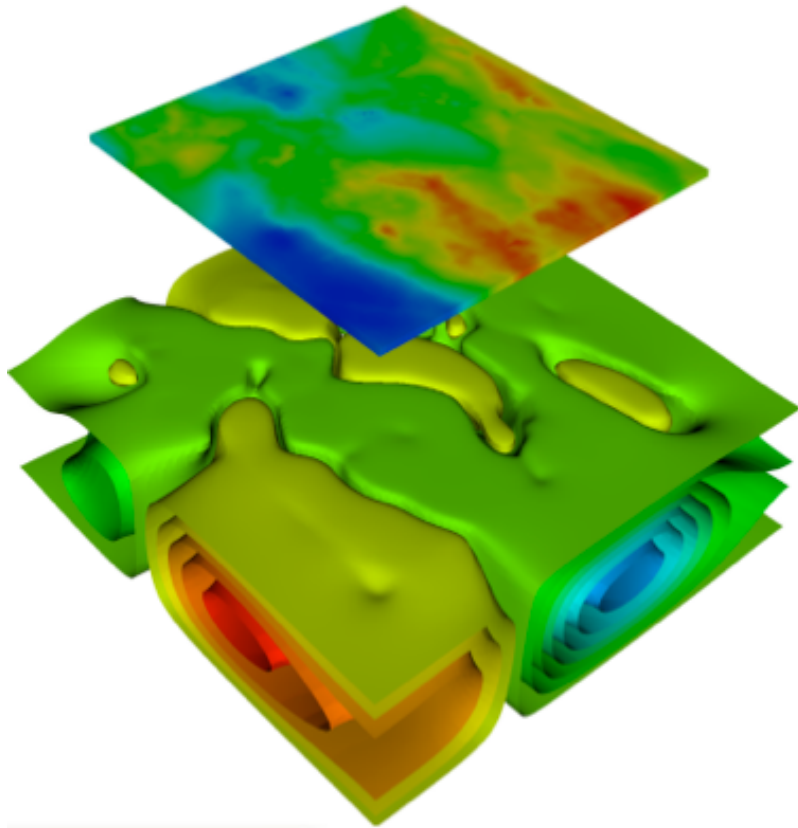


Magnetic Anomaly Map of Australia 2015

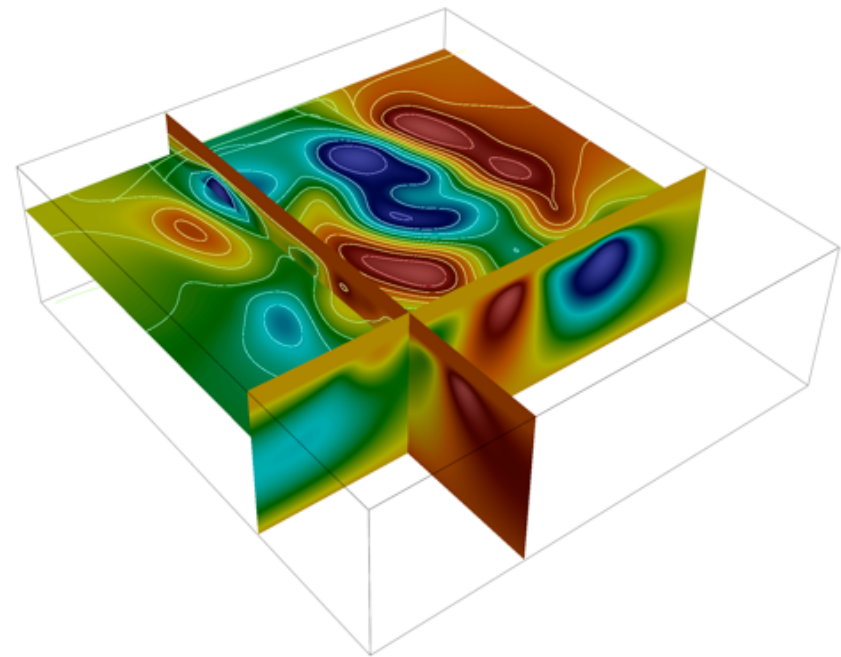


- 80 × 80 m cell size
- Variable Reduction to the Pole produced using GA codes.
- Only possible using the NCI

An ANVGL Result: escript.downunder



Inversion of gravity anomaly data

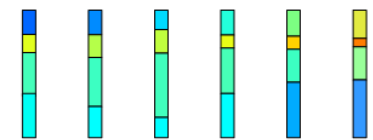


Joint inversion of gravity and magnetic data. ~ 100km by 100km by 30km depth showing magnetic susceptibility variation.

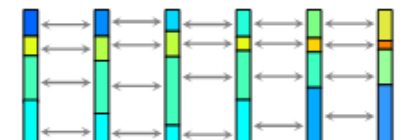
Airborne Electromagnetics (AEM) Inversion

- All codes developed at GA in platform independent C++
- Our inversions code is based on layered earths (1D not 3D)
- Deterministic Gradient Based
 - GALEISBS - sample by sample (SBS)
 - our main production algorithm
 - GALEILBL - line by line
 - used in strong layered earth environment
 - MONTE CARLO (SBS)
 - Very computationally intensive
 - enables a deduction of confidence
 - HOLISTIC - survey at a time
 - frequency domain only

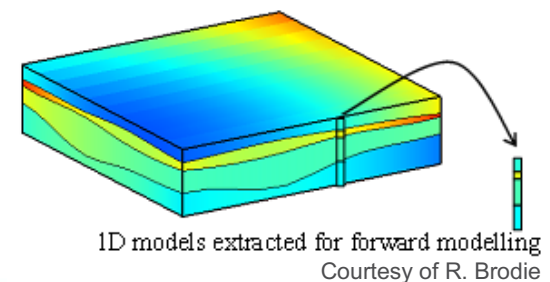
Sample by sample (SBS)
many completely independent 1D models



Laterally constrained (LCI)
many 1D models linked along line by covariance



Holistic
one smooth continuous 3D model



The ANVGL - Summary

Where are we at :

- Data distribution with meta-data information
- Implementation of Ross Brodie's AEM codes
- Gravity & Magnetic Inversion Escrip code

