Potential Field modelling of northern South Australia

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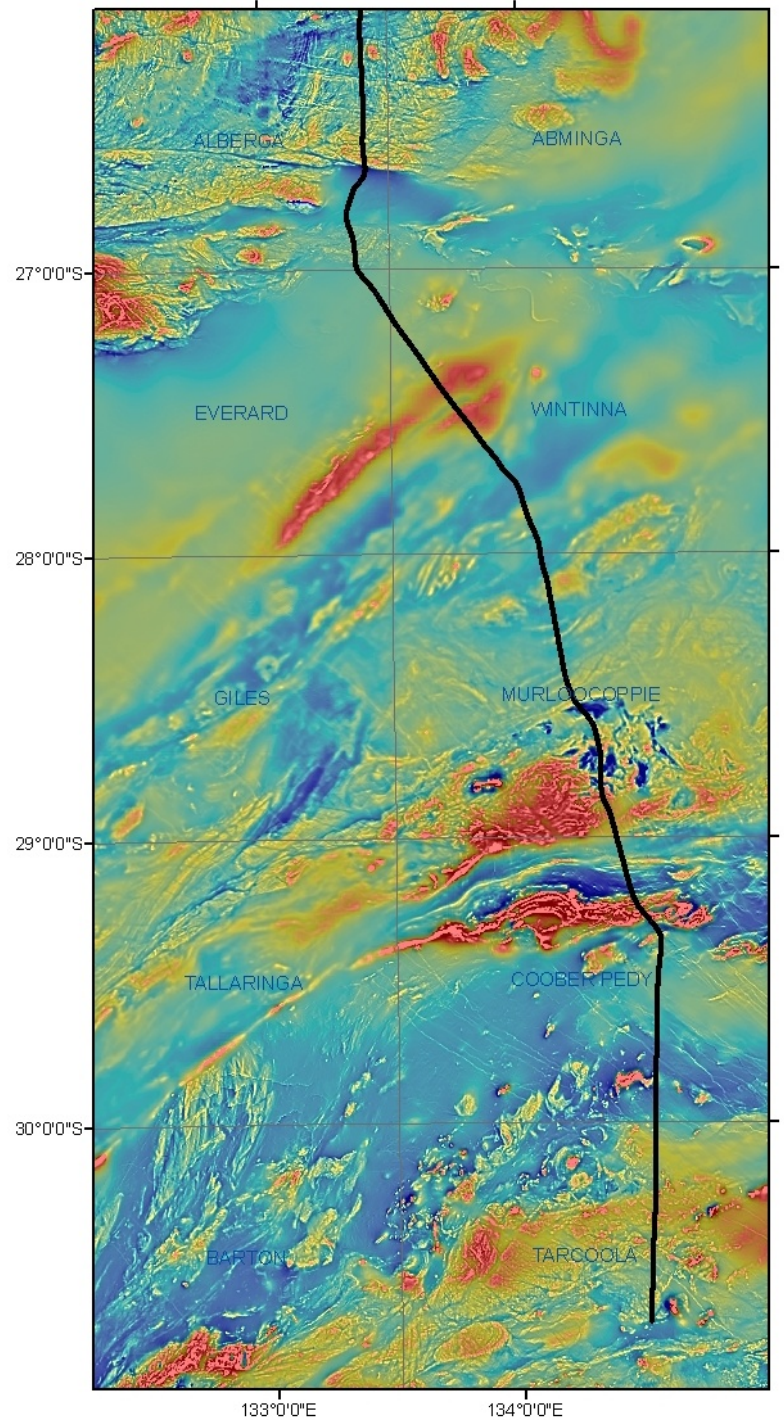
Potential Field Data

Allows us to extrapolation between outcrops/drill-holes

Provides higher lateral resolution than sparse data sets (MT and Passive Seismic)

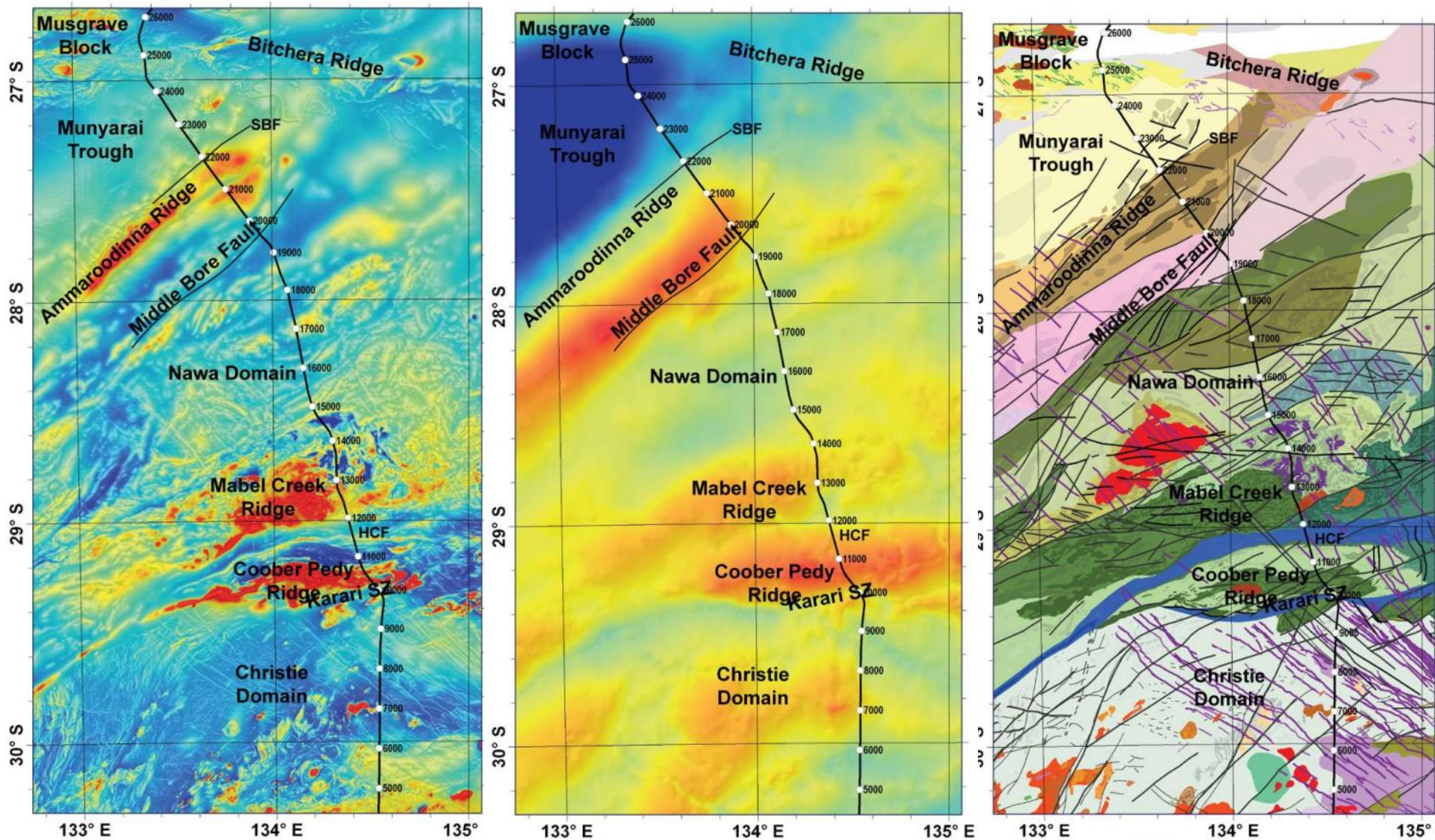
Allows us to expand our interpretations beyond the GOMA line



Steps in the Analysis

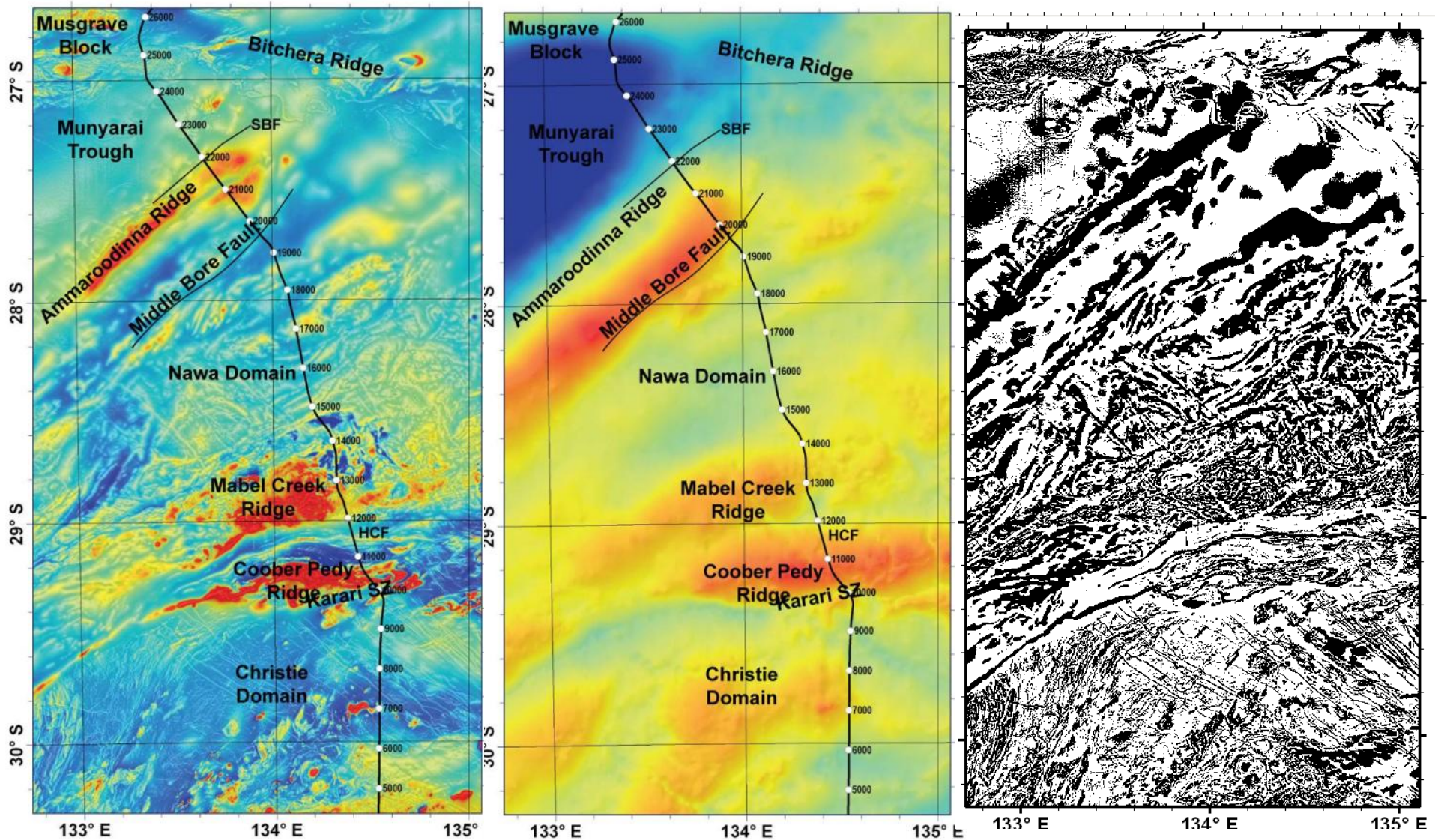
- Map based interpretation
- Unconstrained Inversions
- Constrained Inversions
- Forward Models
- Comparison to the GOMA Line

Potential Field Solid Geology Interp.

