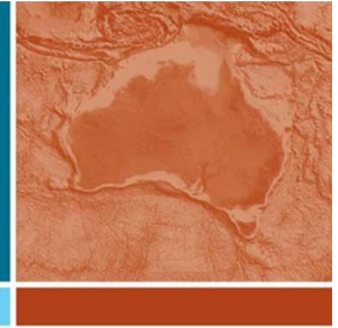




Australian Government
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3D Geological Model and Geophysical Investigation of the Yilgarn-Officer-Musgrave Region

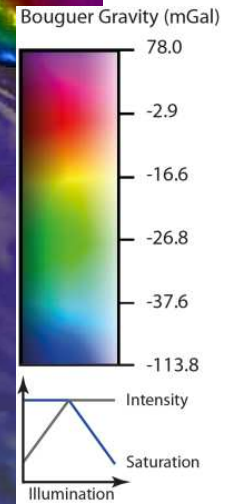
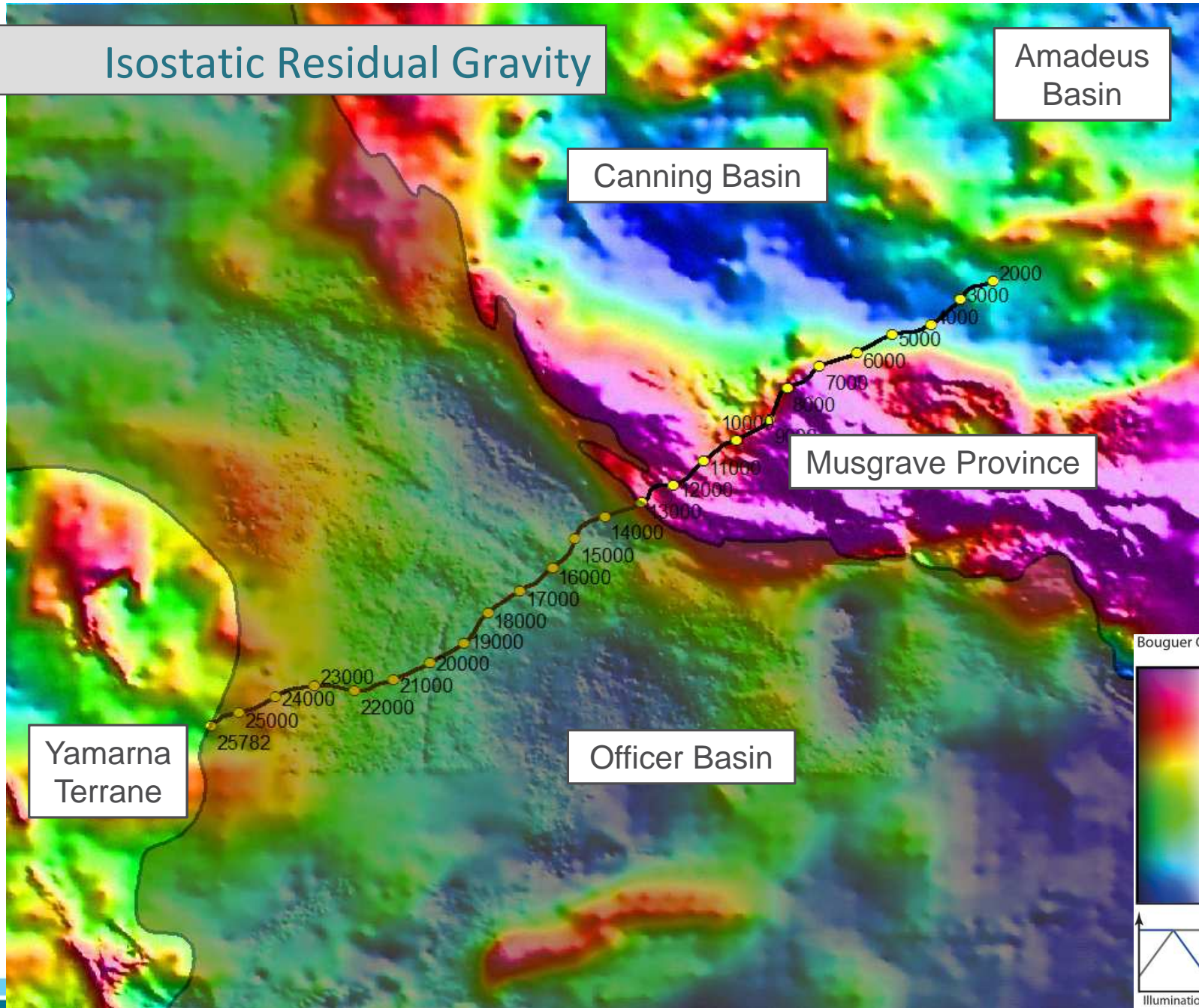
James Goodwin, Tim Jones, Terry Brennan and Malcolm Nicoll

Aims

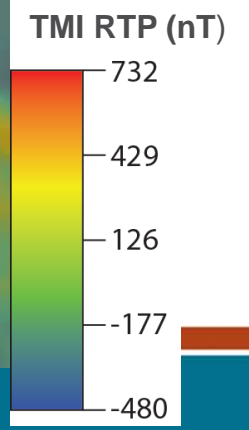
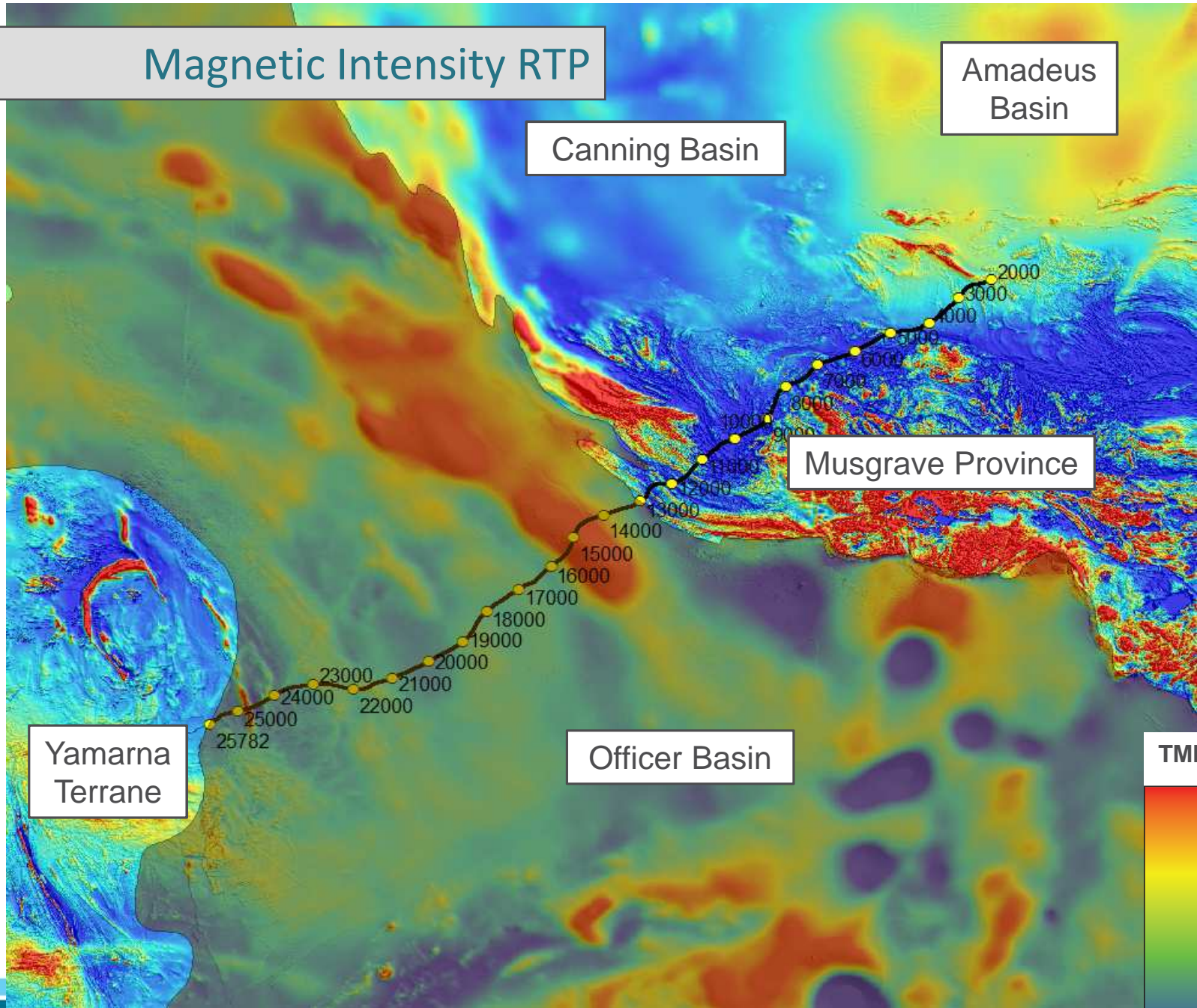
1. Compare the 11GA-YO1 seismic interpretation with gravity and magnetic data
 - a) Interpretation of data grids
 - b) Forward modelling
 - c) 3D inversion