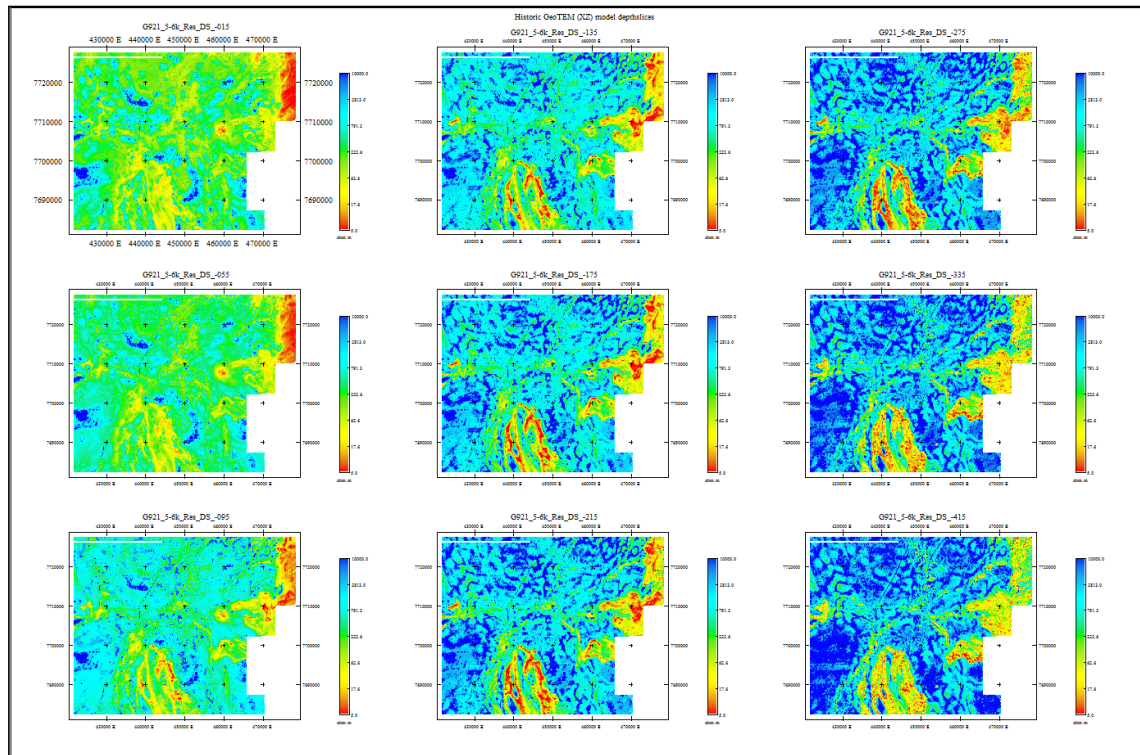
Where are we heading:

- Tweaks on interaction, visualisation, outputs, processing/filtering options.... (minor)
- Further Development of Escrip – (Localised Tiling, spherical co-ordinate modelling)
- Integration of Art Raiche (P223F) & Jim Hanneson EM modelling codes
- Colorado School of Mines Gravity/Magnetic inversion codes – (in testing phase)
- Access to Raijin with a user pay model – first quarter next year! (game changer)
- Pay Model access to External Party Software (John Paine's 3D mag/grav inversion...)

Script sharing

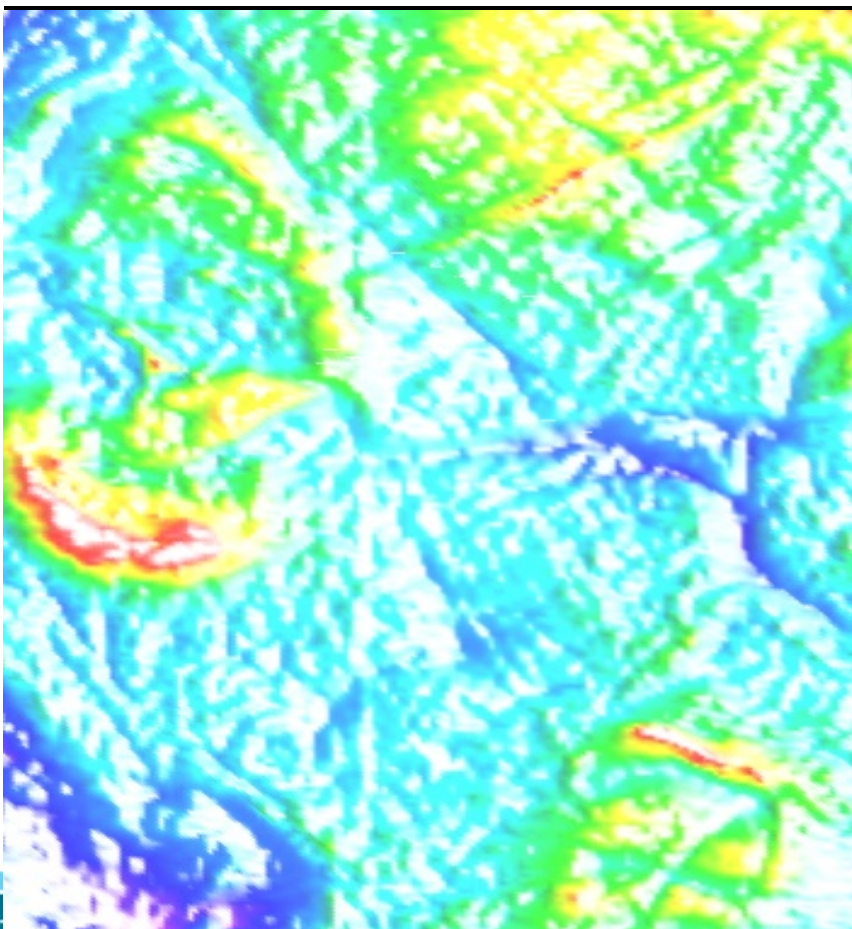
- GA working on QC tools (AEM & Mag/Rads)
- Deeds – data collection standards
- Inversion analysis (DOI, Constraints)
- System control files