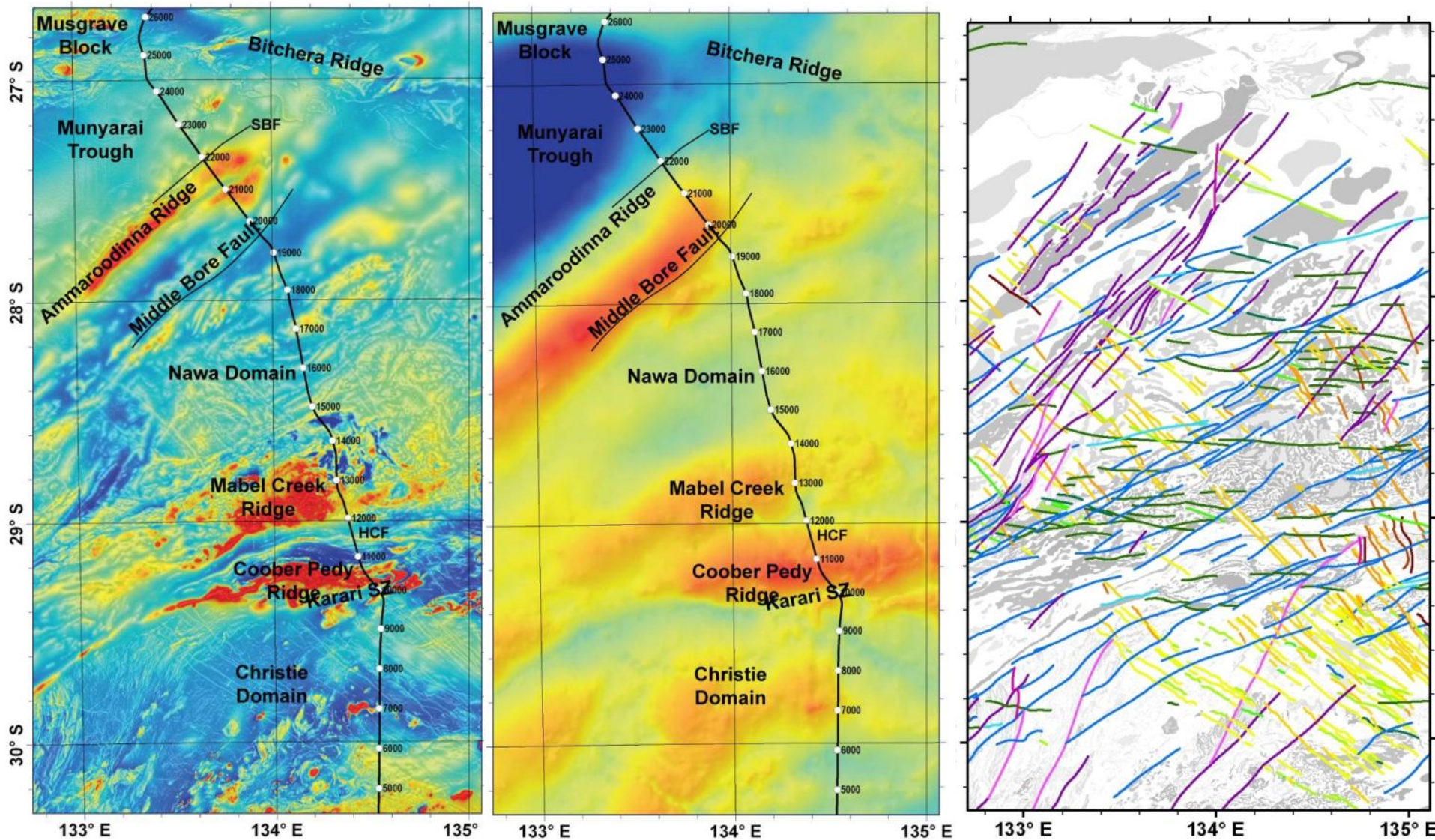


Musgraves and Christie Domain – from PIRSA

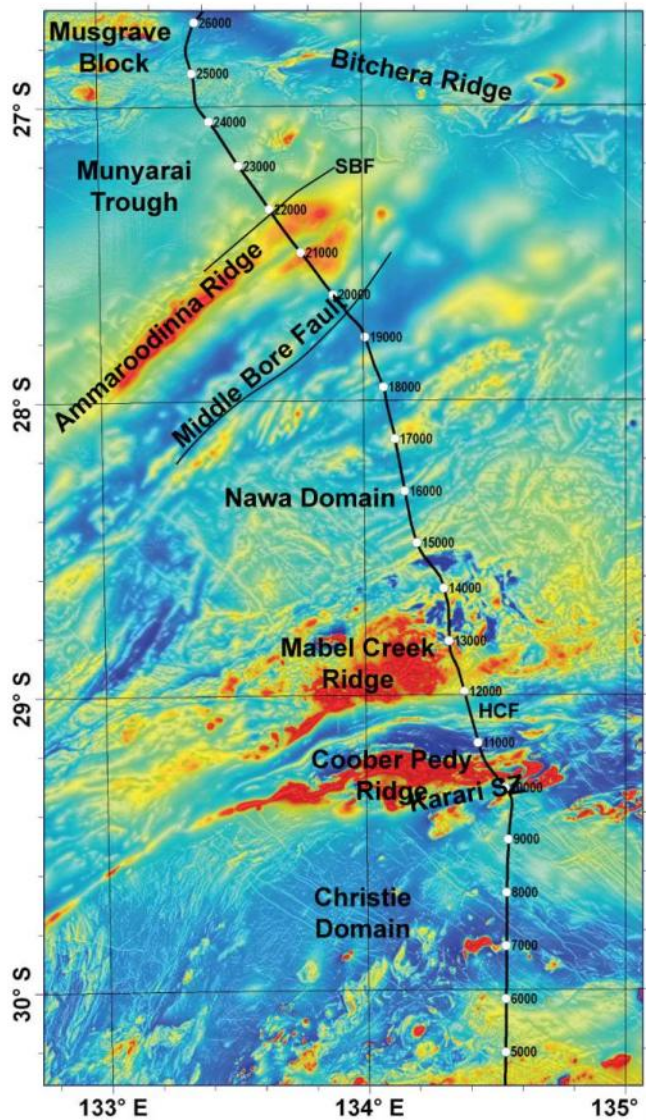
Building the Interpretation

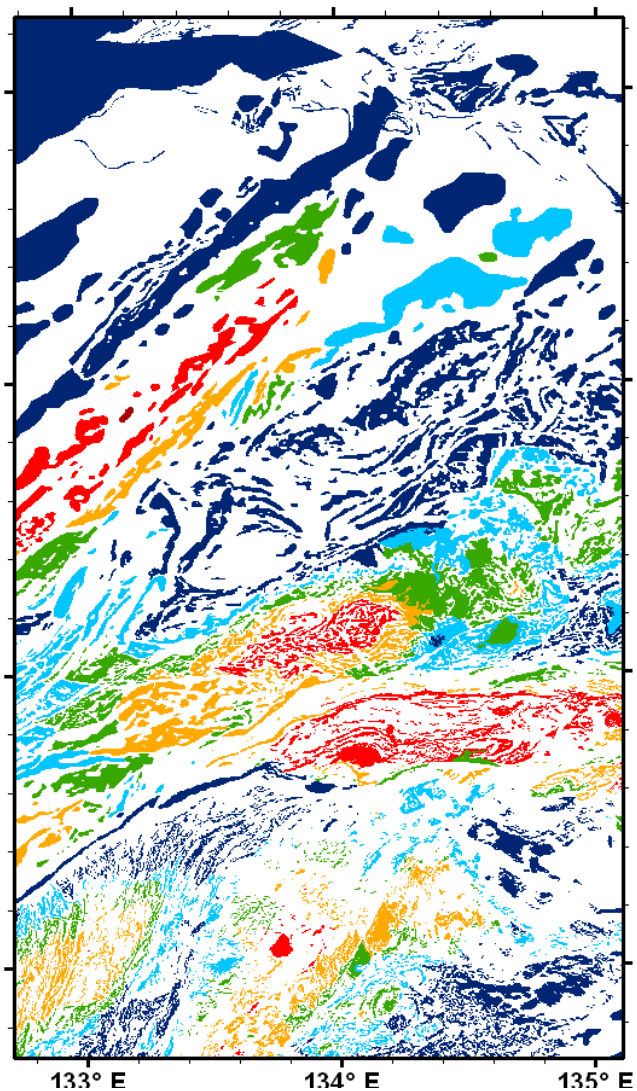


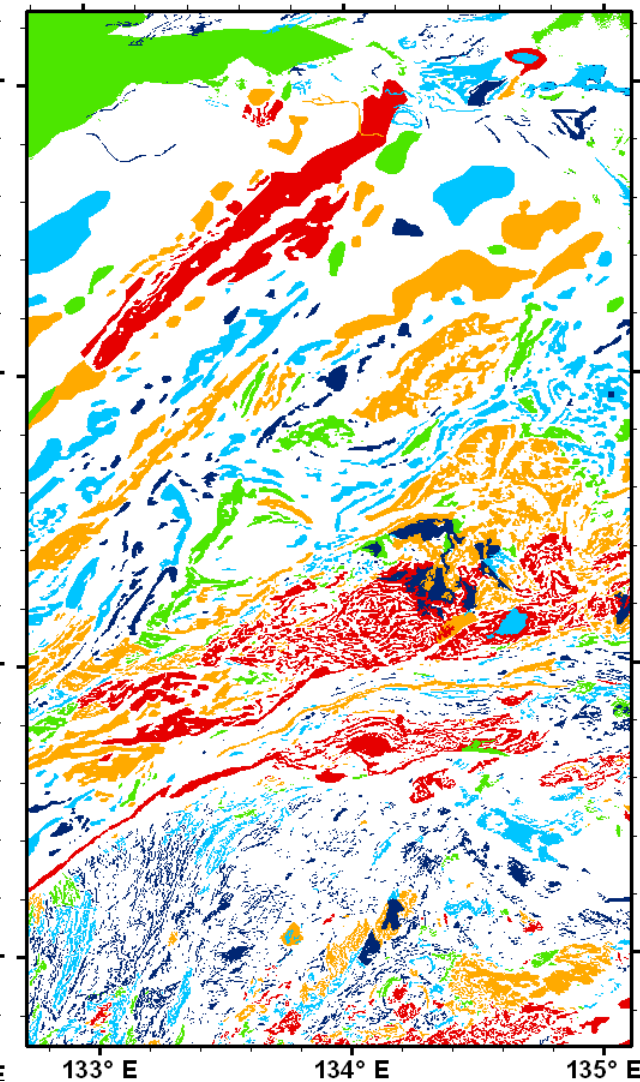
Pick Faults/Dykes



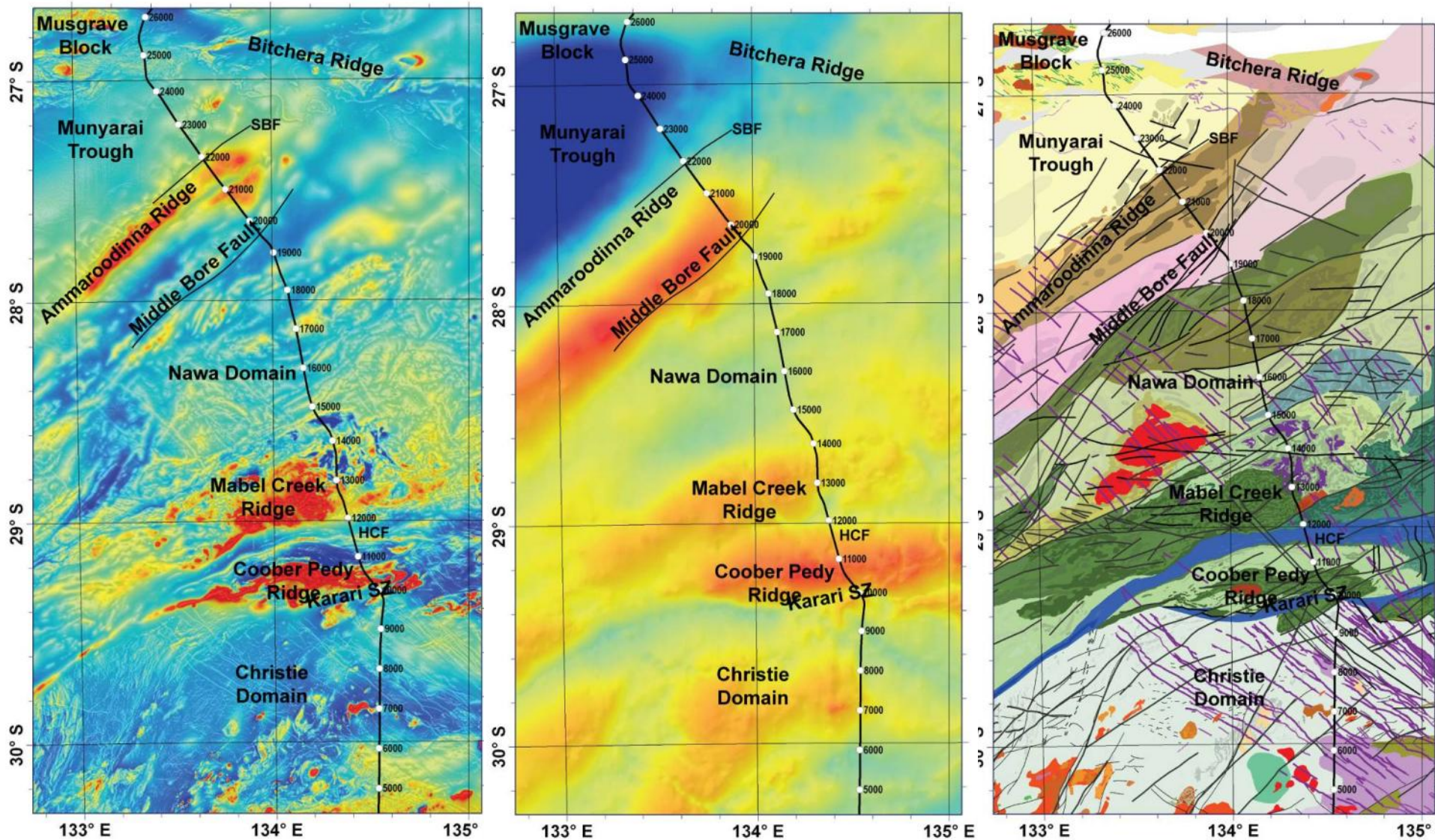
Potential Field Interp.







Potential Field Solid Geology Interp.



Musgraves and Christie Domain – from PIRSA

Modelling Aims

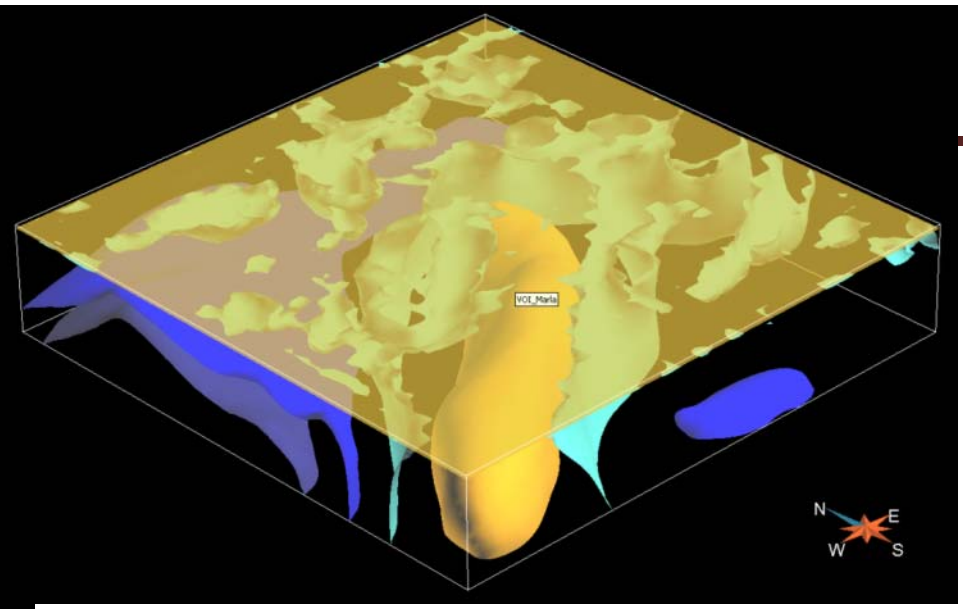
- Image density and magnetic susceptibility structure
- Correlate with results of the GOMA line
  - Highlight similarities
  - Understand the differences
- Determine lithospheric architecture…
  …and how it developed

Modelling Methods