2. Produce a 3D geological model of the area surrounding 11GA-YO1

Isostatic Residual Gravity

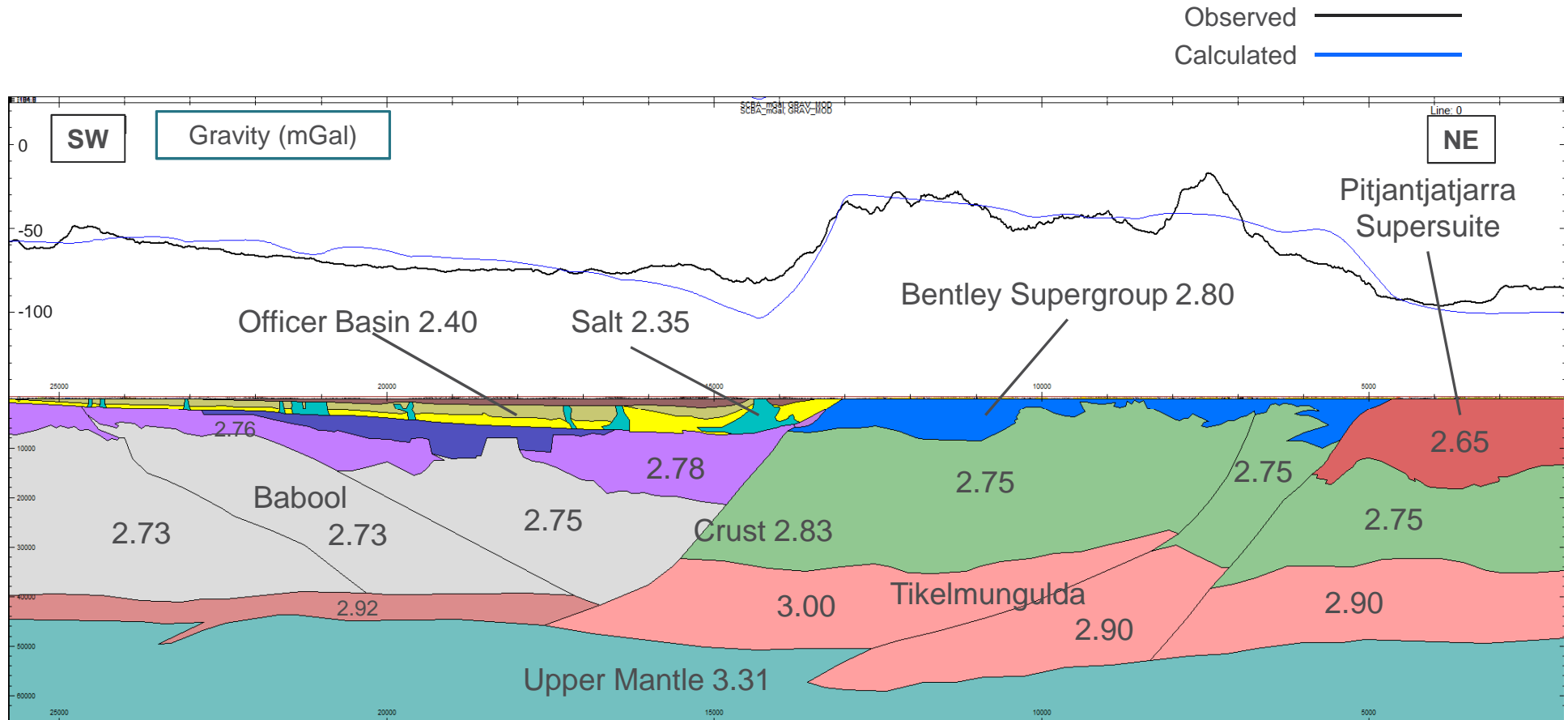


Magnetic Intensity RTP



Forward Modelling 11GA-YO1

*All density values displayed are g/cm³



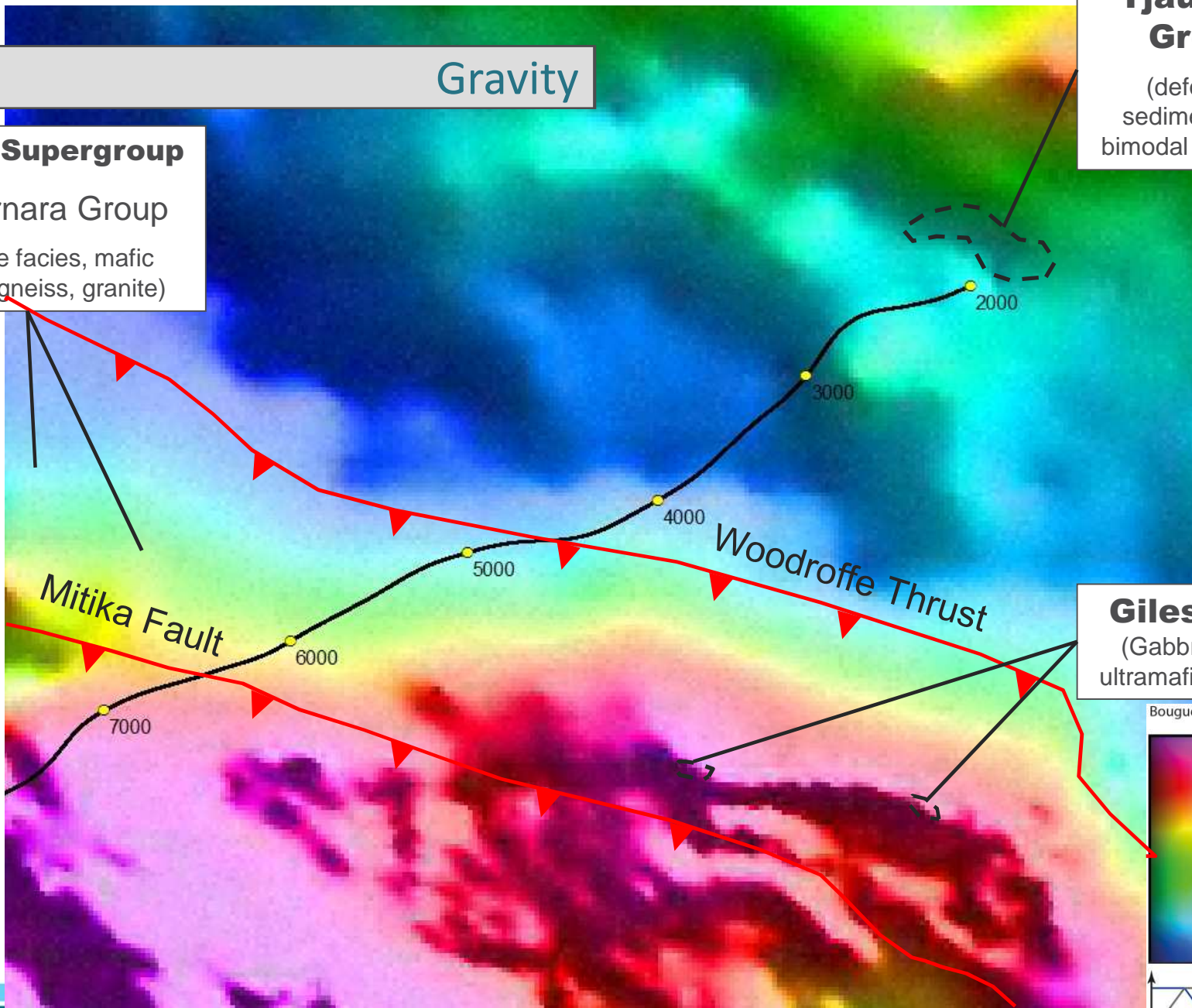
Gravity

Tjauwata Group
(deformed sediments and bimodal volcanics)

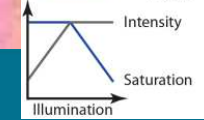
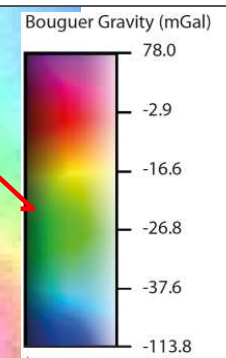
(deformed sediments and bimodal volcanics)

Bentley Supergroup

Kunmarnara Group
(Granulite facies, mafic granulite, gneiss, granite)

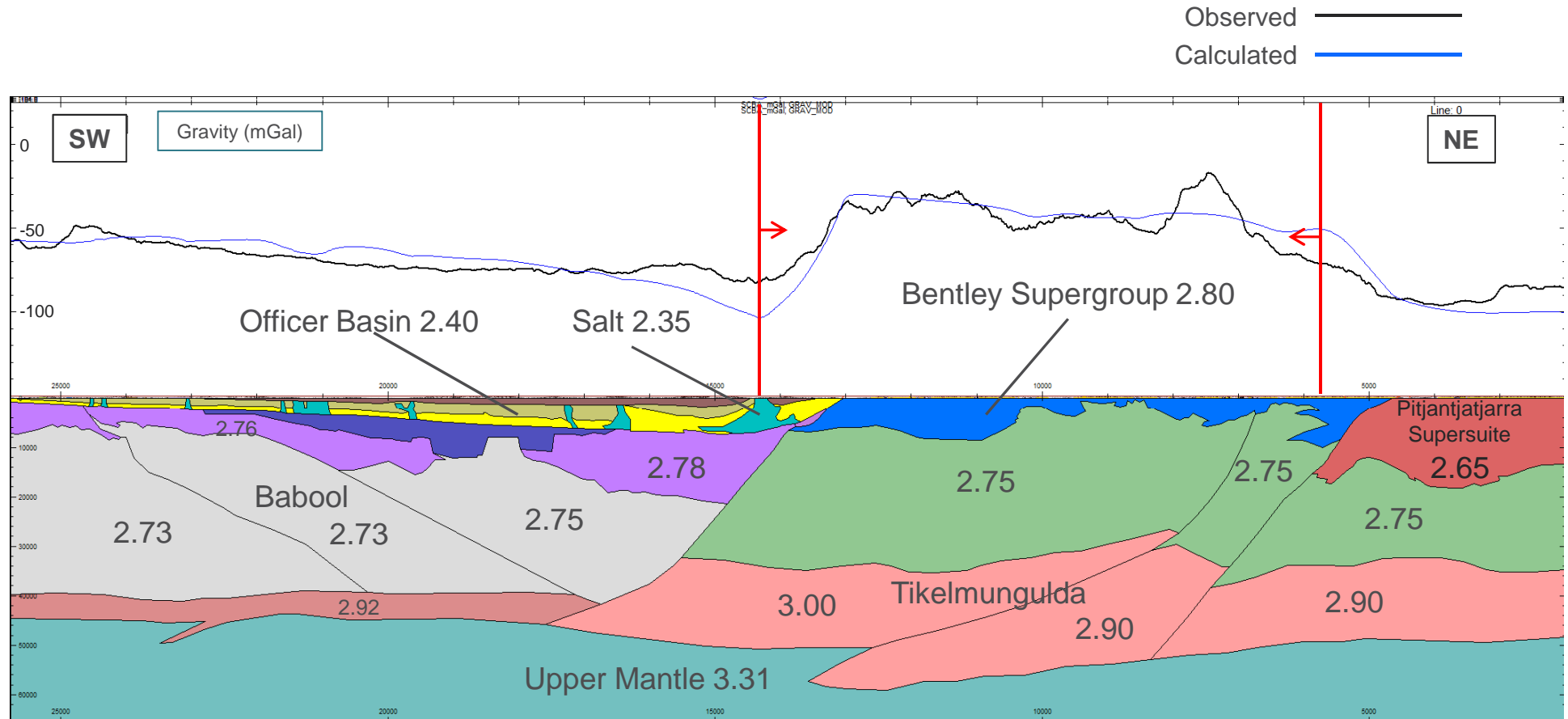


Giles Suite
(Gabbro, mafic-ultramafic intrusion)



Forward Modelling 11GA-YO1

*All density values displayed are g/cm³



Gravity

Bentley Supergroup

Kunmarnara (Granulite Facies, Mafic granulite, gneiss, granite)

Winburn Granite

Giles Suite
(Gabbro, mafic-ultramafic intrusion)

Mount Palgrave

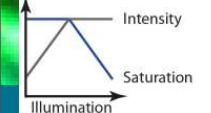
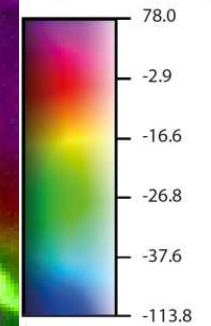
Pussycat

Cassidy

Mission

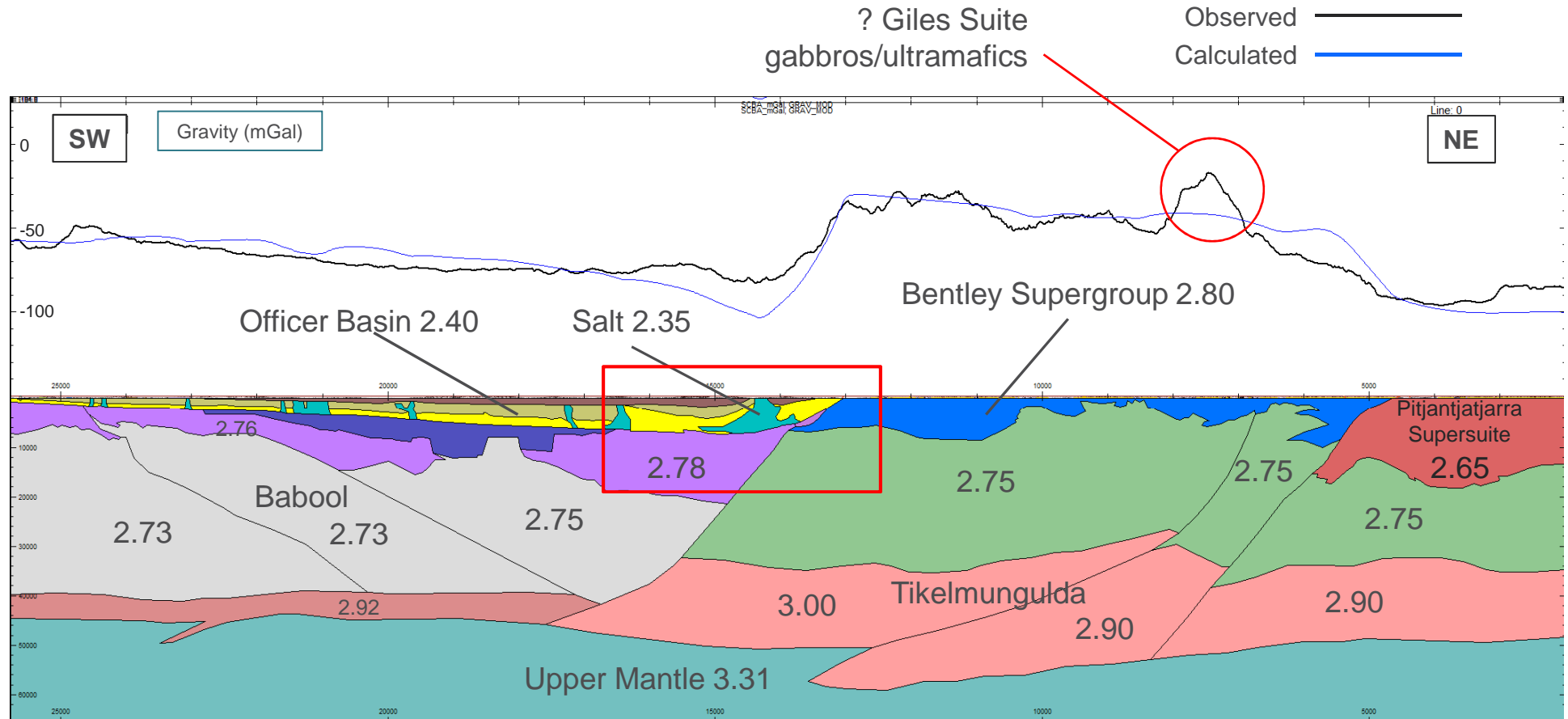
Upper Mount Palgrave Group
(rhyolite)