GeoTEM model depthslices



AEM

Gawler Craton

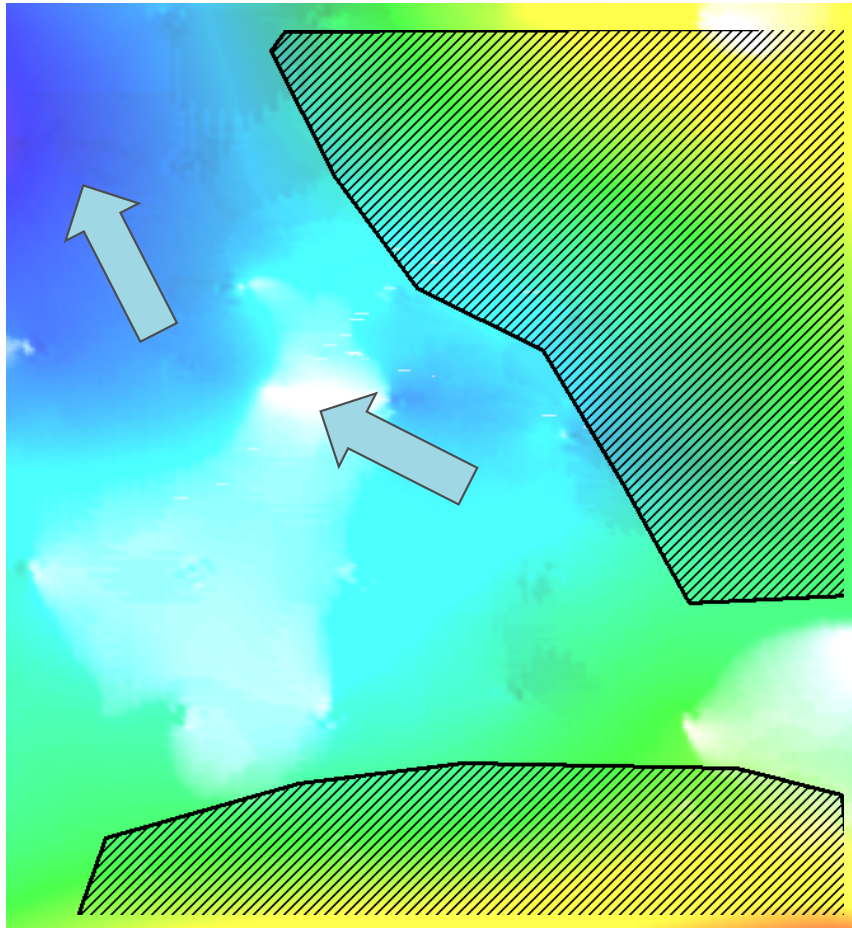


The Host sequence is the Padinga formation

Eocene in age consisting of unconsolidated sediments

↑ N 5km

Residual Gravity Image (Public Domain Data)



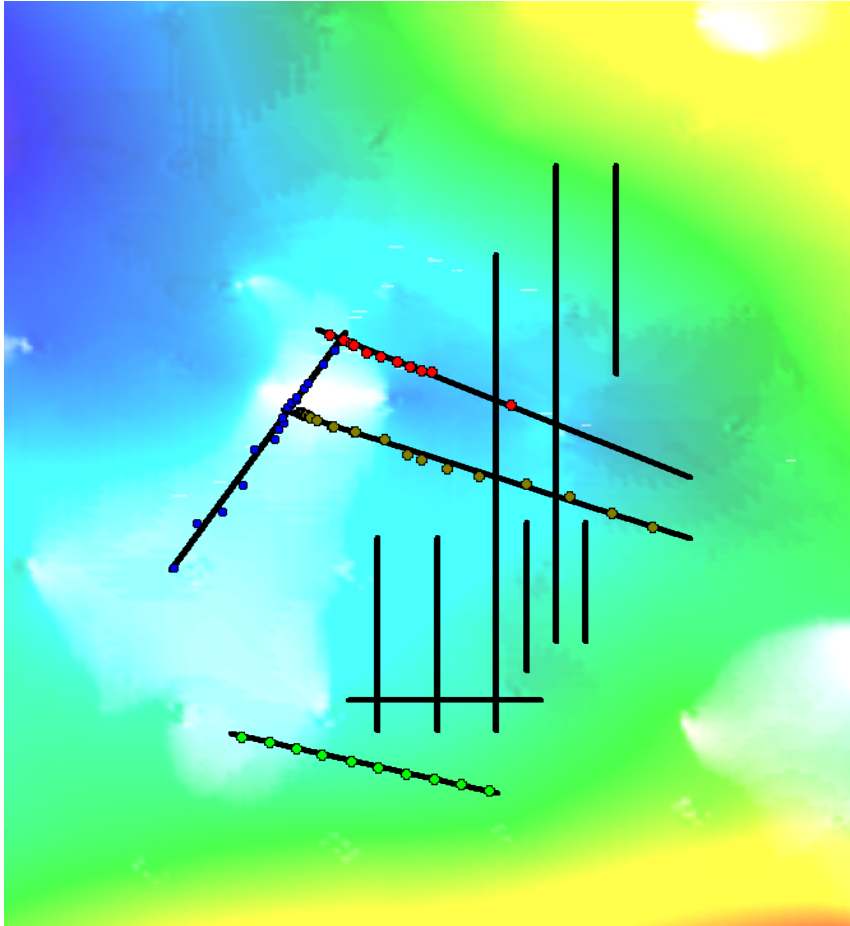
Gravity Data Displays:

Basement Highs.