Method	Inversions		Forward Models
	Unconstrained	Constrained	
Dimensions	Routinely 3D		Routinely 2D (3D Possible)
Model Definition	Mathematical	Mathematical/ Geological	Geological
Boundaries	Smooth	Smooth/Sharp	Sharp
Input Structure	Nowhere	Where Data	Everywhere
Results	Objective	Objective*	Subjective
Use here	Constrain Nature of Sources (Depth, Dip, etc)		Test/Validate Interpretation

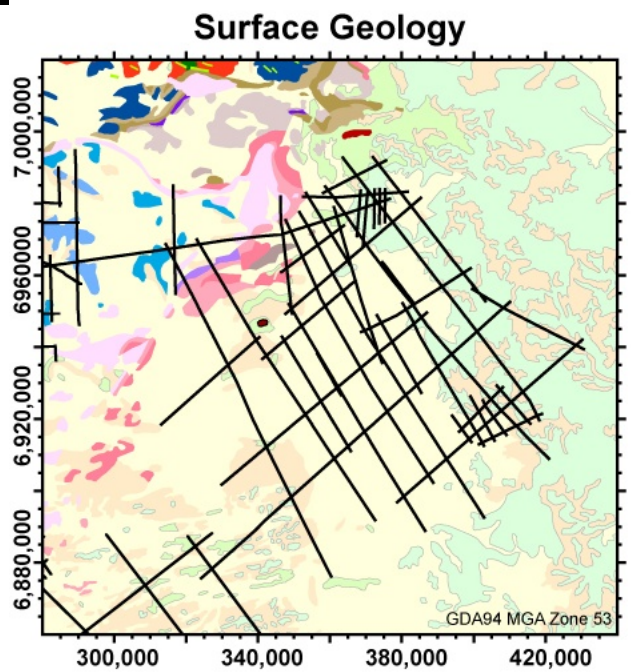
* Assuming constraints 100% reliable

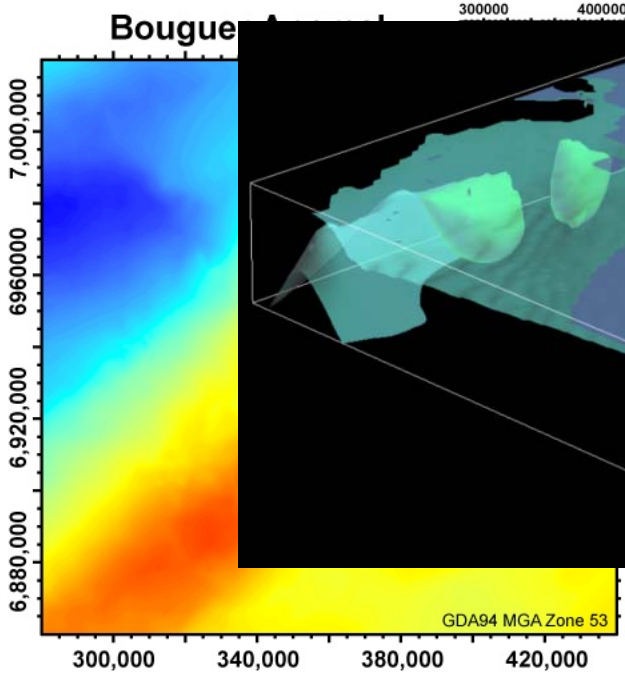
Unconstrained Inversions



Unrealistic low at depth beneath the Officer Basin

Can we add in the basin?

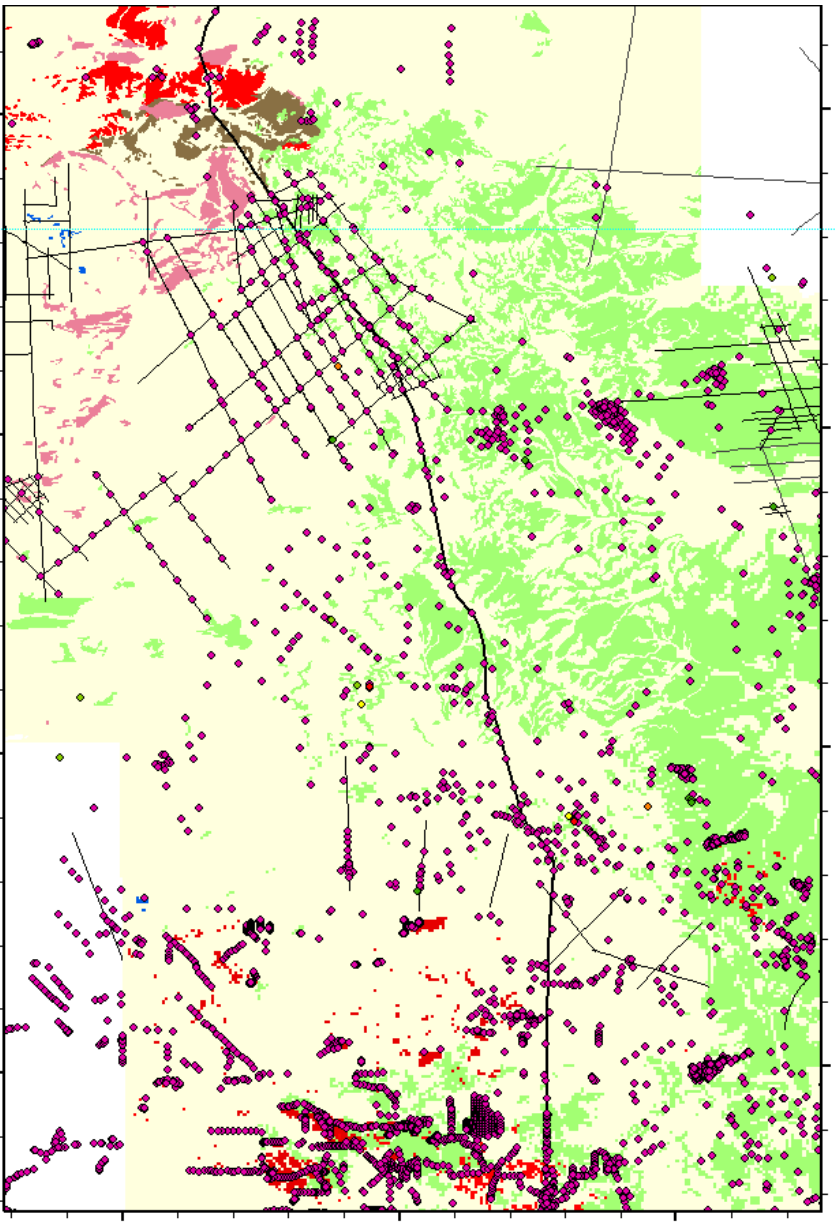




Constrained 3D Inversions

How can we add constraints?