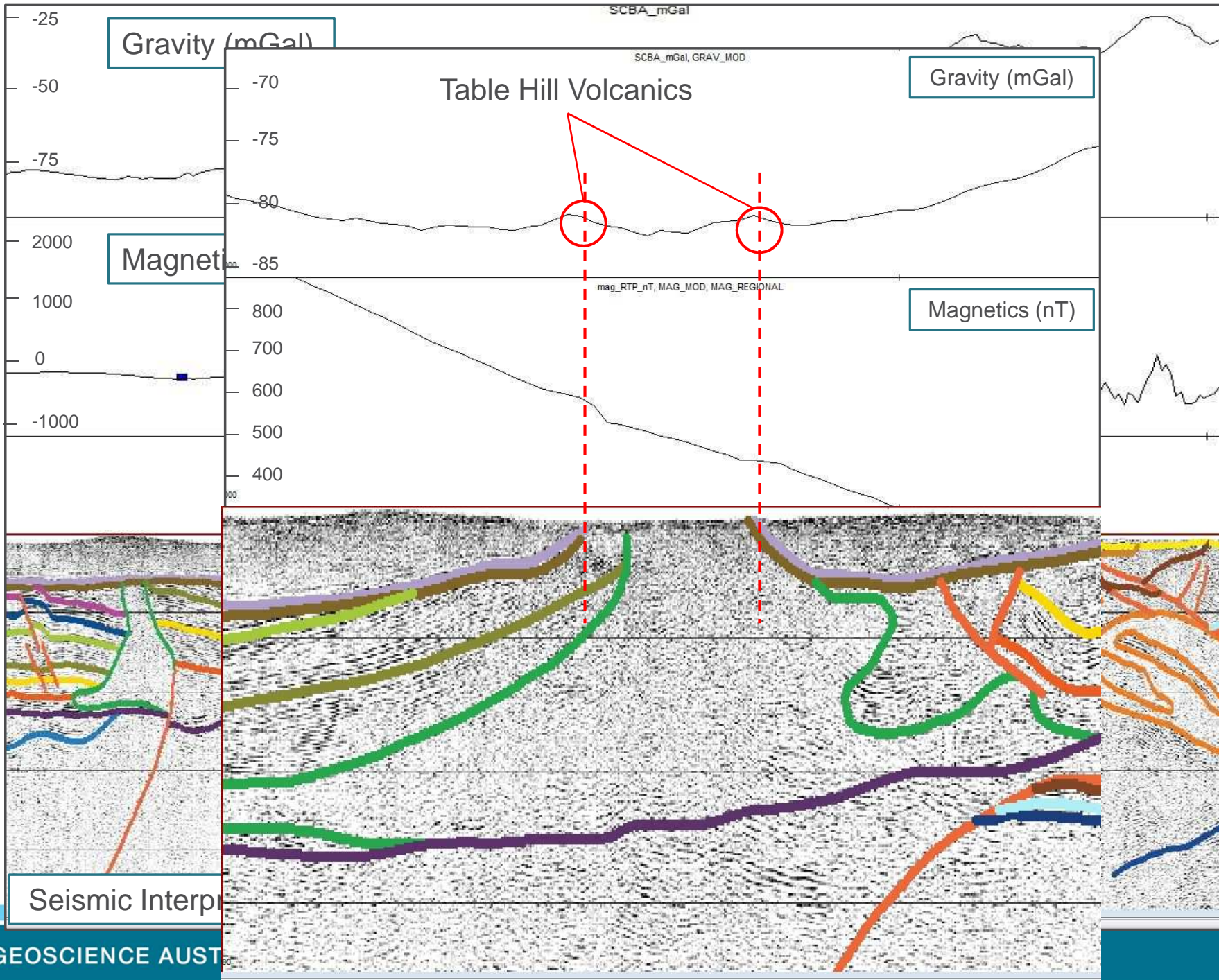
Bouguer Gravity (mGal)



Forward Modelling 11GA-YO1

*All density values displayed are g/cm³

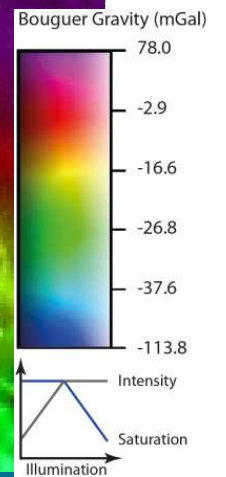
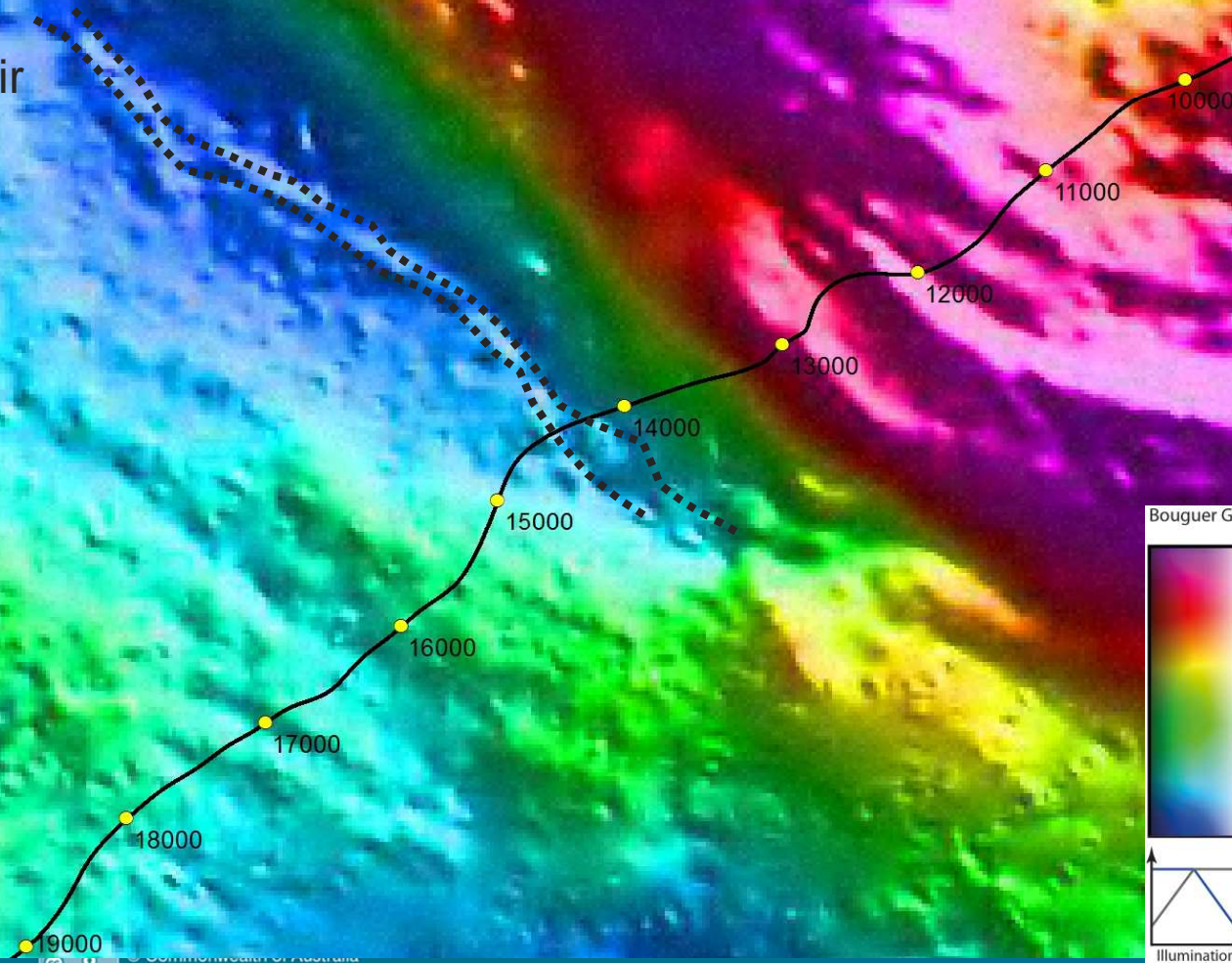