**Potential Paleo-channel
orientation**

**Note Gravity data station spacing is
relatively coarse at 5 to 10 km**

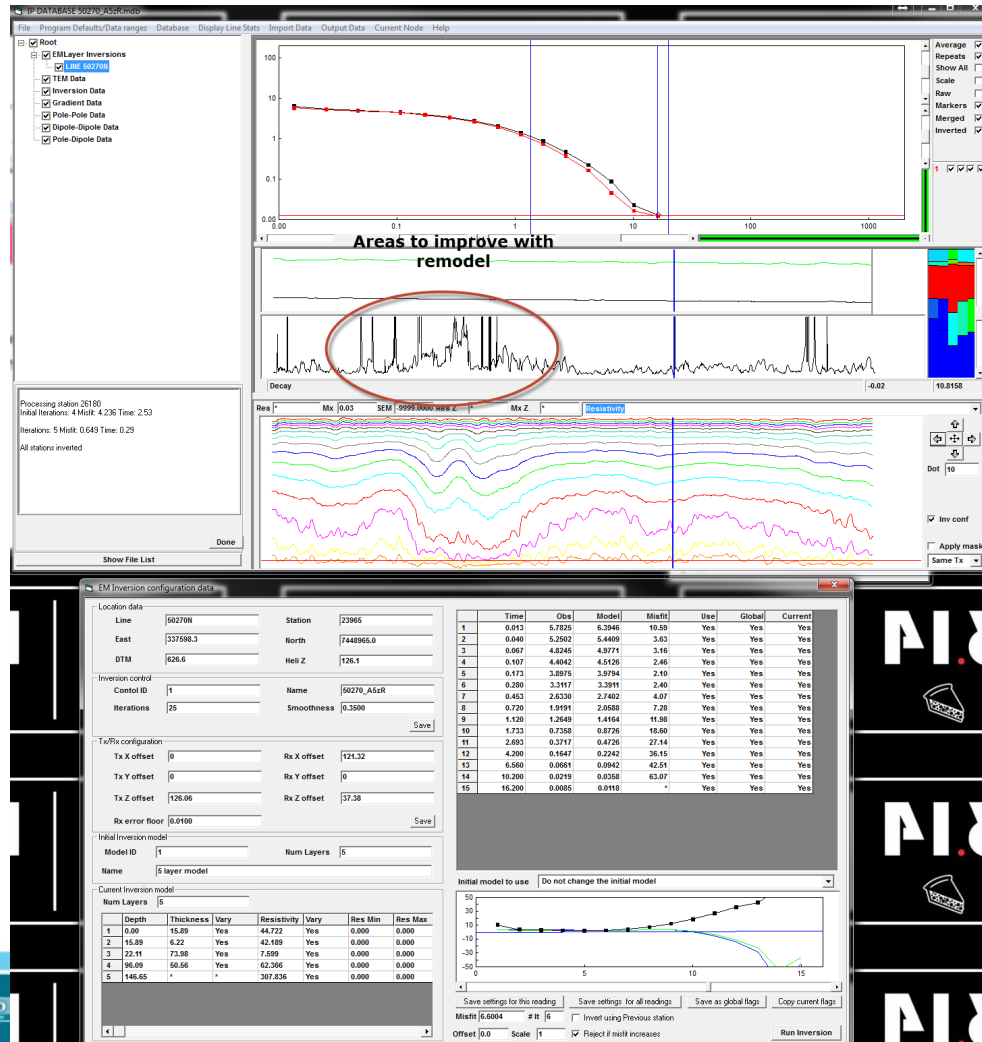
HoisTEM Survey



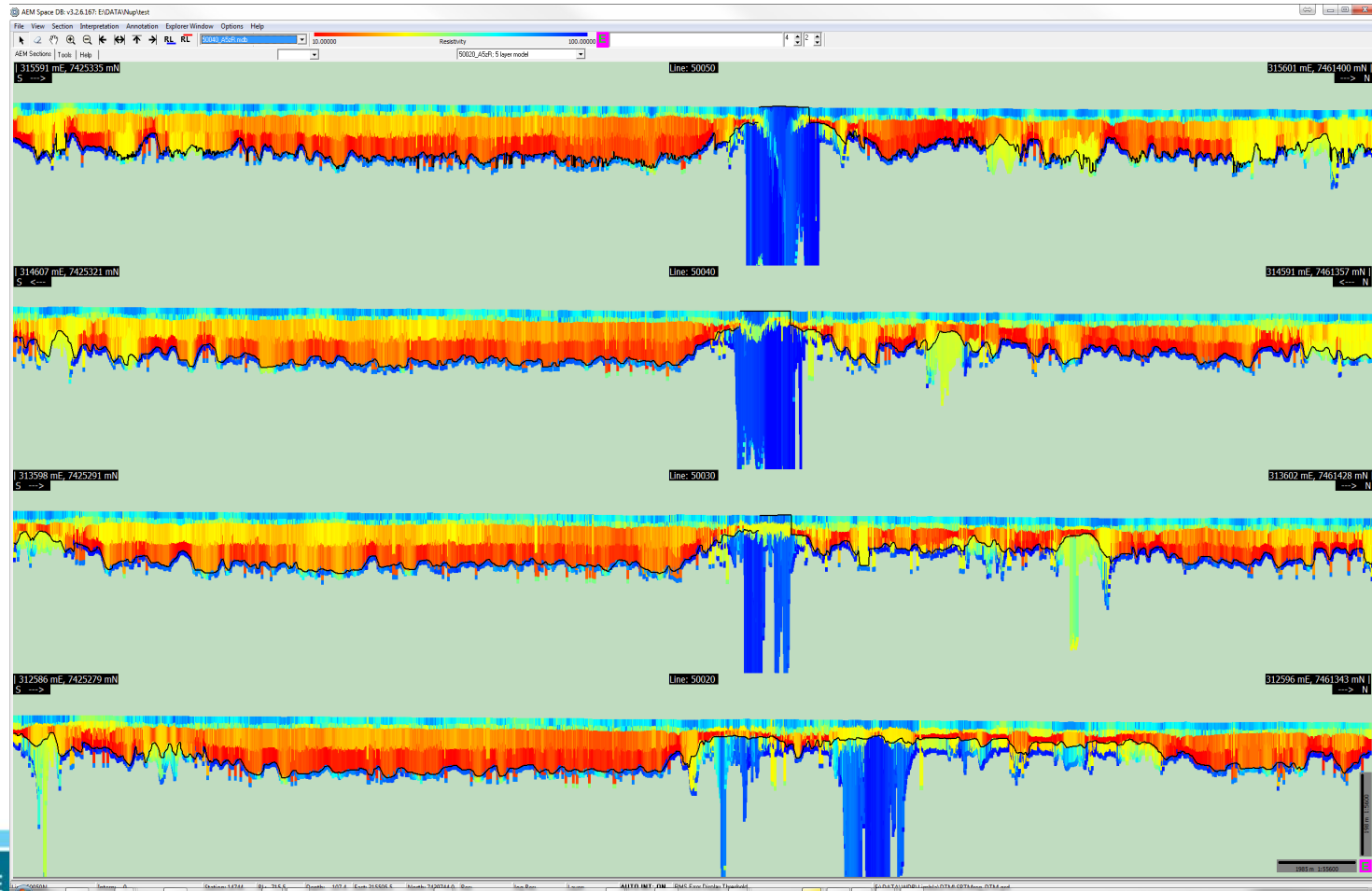
12 Traverses of HoisTEM data
(200+ km)