1. Assign starting model
2. Assign a complex reference model
3. Min and max limits on properties
4. Reduce smoothing across known geological boundaries

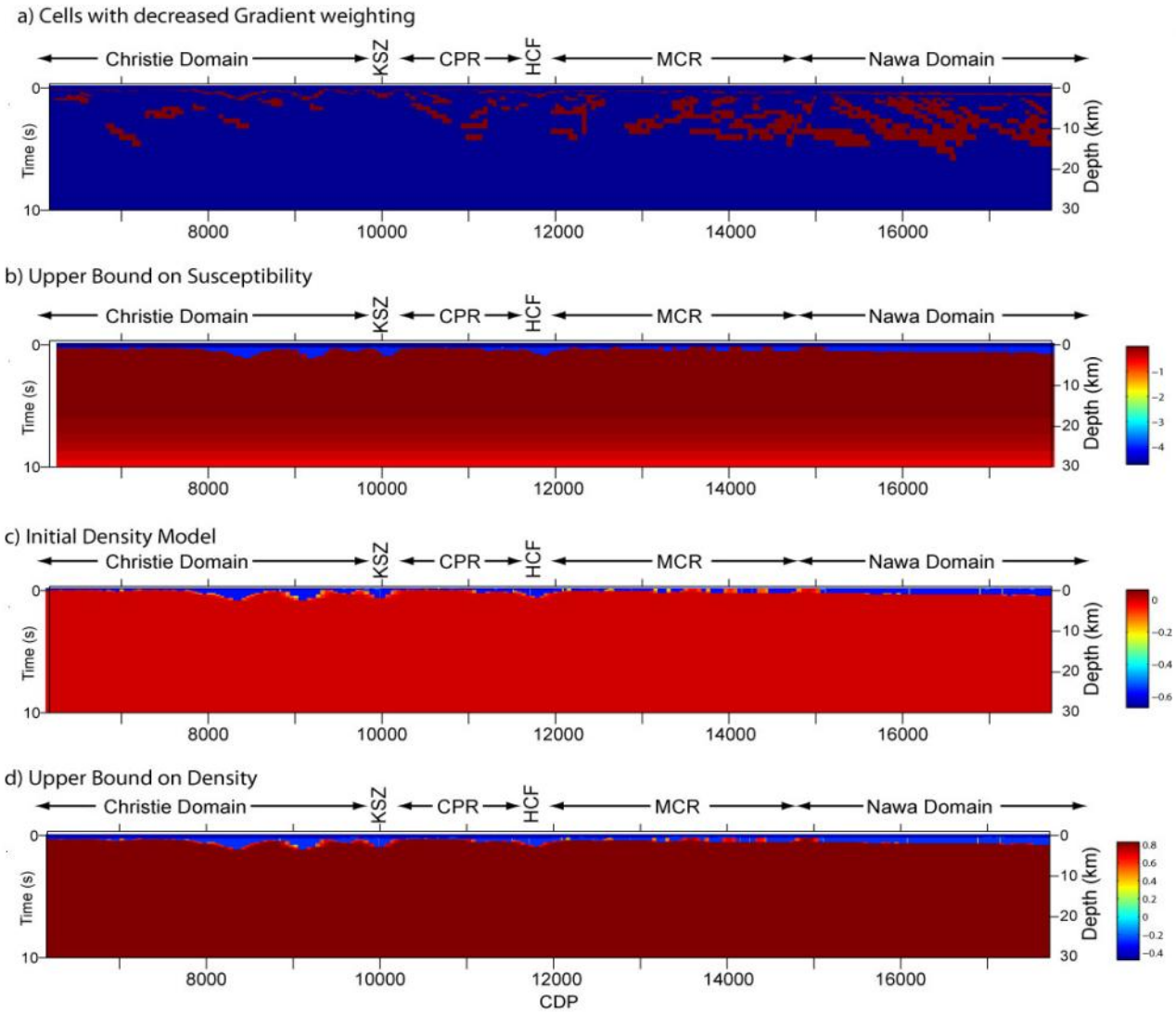


Data included

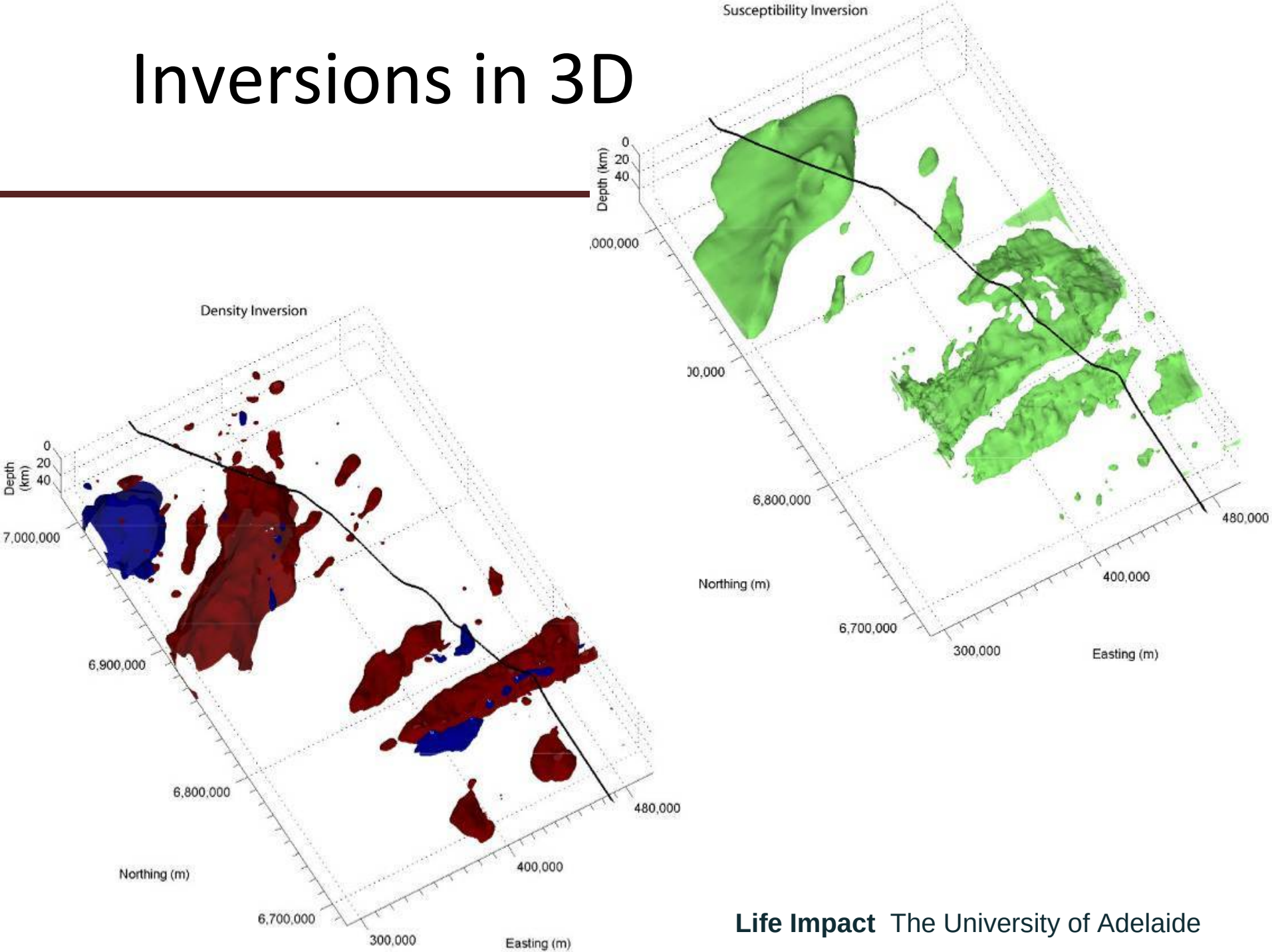
Hierachy of Constraints

- Measured Petrophysics
- Downhole Logs
- Drillhole Stratigraphy
- Surface Geology
- Seismic Reflections