Gravity

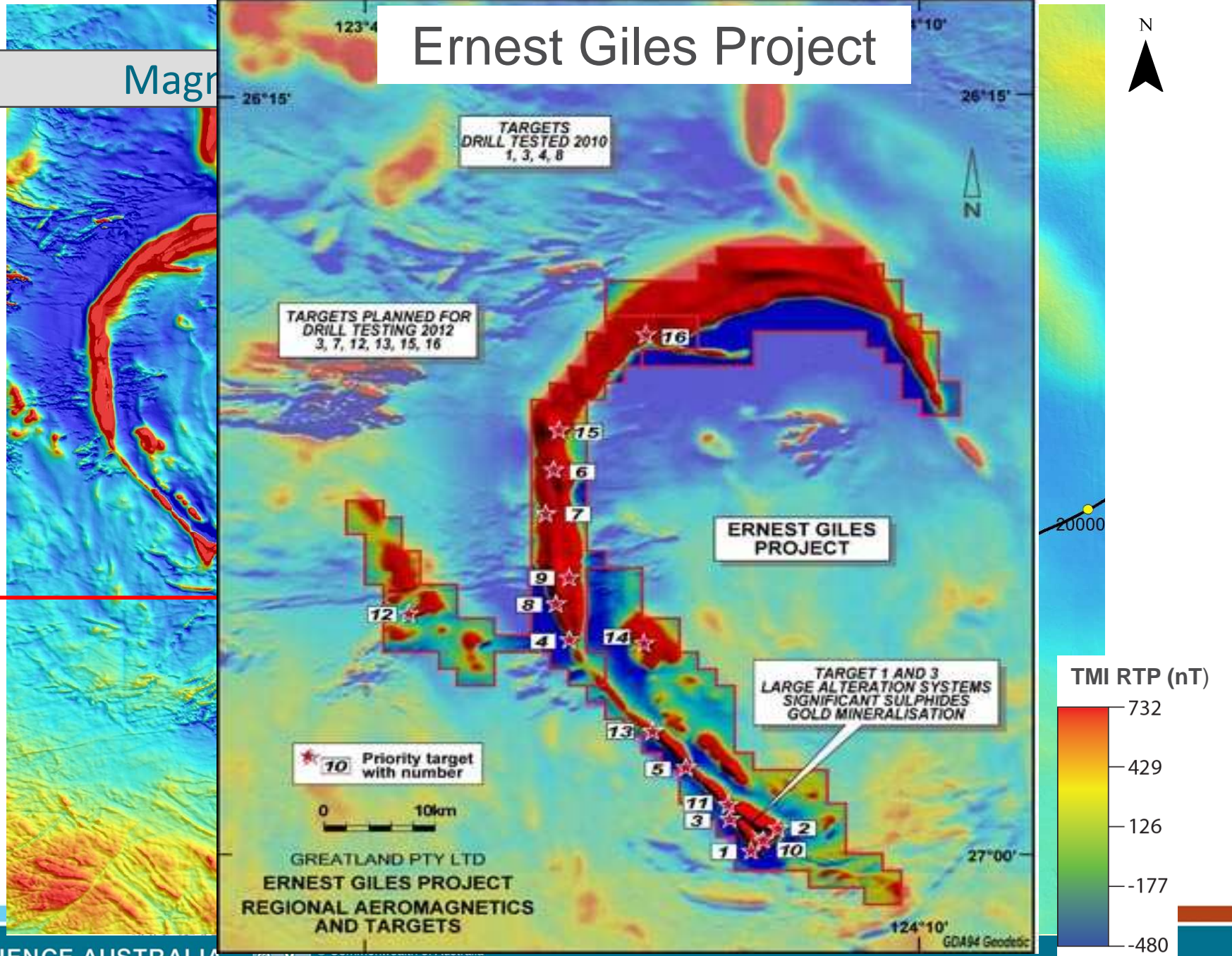


Salt diapir

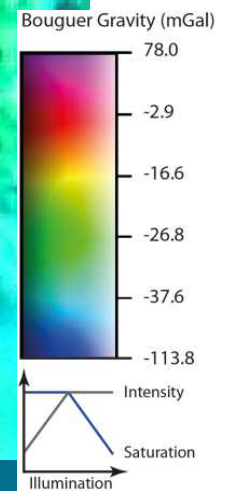
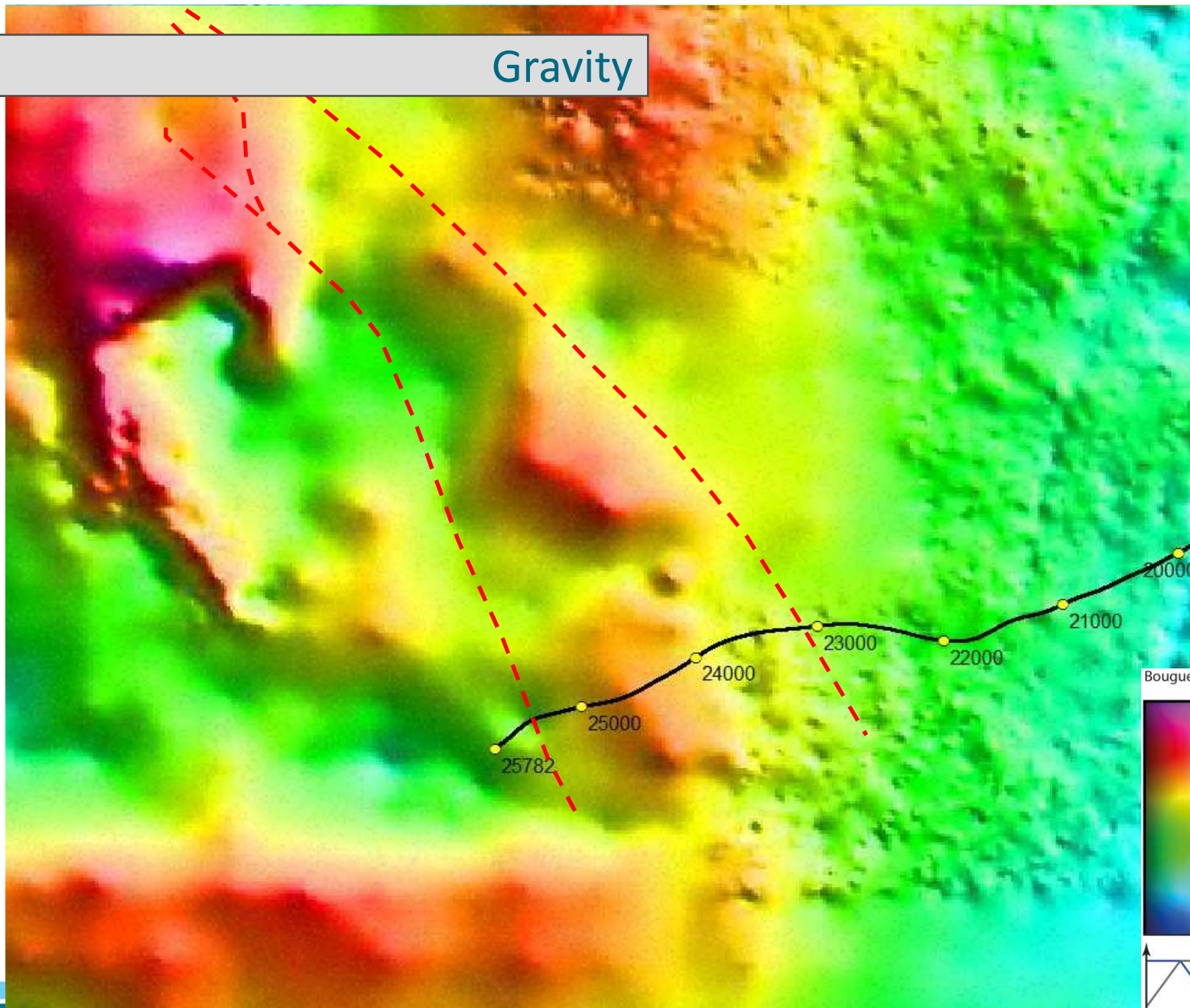


Ernest Giles Project

Magn



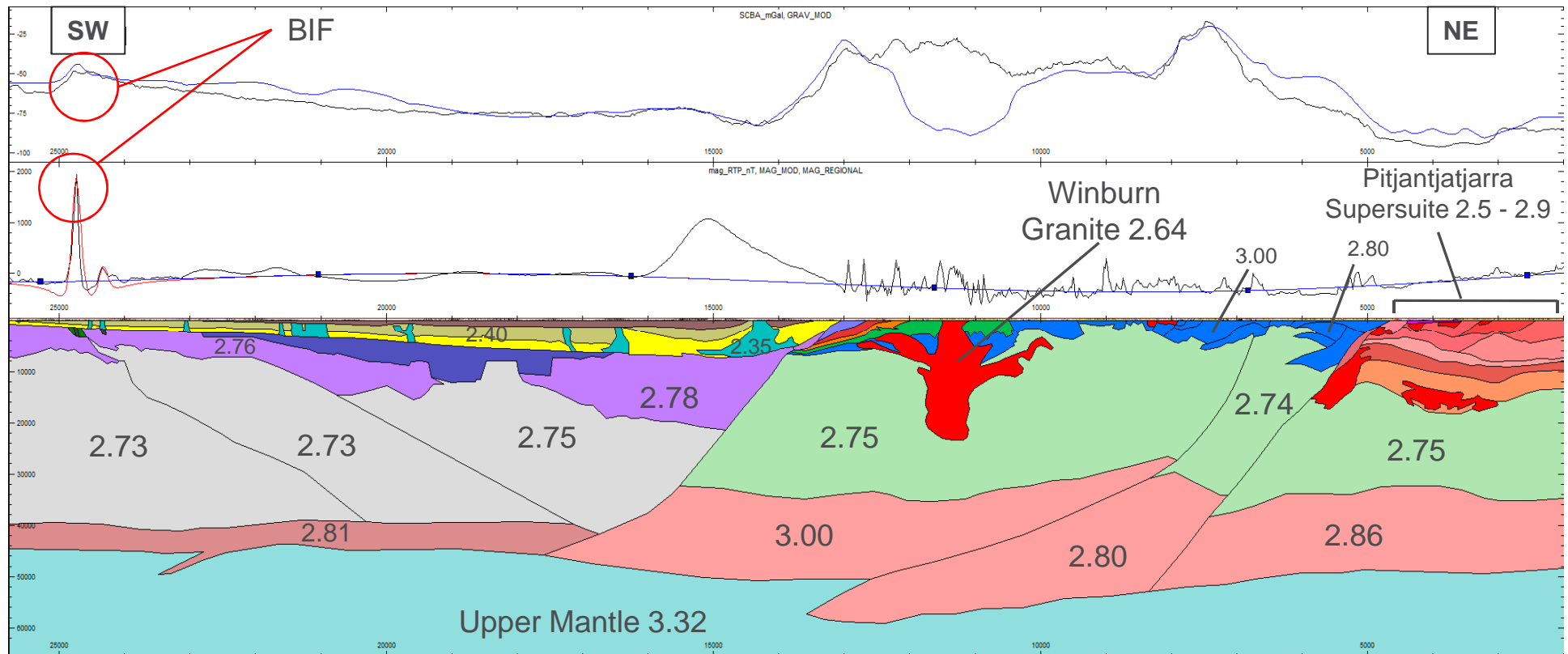
Gravity



Forward Modelling 11GA-YO1

*All density values displayed are g/cm³

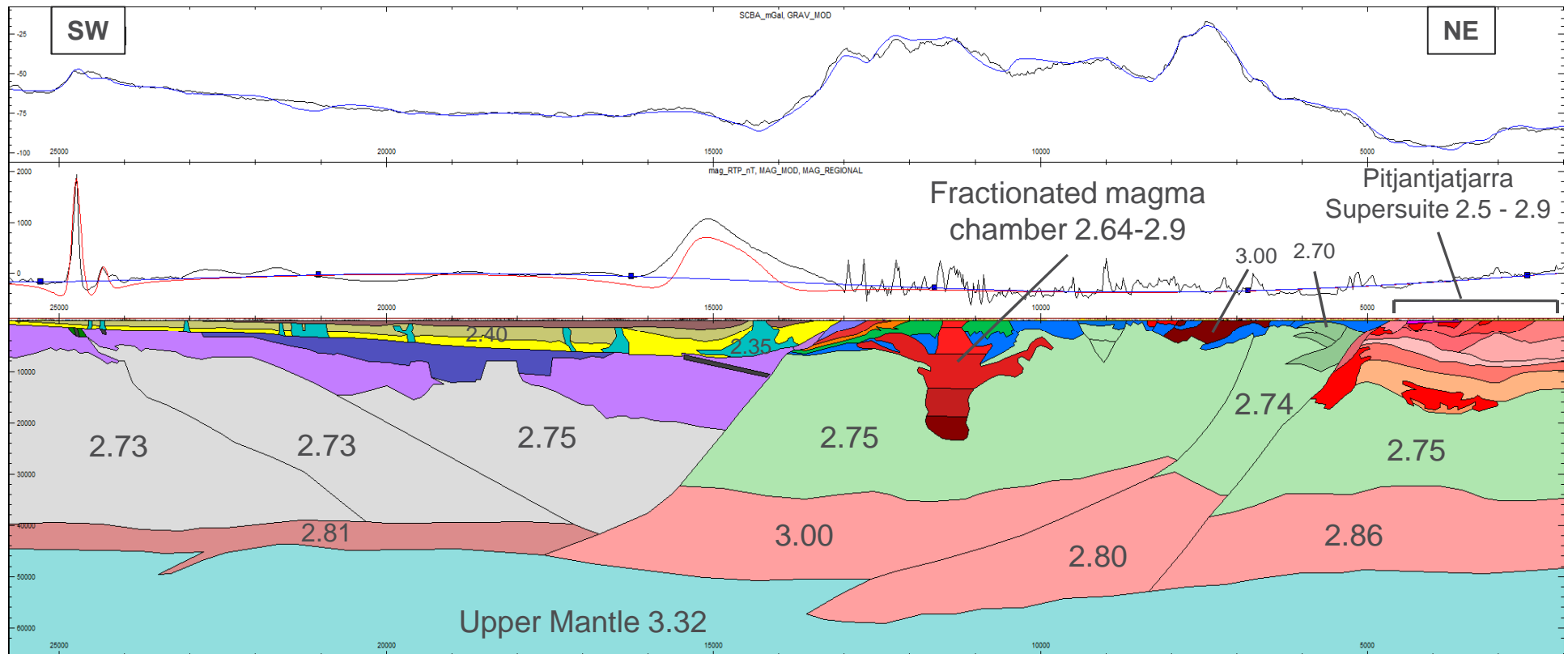
Observed Data —
Gravity Calculated —
Magnetics Calculated —