4 coincident with historic
RAB/AC drilling

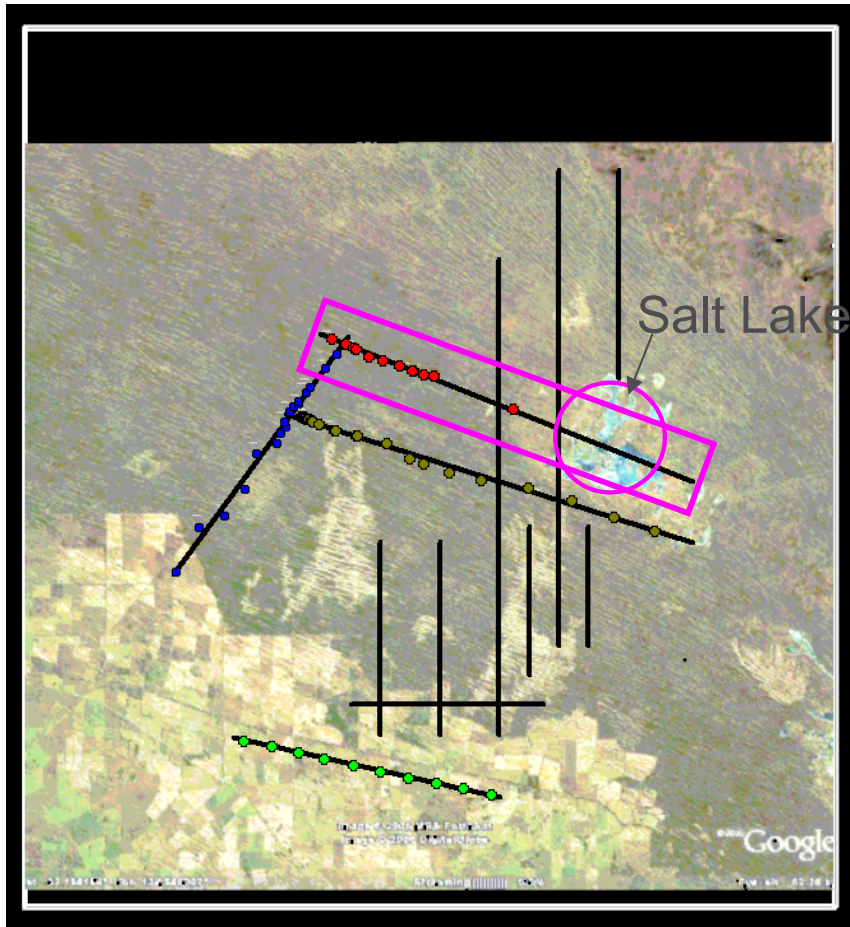
Layered Earth Inversion (LEI) Models



Stacked LEI Model Interp 2007 Area 5



HoisTEM Modelling

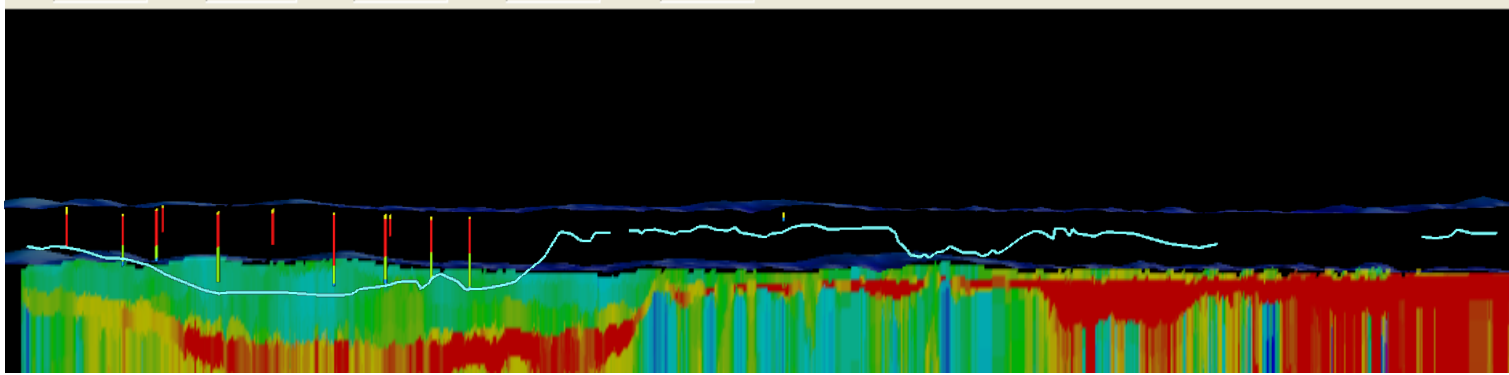


The HoisTEM data has been modelled using a 1D layered earth inversion.

The traverses over the Google Earth snap shot

Select this traverse to view the resultant model

Model of HoisTEM Data Traverse 1040



The model of the HoisTEM data produces a section that reflects the variations in the resistivity of the underlying geology.

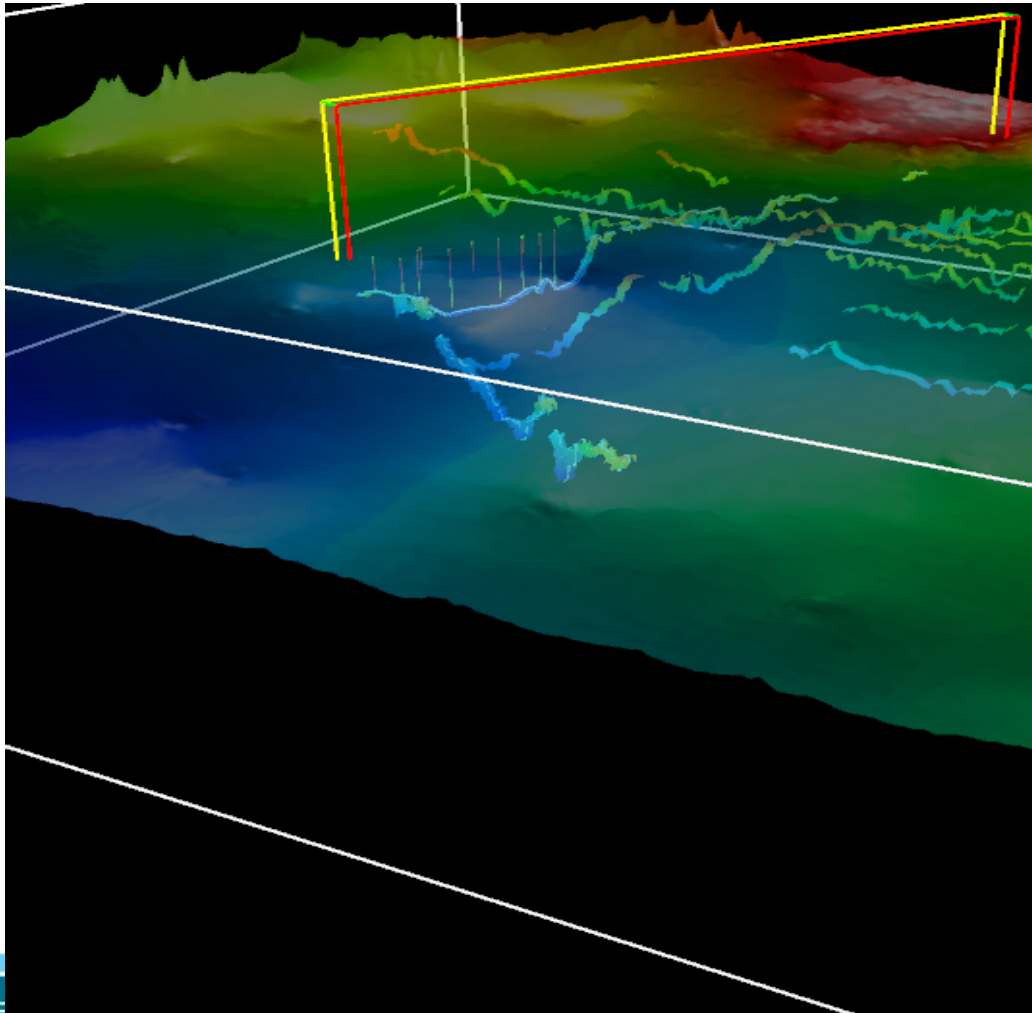
The interpretation of the depth to the top of the basement