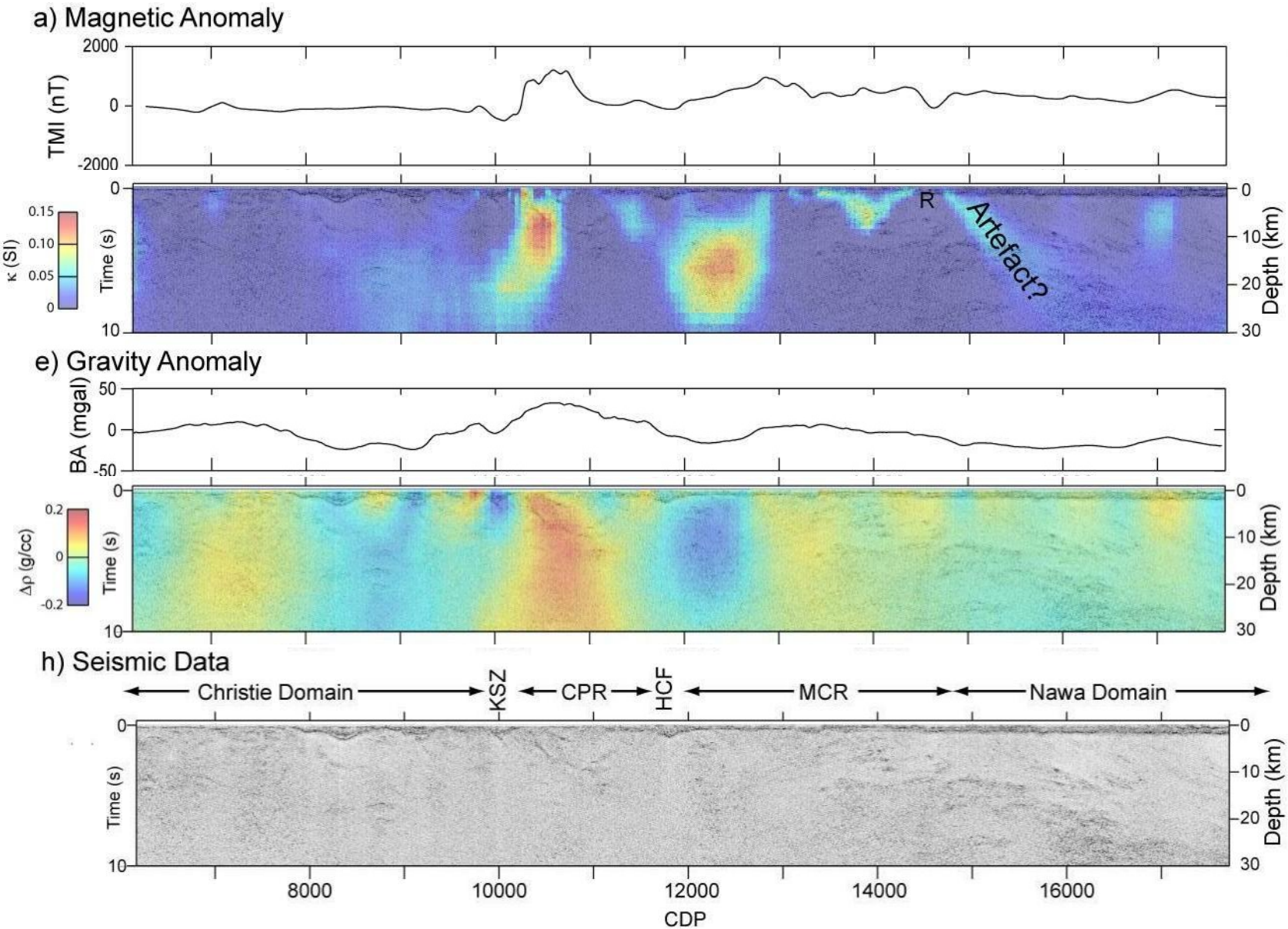
Example Constraints



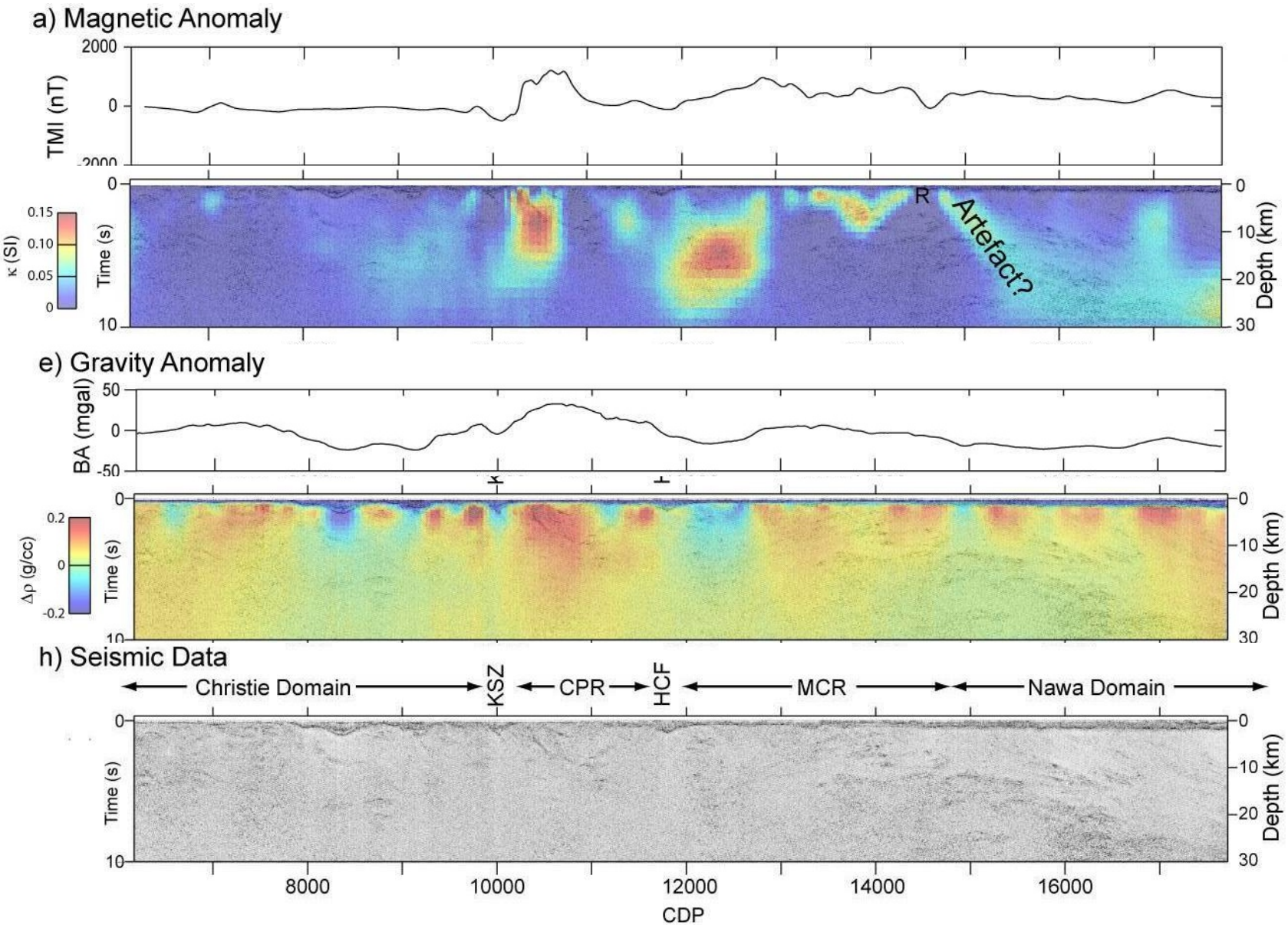
Inversions in 3D



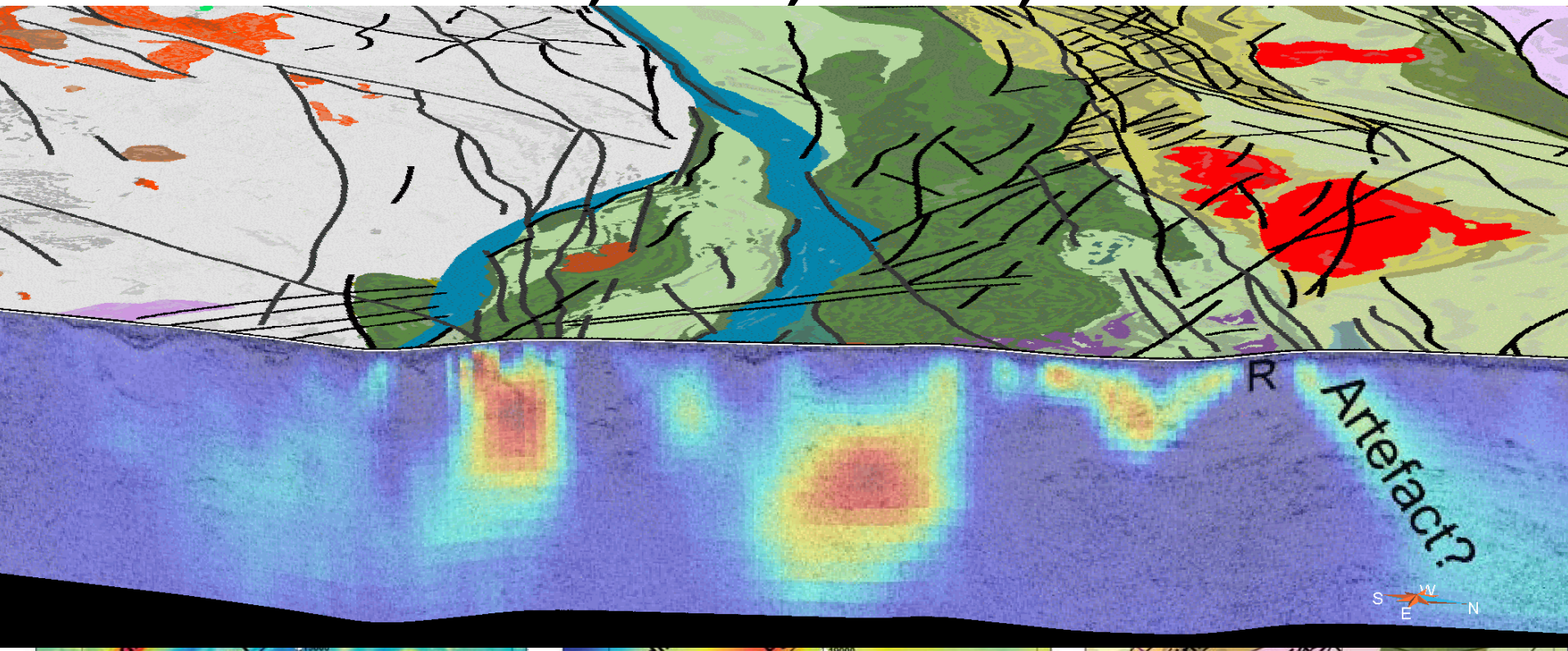
Christie to Nawa Unconstrained

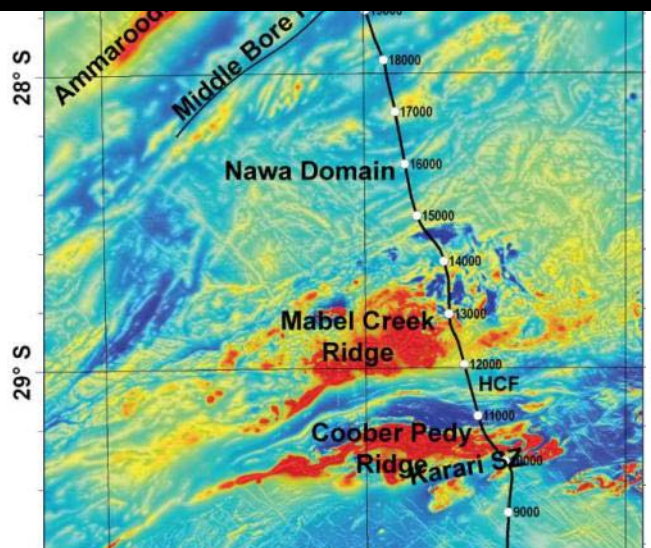


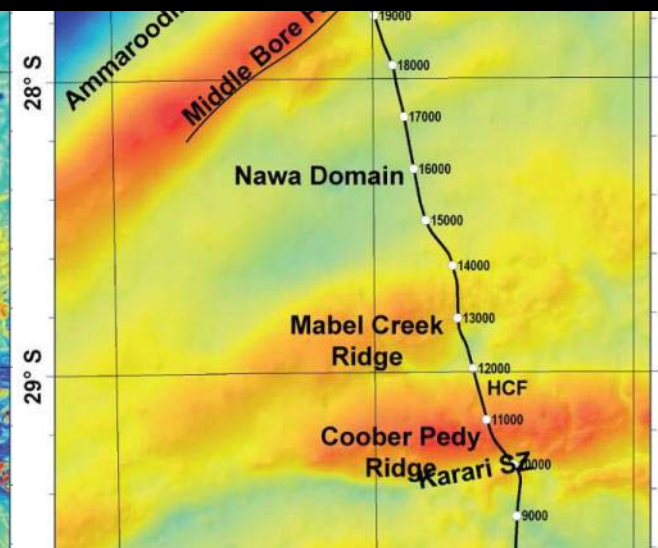