Forward Modelling 11GA-YO1

*All density values displayed are g/cm³

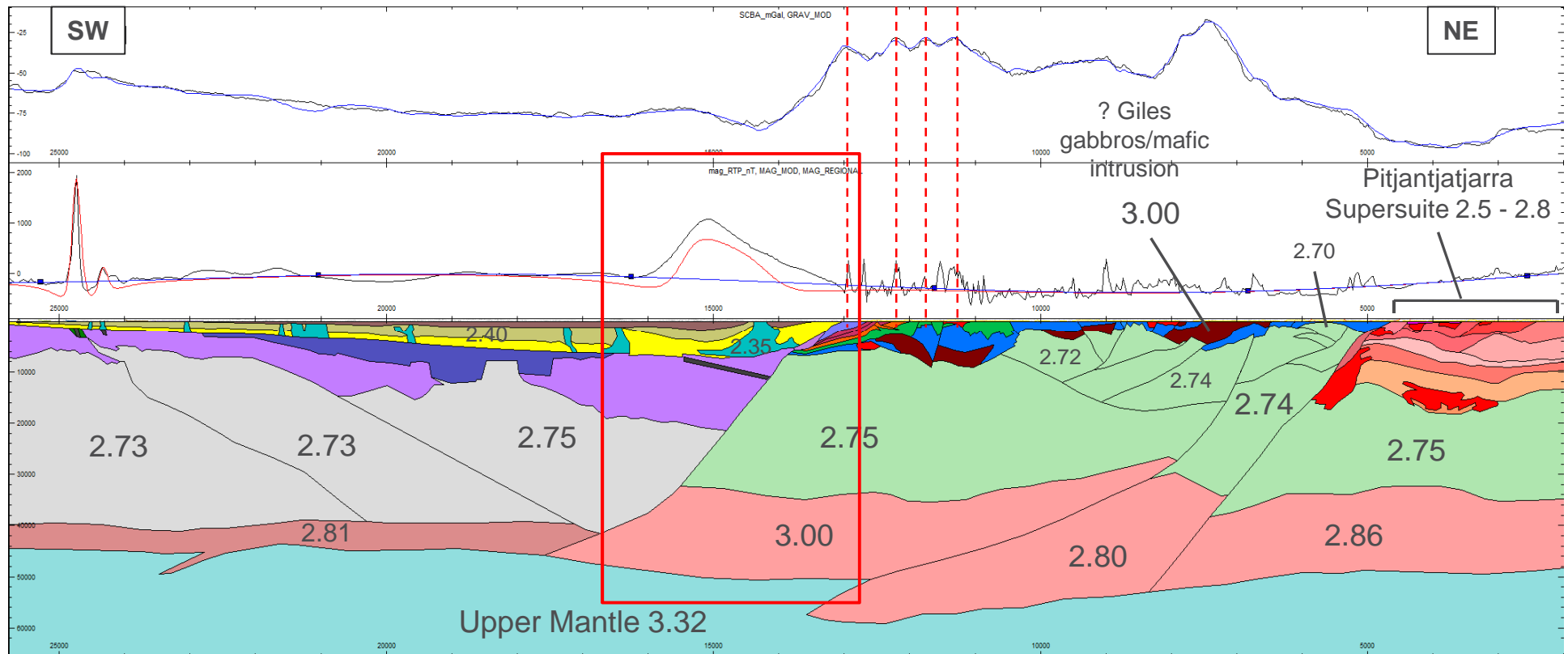
Observed Data —
 Gravity Calculated —
 Magnetics Calculated —



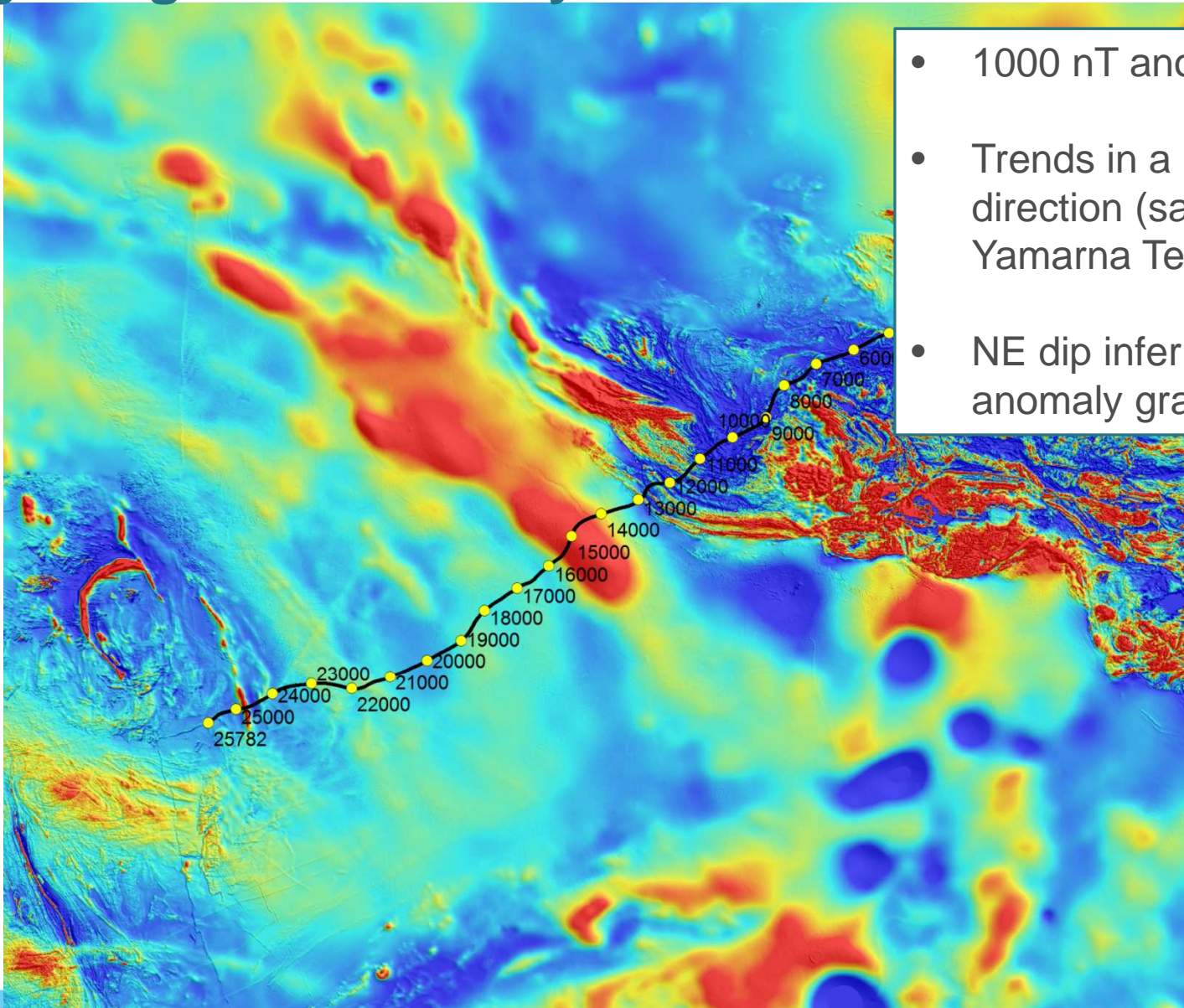
Forward Modelling 11GA-YO1

*All density values displayed are g/cm³

Observed Data —
 Gravity Calculated —
 Magnetics Calculated —

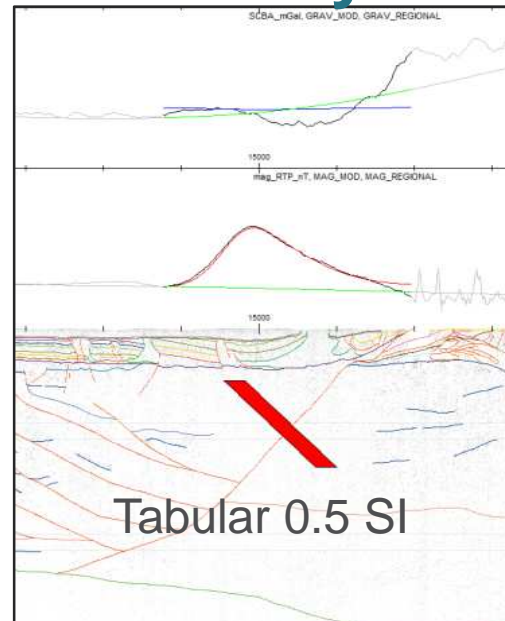
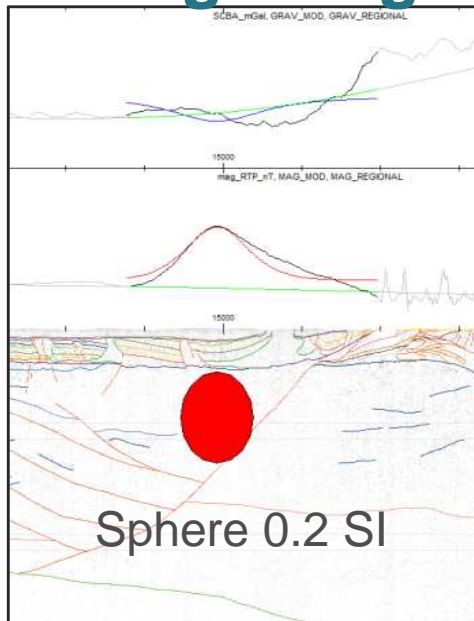


Large Magnetic Anomaly CDP 13000-16000

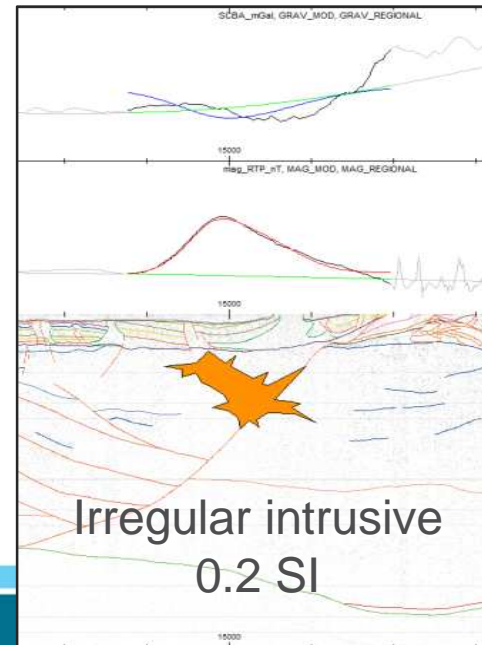
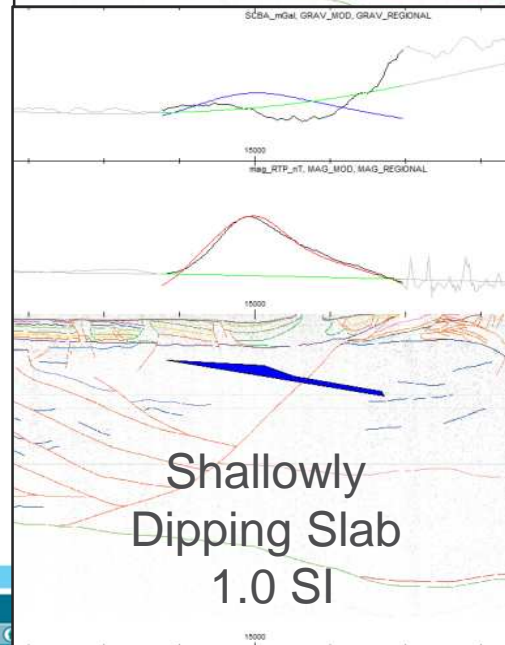
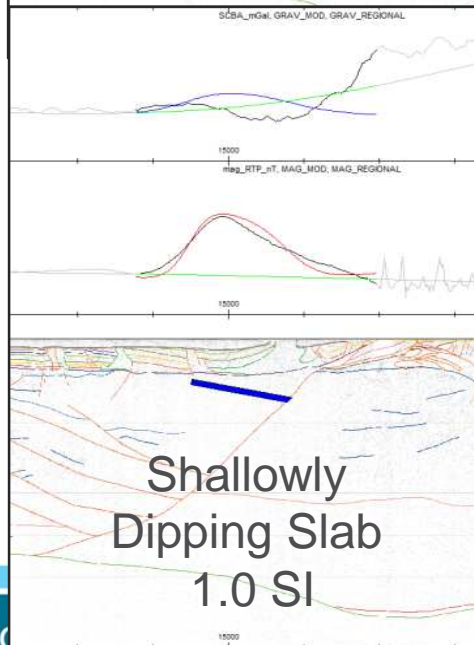


- 1000 nT anomaly
- Trends in a NW-SE direction (same as Yamarna Terrane)
- NE dip inferred from anomaly gradient

Large Magnetic Anomaly CDP 13000-16000



- 1000 nT anomaly
- Trends in a NW-SE direction (same as Yamarna Terrane)
- NE dip inferred from anomaly gradient



Building a 3D Geological Model

Input Data:

Surface and Solid Geology Maps

Gravity and Magnetic Data

- a) Data interpretation
- b) Worms
- c) Forward Modelling
- d) 3D Inversion

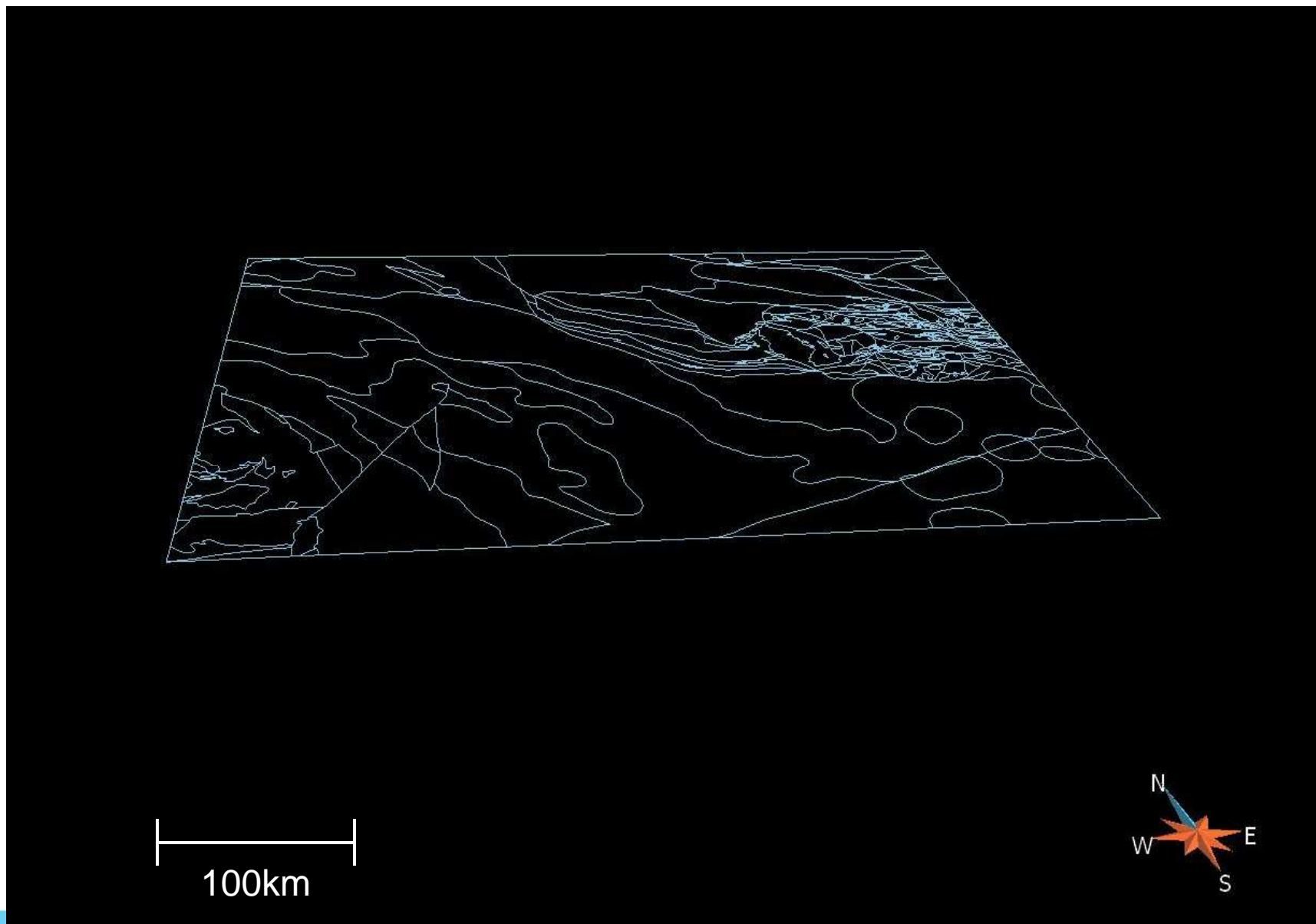
Seismic Interpretation (11GA-YO1 and industry traverses)

Drill Holes

Magnetotellurics (MT)

AusMoho

Building up the Model



Major Blocks - Undivided

Preliminary Model – Province Scale

AusMoho

Crustal faults

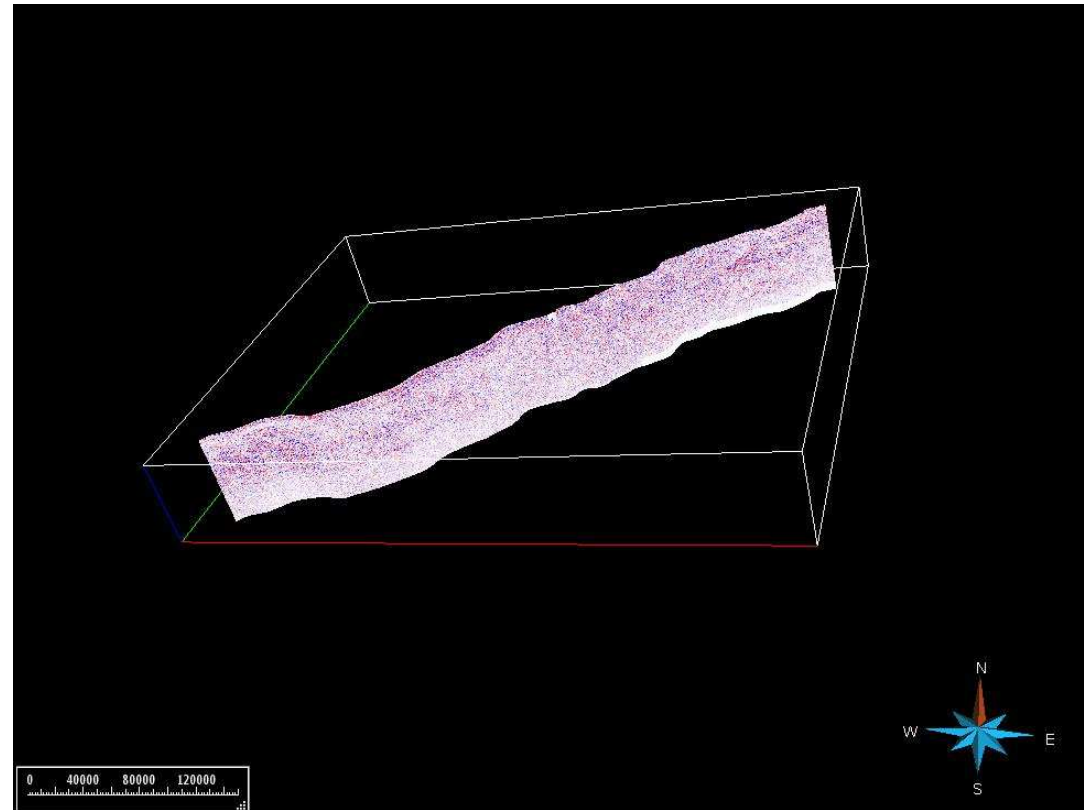
Musgrave Province

Proterozoic
basement

Yilgarn Craton

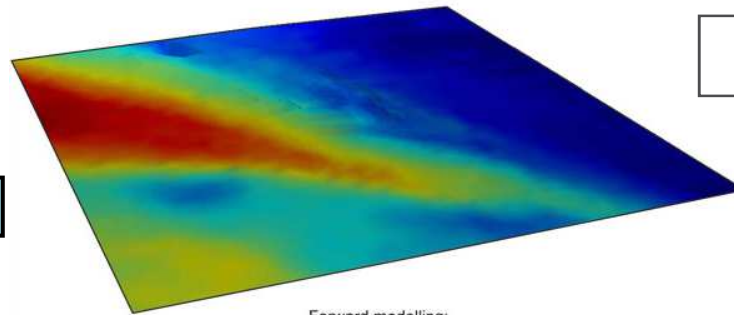
Officer Basin

Canning Basin



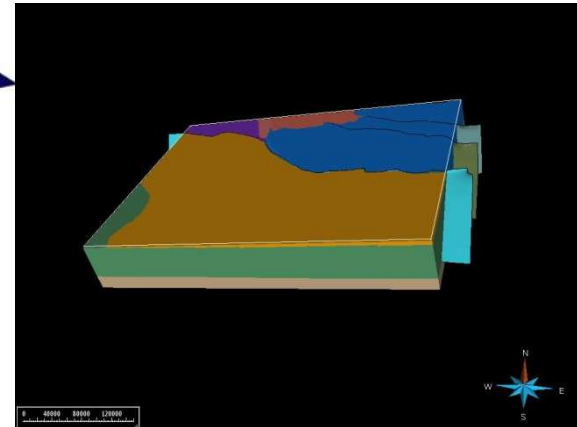
3D Inversion

Gravity or Magnetic Data

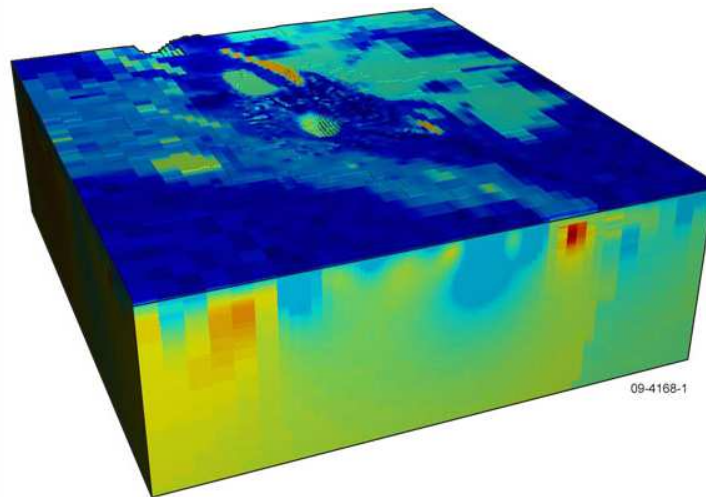


Forward modelling:
Calculate exact response, based on physics

3D Geological Model



Density or Susceptibility



Inverse
Modelling

Non-unique

Constraints

Summary

Interpretation

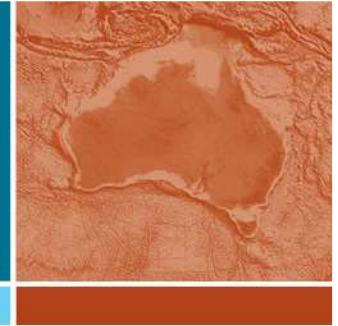
- Gabbros and mafic-ultramafic intrusions of the Giles Suite correlate well with the largest gravity anomalies across the Musgrave Province
- Extent of salt within Officer Basin estimated from gravity and magnetic data
- Large NE dipping magnetic high between CDP 13000-16000 modelled as BIF/mafics within Yamarna Terrane

Preliminary 3D Geological Model

- Regional scale fault architecture defined
 - Woodroffe, Mitika and Winduldarra faults
- Officer Basin depth and extent well defined by seismic and drill hole data
- 3D inversion will be used to test and improve the 3D geological model



Australian Government
Geoscience Australia



Acknowledgements

Geoscience Australia:

Russell Korsch
Narelle Neumann
Richard Blewett
Ron Hackney
Richard Lane
Geoff Fraser
Richard Chopping
Anthony Schofield