The historic drilling

Good conductors are displayed in red colours and strong resistors are displayed in blue colours

1km

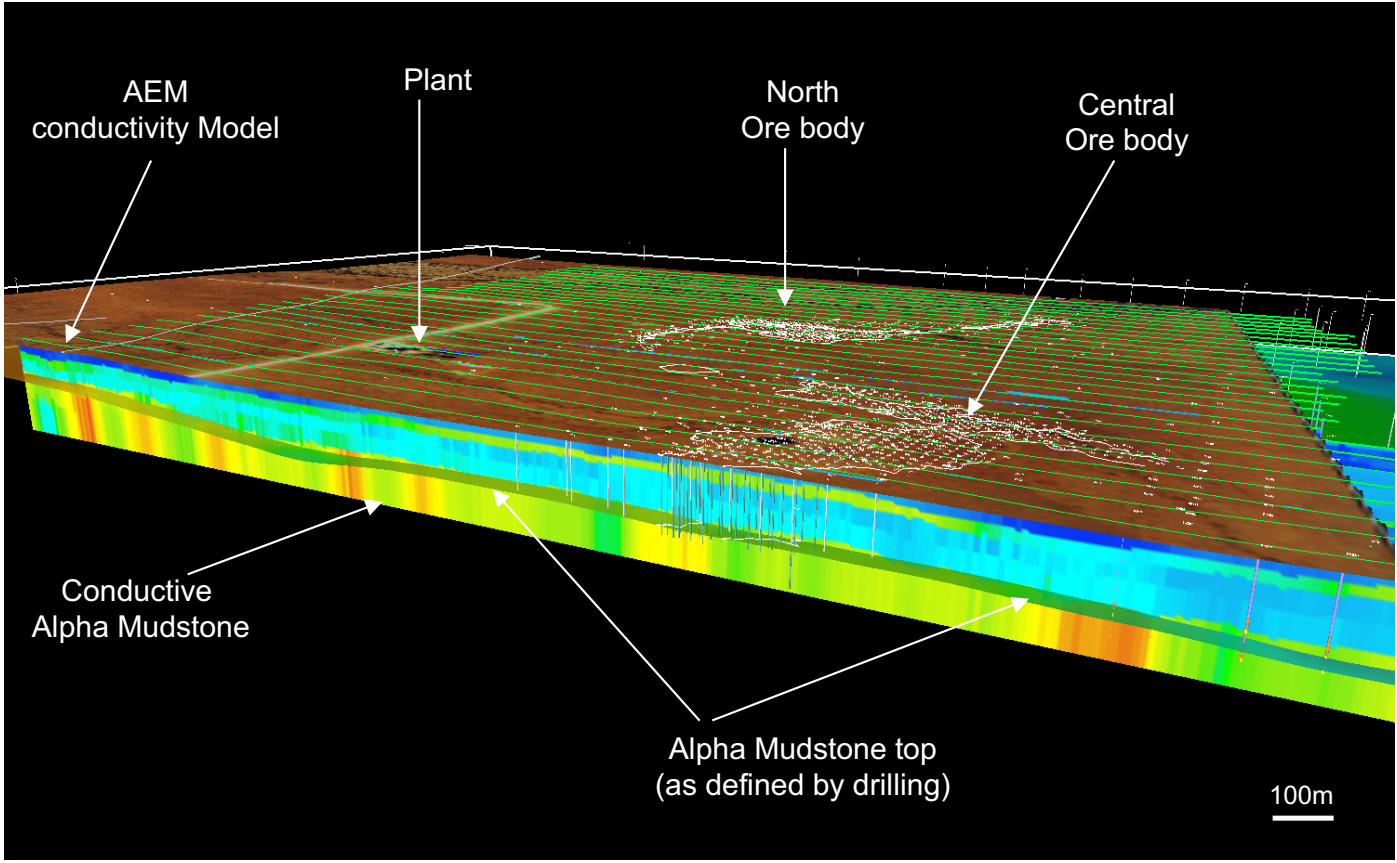
Depth Exaggeration 10:1 (V/H)