Christie to Nawa Constrained

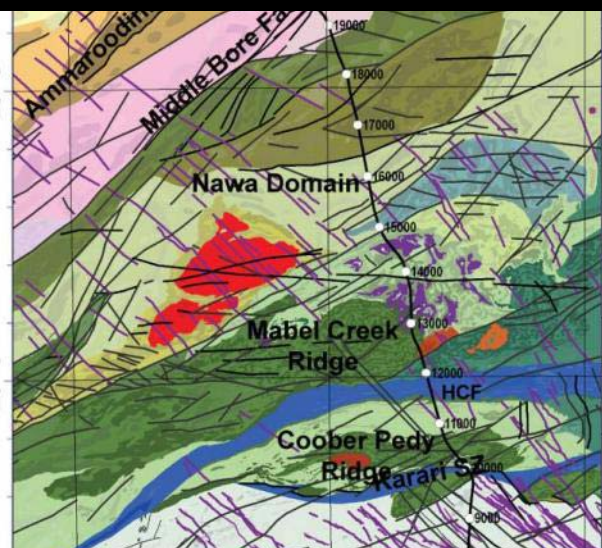


Christie, CPR, MCR, Nawa

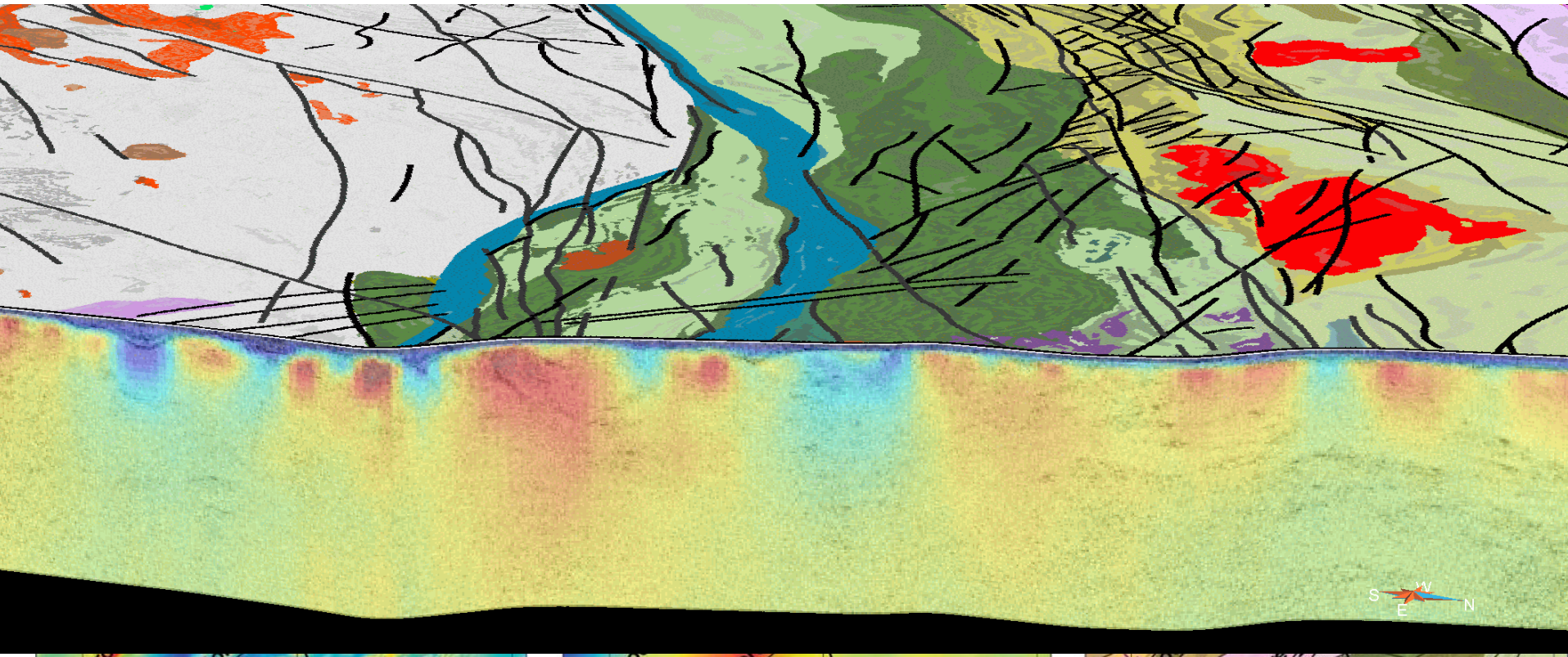


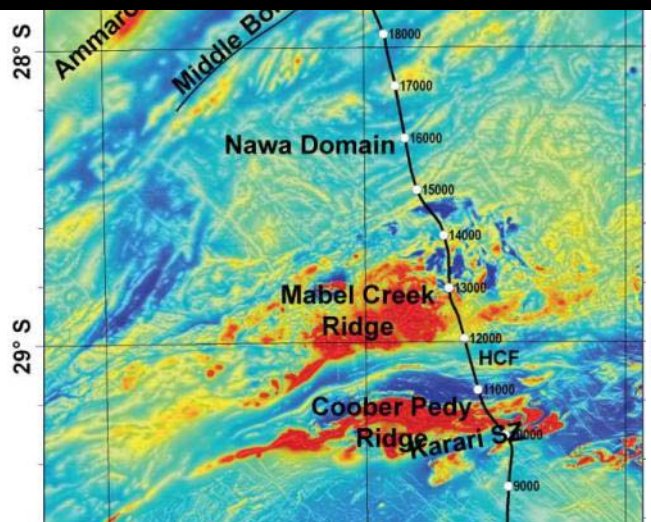


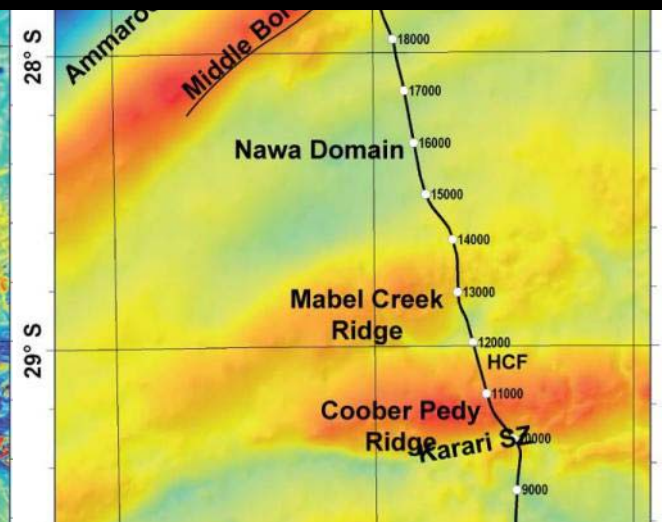


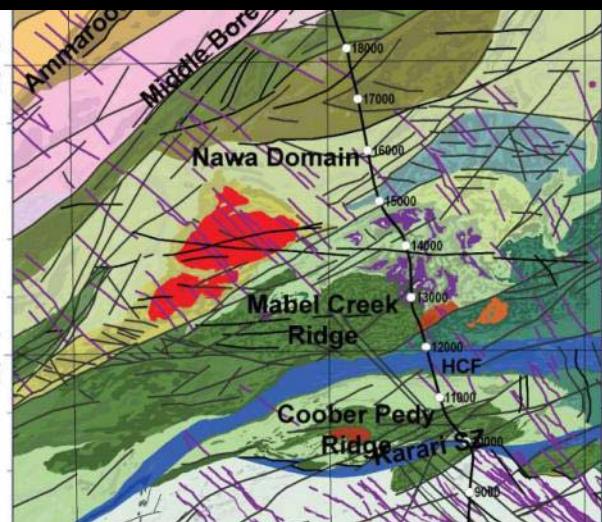