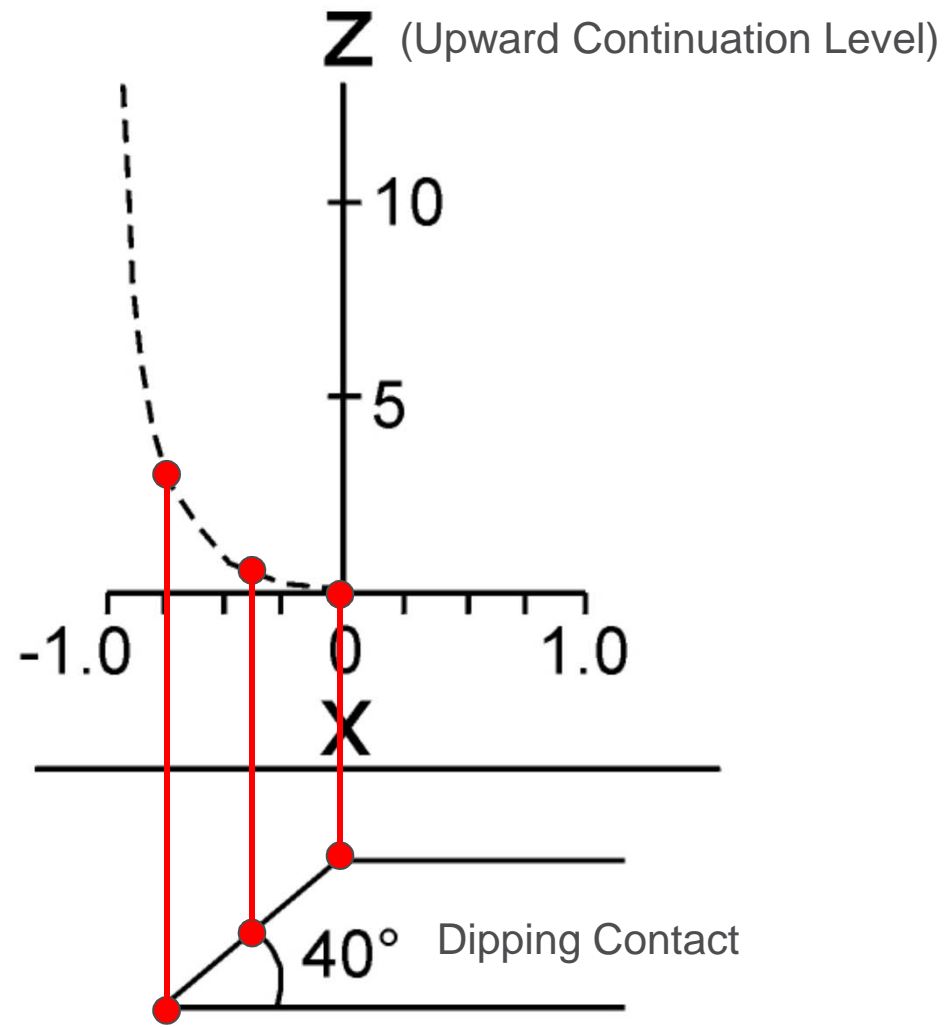
GSWA for provision of industry seismic data and WA solid geology maps

Contact: James Goodwin

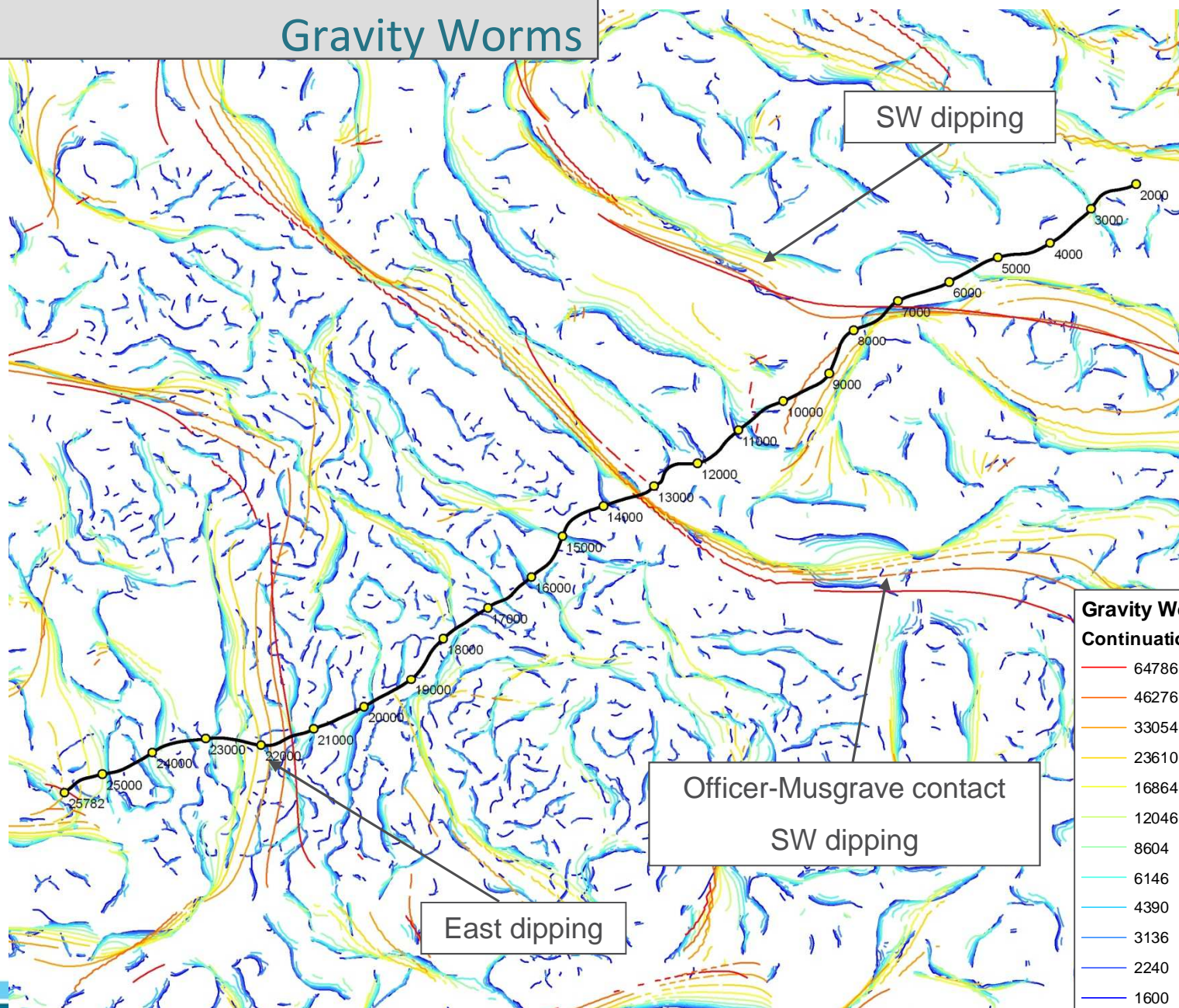
Phone: 02 6249 9705

Email: james.goodwin@ga.gov.au

Multi-scale Edge Detection (Worms)



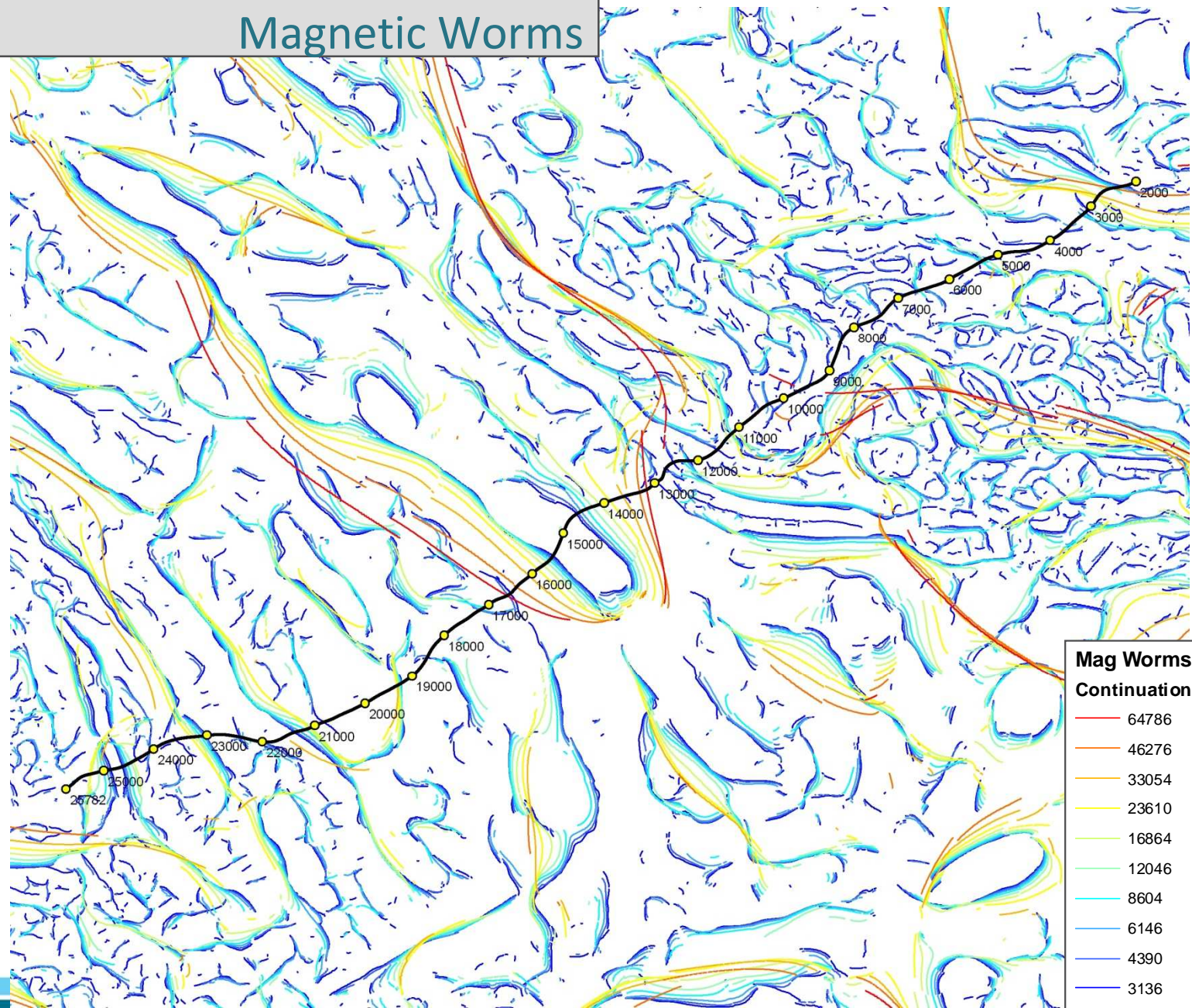
Gravity Worms



Gravity Worms	
Continuation Height (m)	
Red	64786
Orange	46276
Yellow	33054
Light Green	23610
Green	16864
Light Blue	12046
Blue	8604
Dark Blue	6146
Very Dark Blue	4390
Black	3136
Dark Grey	2240
Light Grey	1600