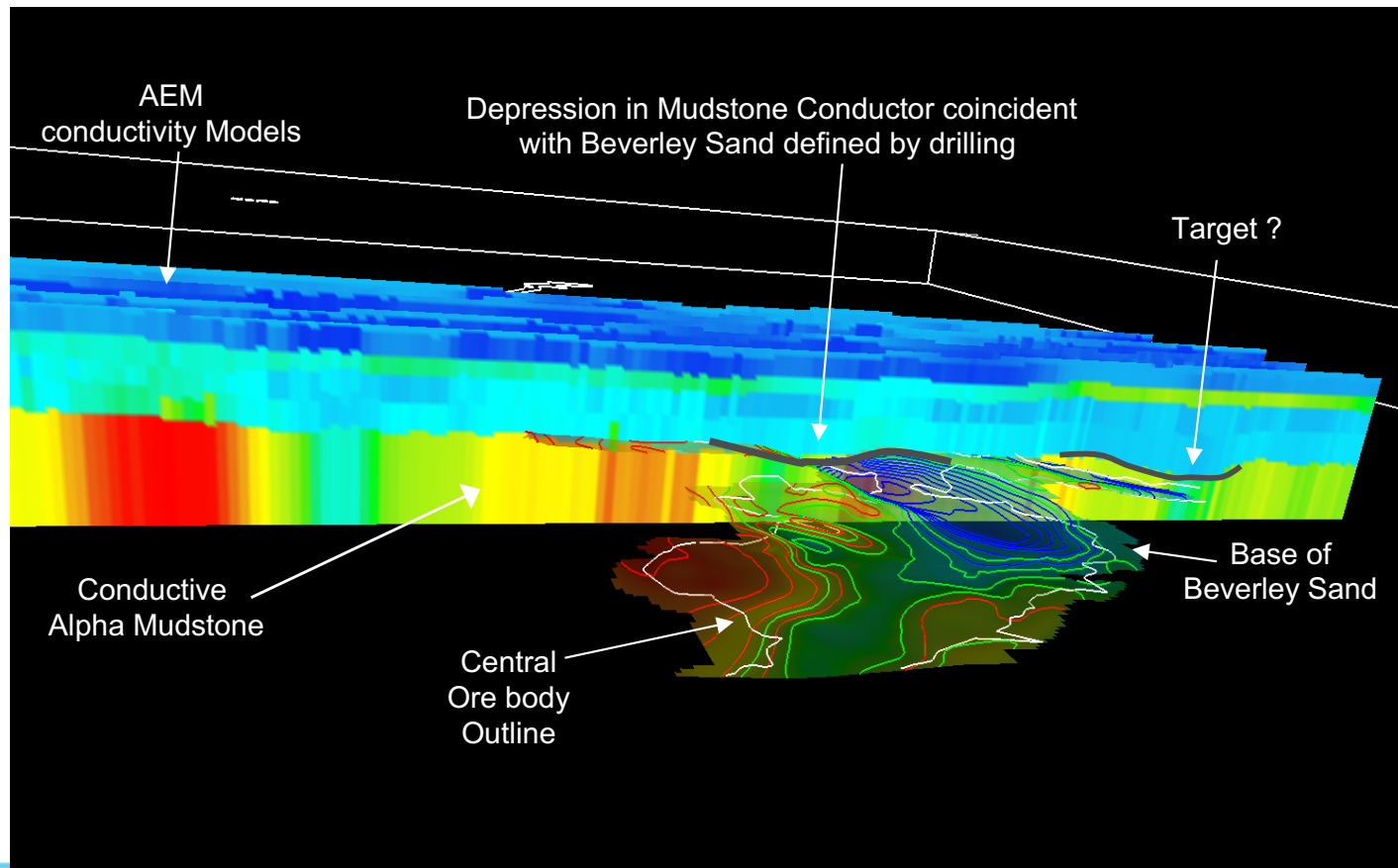
Interpretation
of all the
traverses in 3D
(transparent residual
gravity image overlay)