Christie, CPR, MCR, Nawa

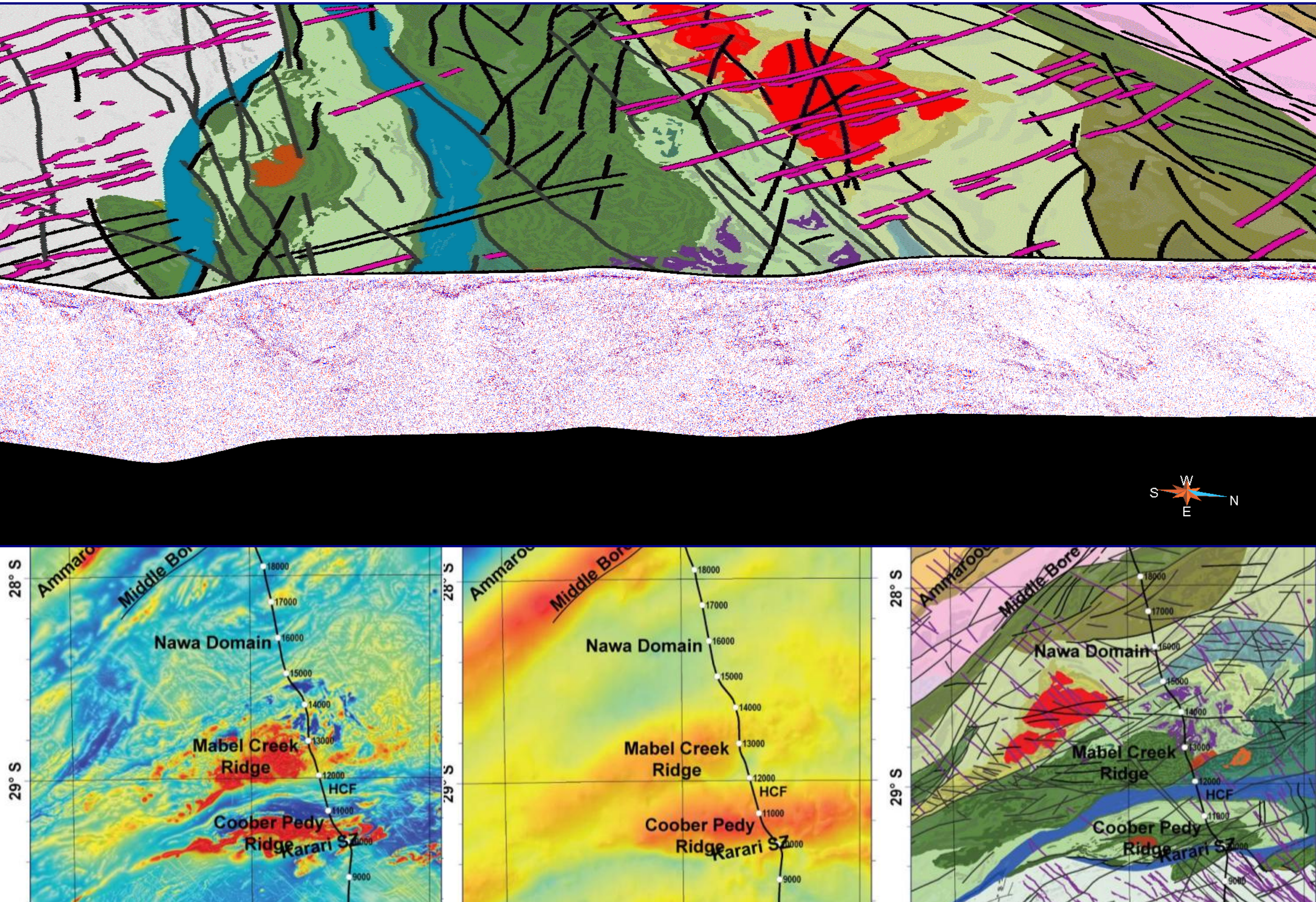




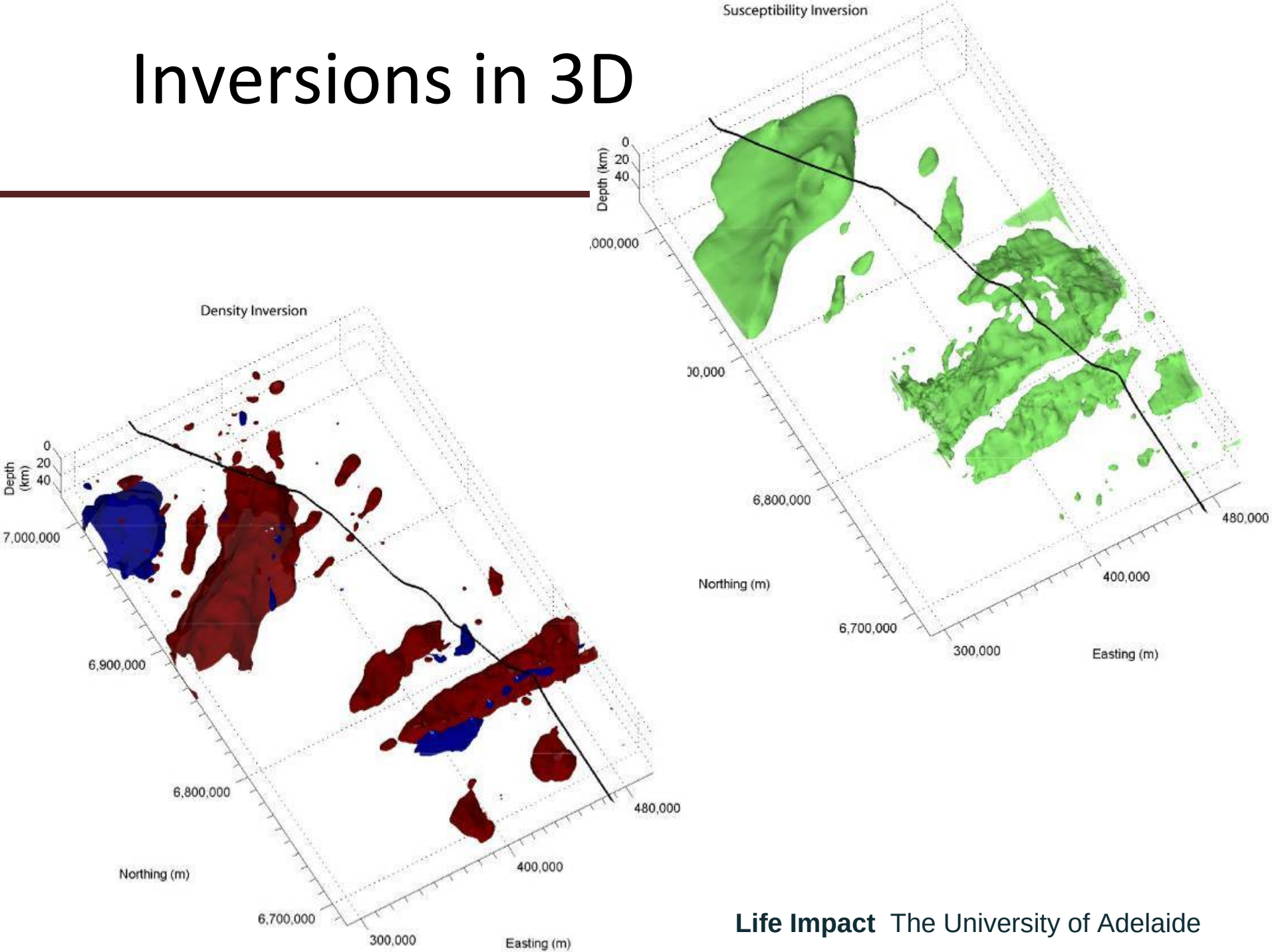




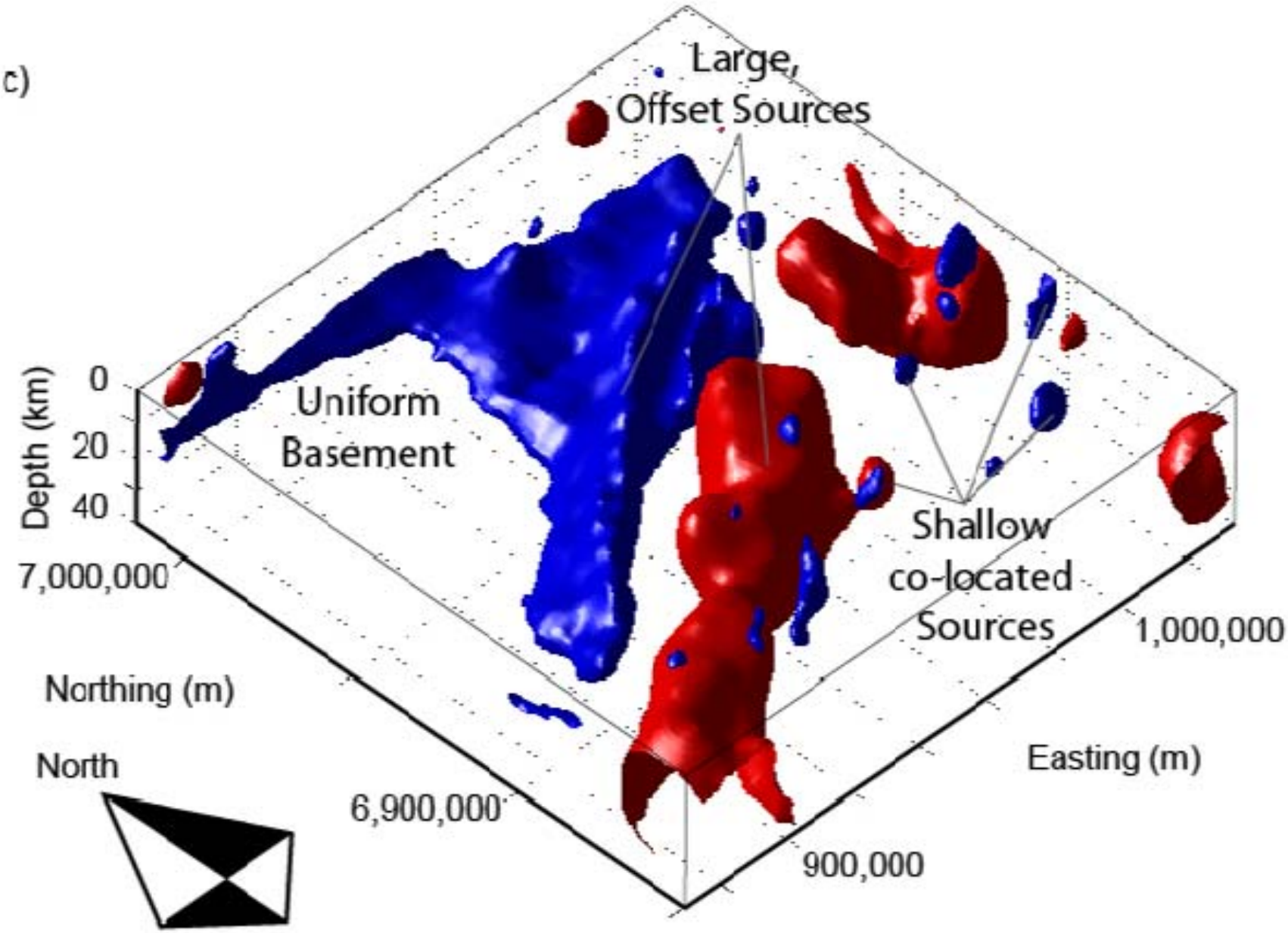
Christie, CPR, MCR, Nawa



Inversions in 3D



GOMA – Eastern Officer Basin



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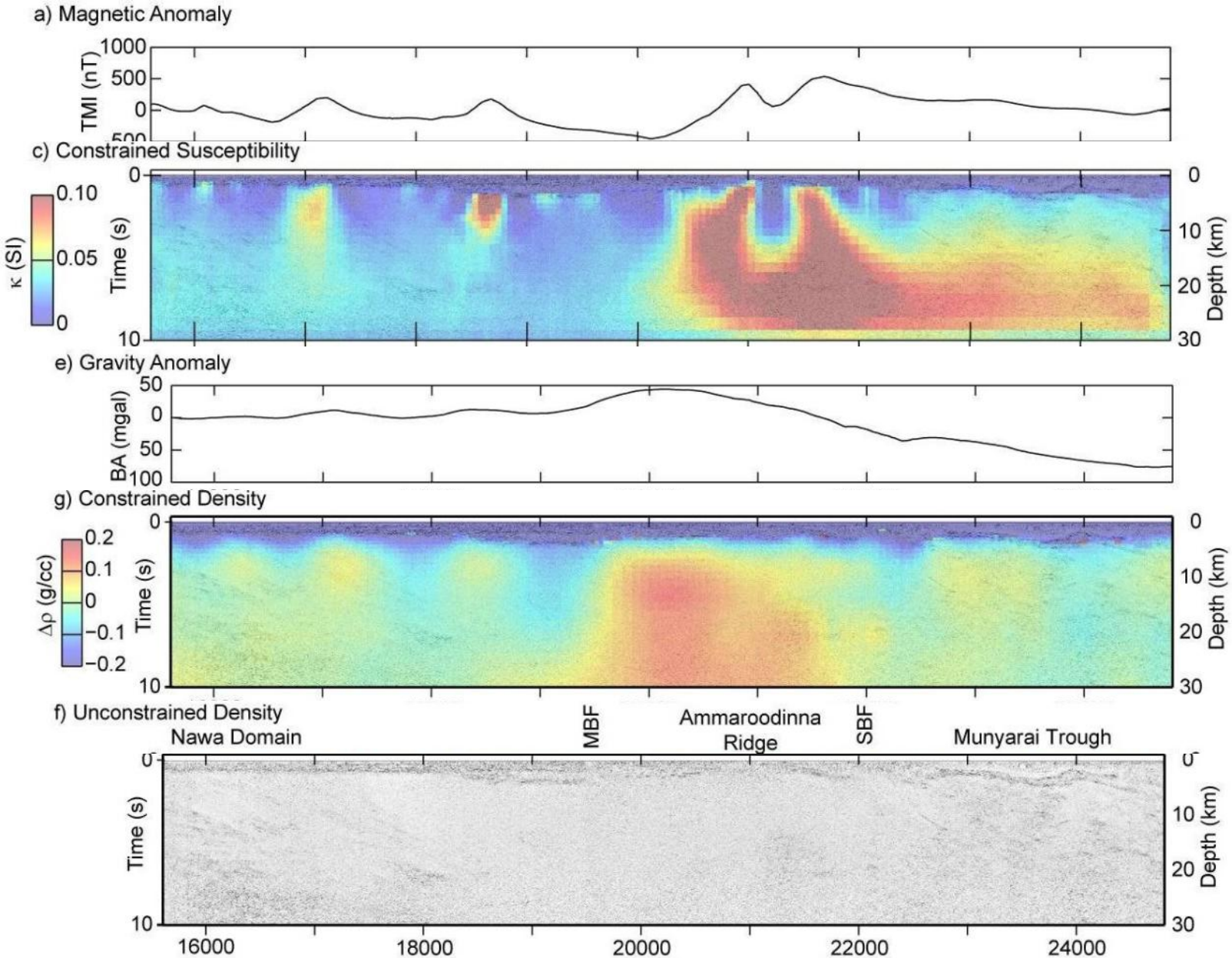