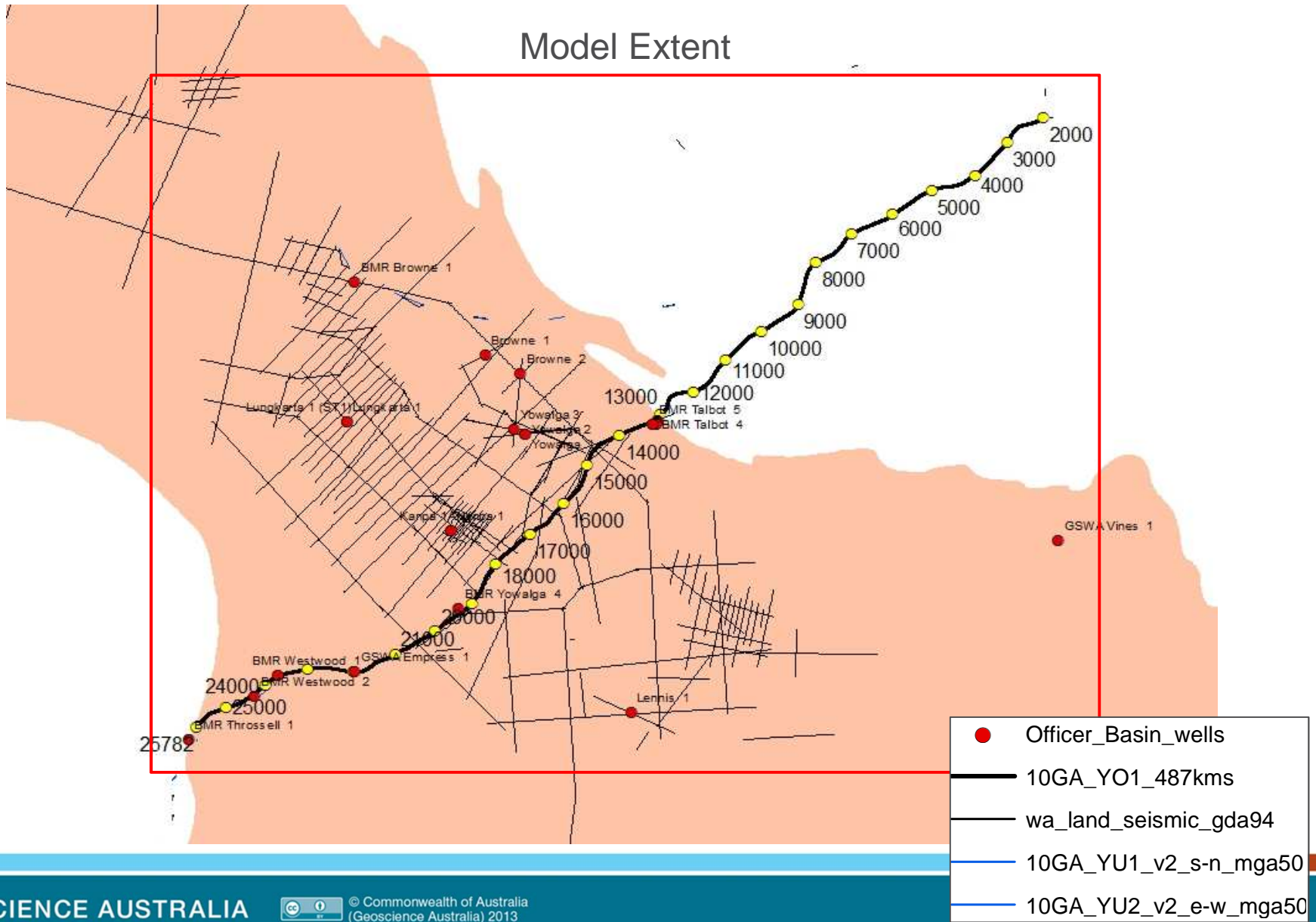


Magnetic Worms

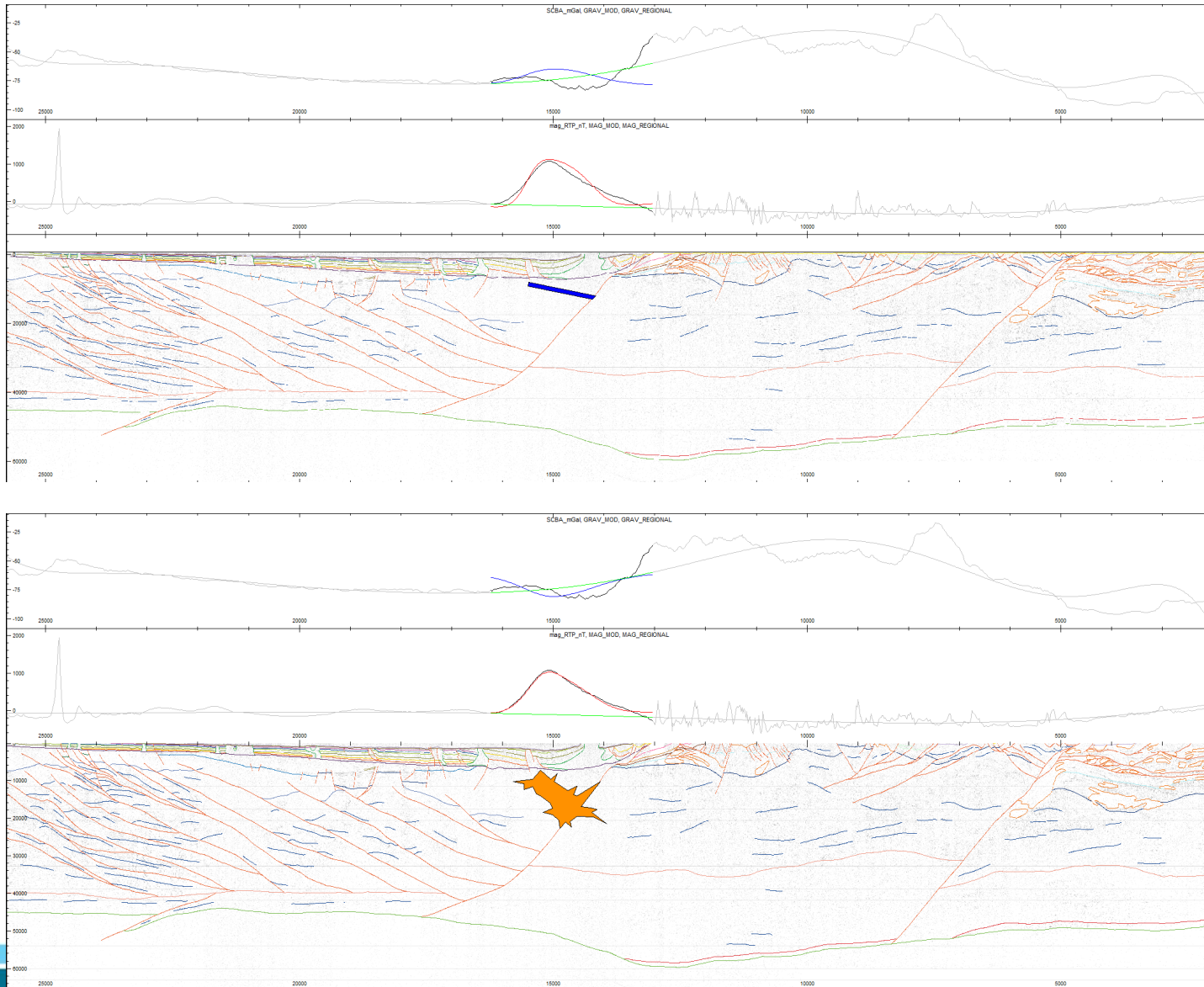


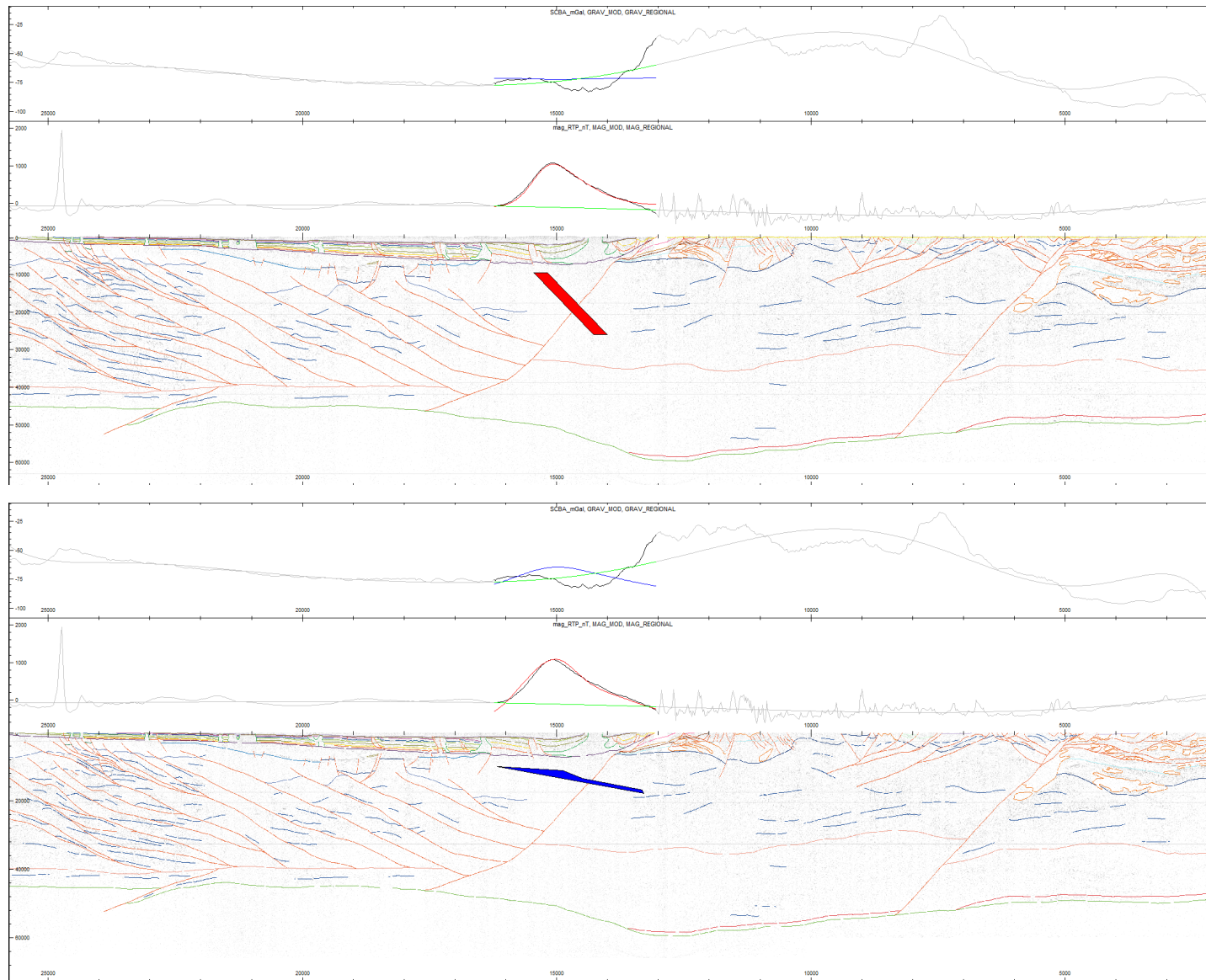
Mag Worms	
Continuation Height (m)	
Red line	64786
Orange line	46276
Yellow line	33054
Light green line	23610
Green line	16864
Cyan line	12046
Blue line	8604
Dark blue line	6146
Light blue line	4390
Dark blue line	3136

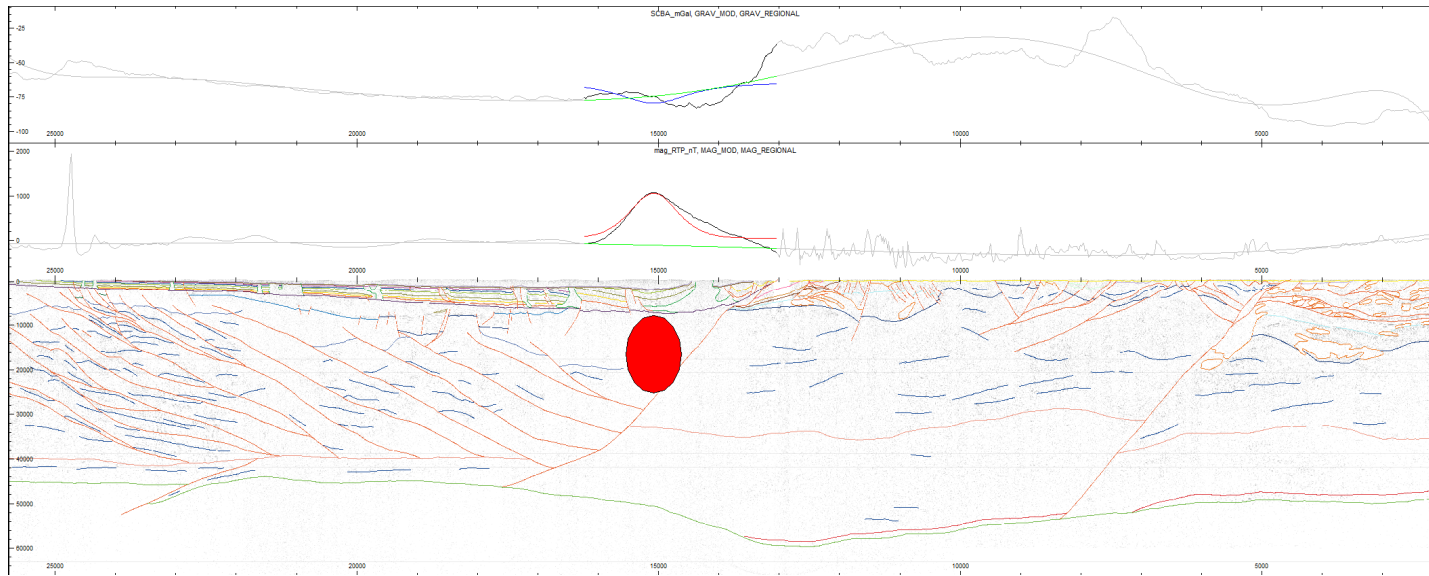
Seismic Interpretation and Drill Holes



Large Magnetic Anomaly







Adjacent Forward Models