Paleo-channel Flow

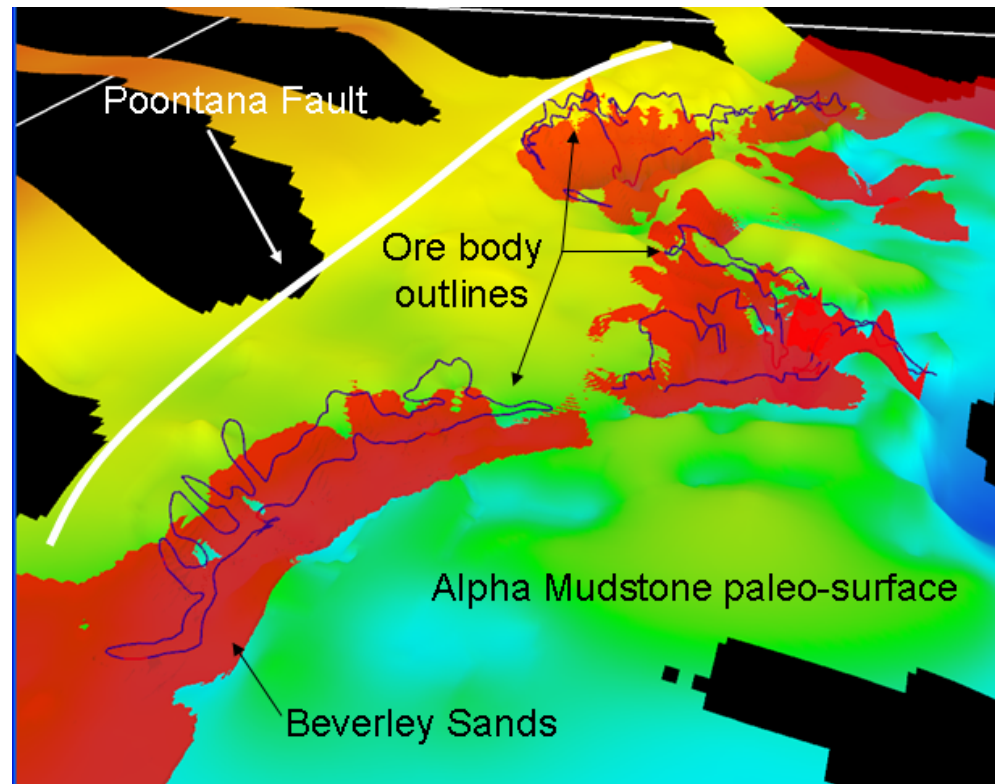
Beverley Mine AEM Models



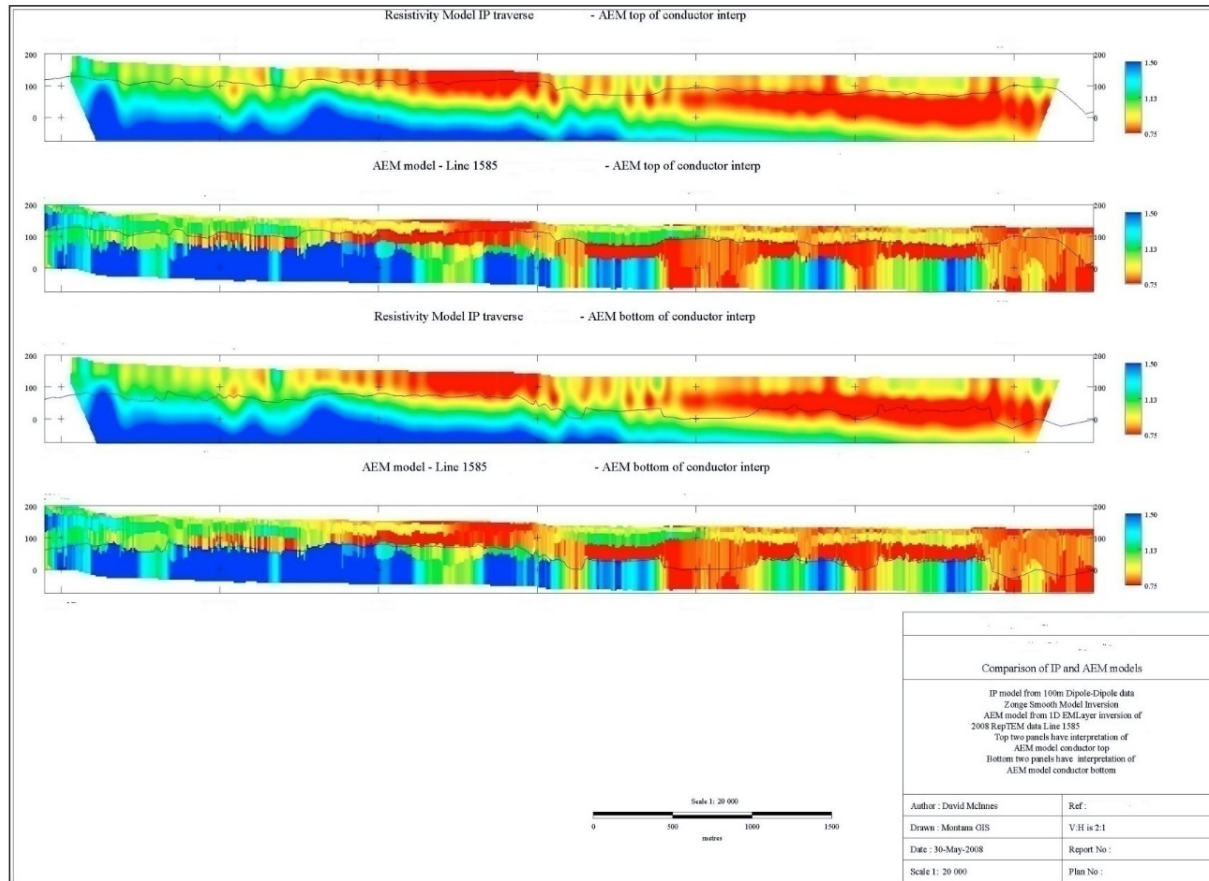
Beverley Central Ore body



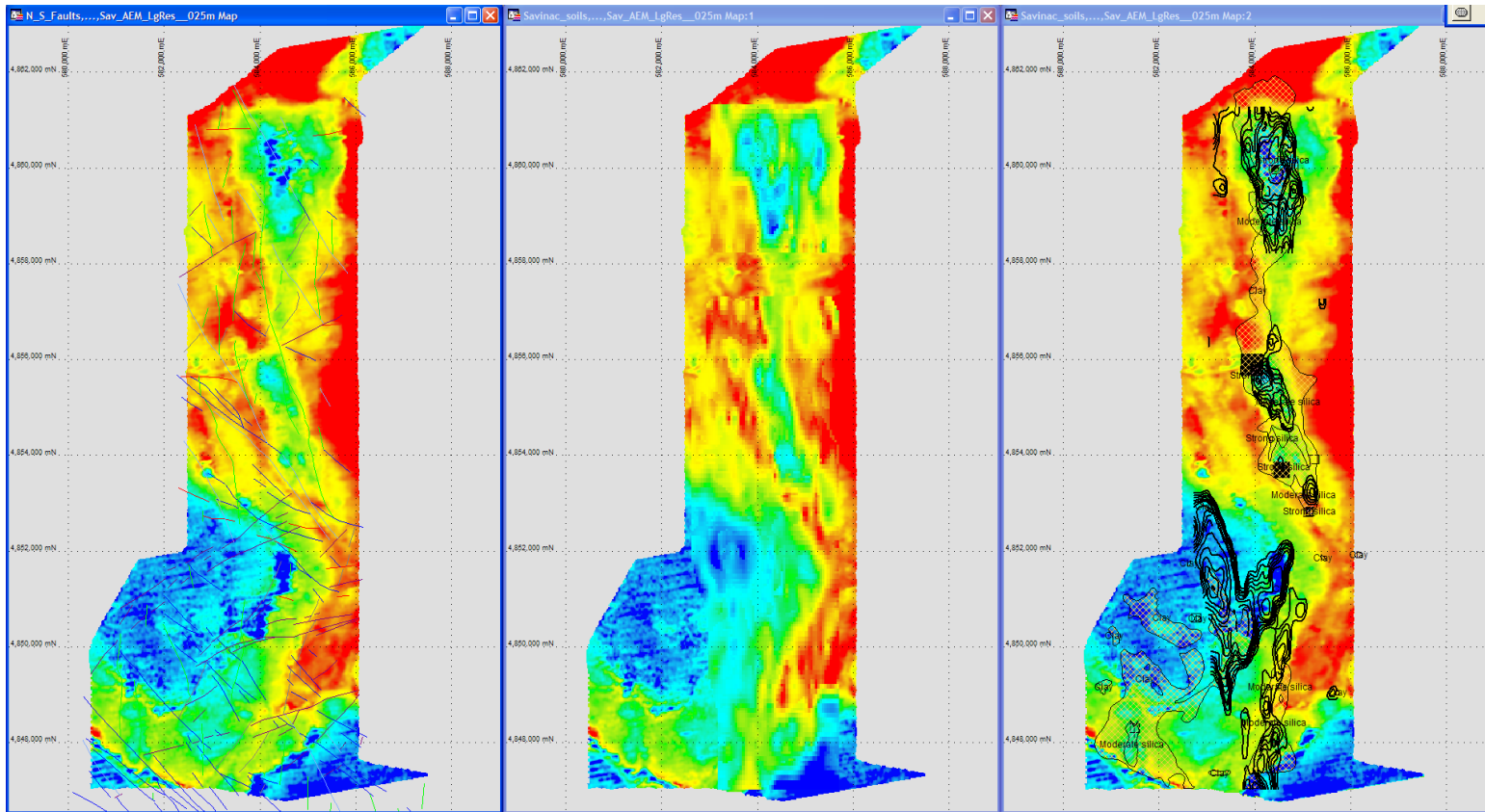
Beverley Paleo-System with Ore bodies



IP Vs AEM Modelling



AEM & IP Resistivity Model Comparison 100m Depth Slice



GEOSCIENCE AUSTRALIA
AEM Depth Slice

IP Depth Slice

AEM with alt & charge

AEM

Goulds Dam 3D