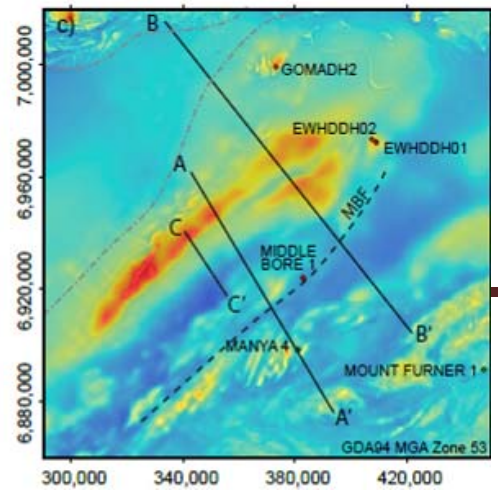
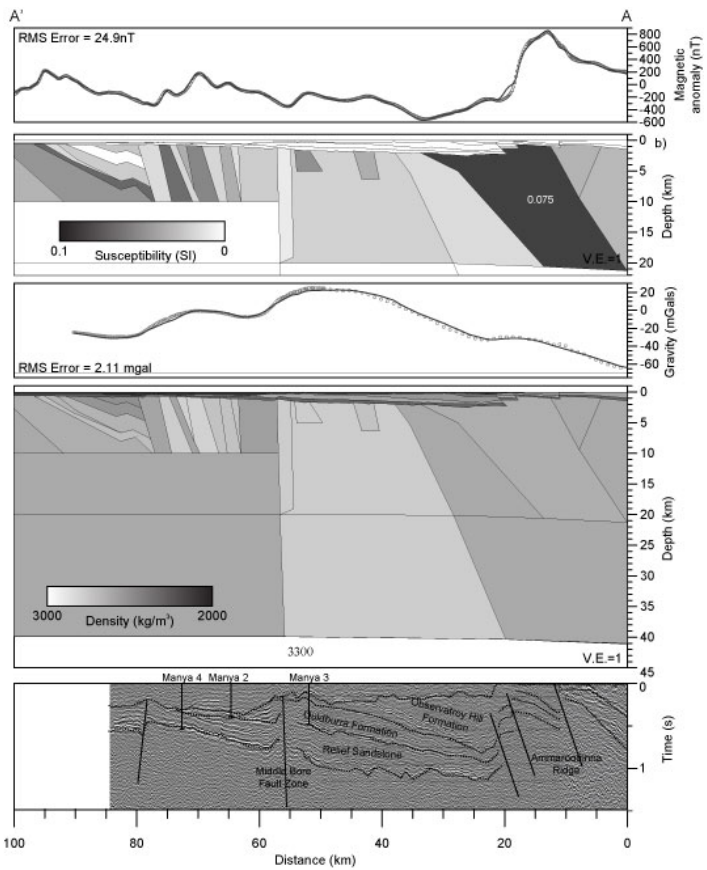
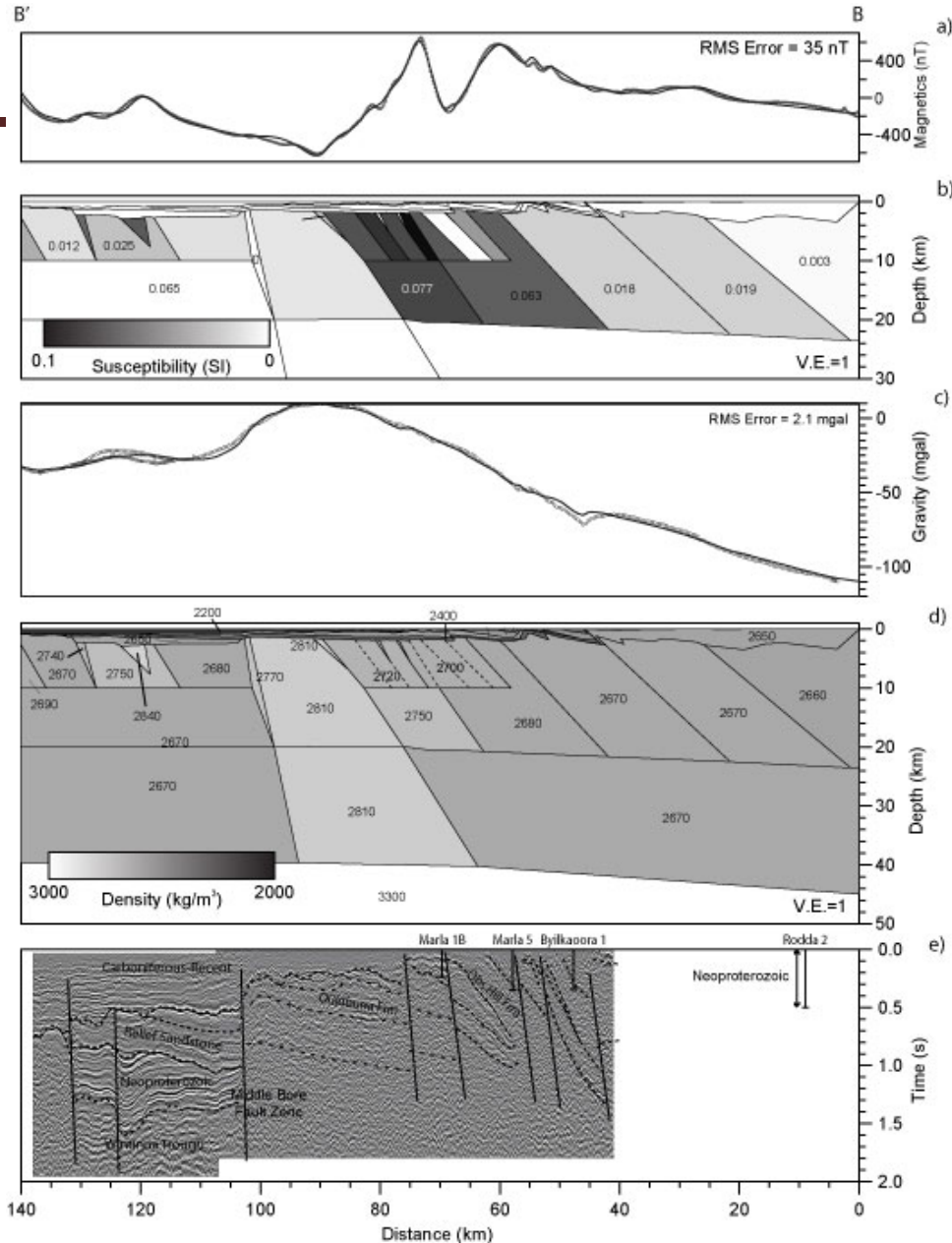


Eastern Officer Forward Models

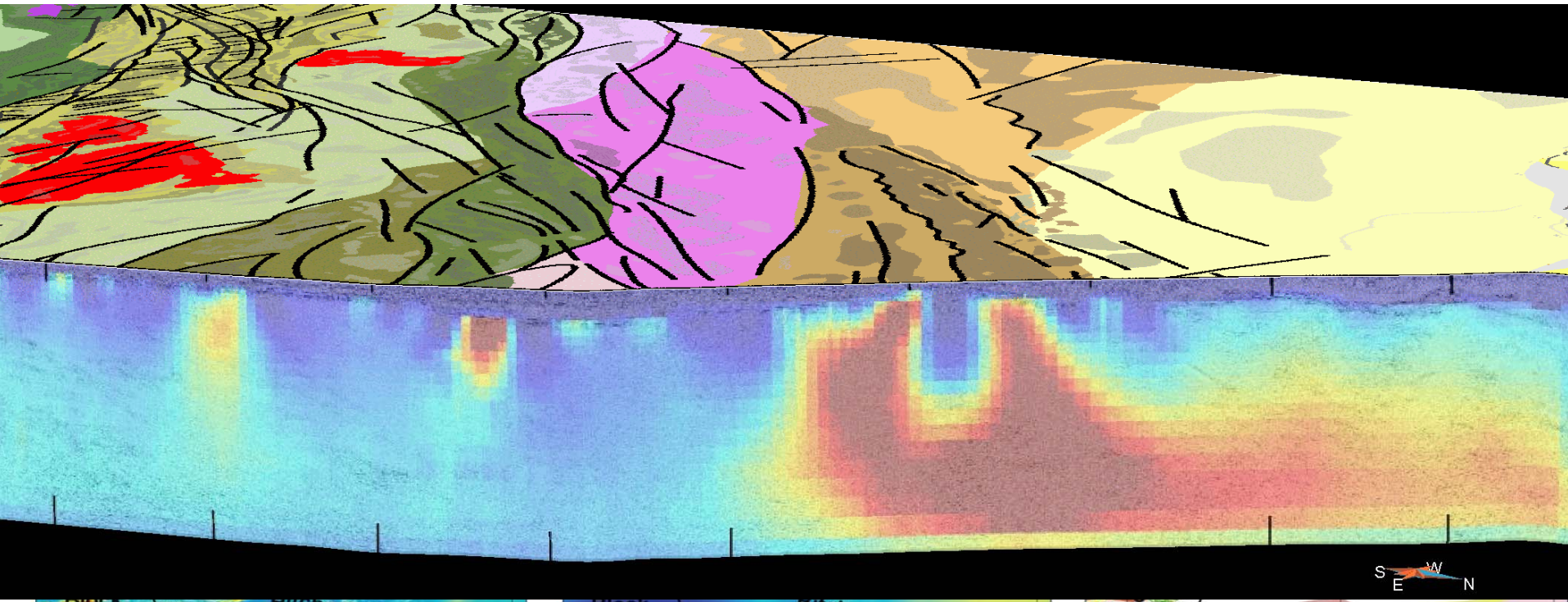


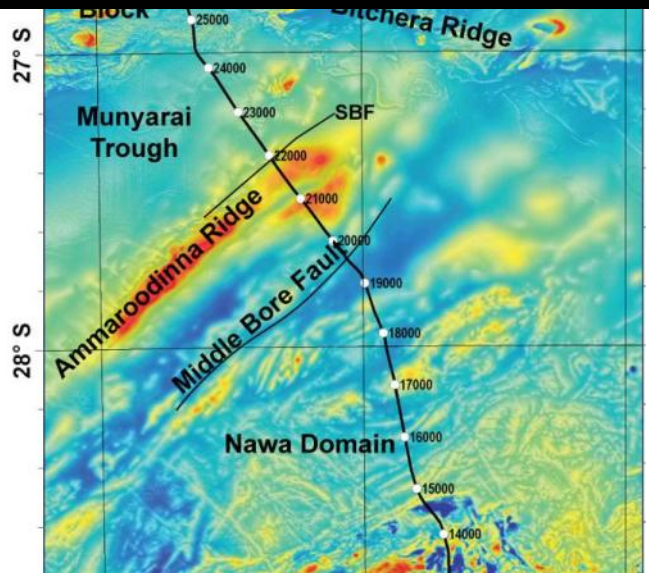


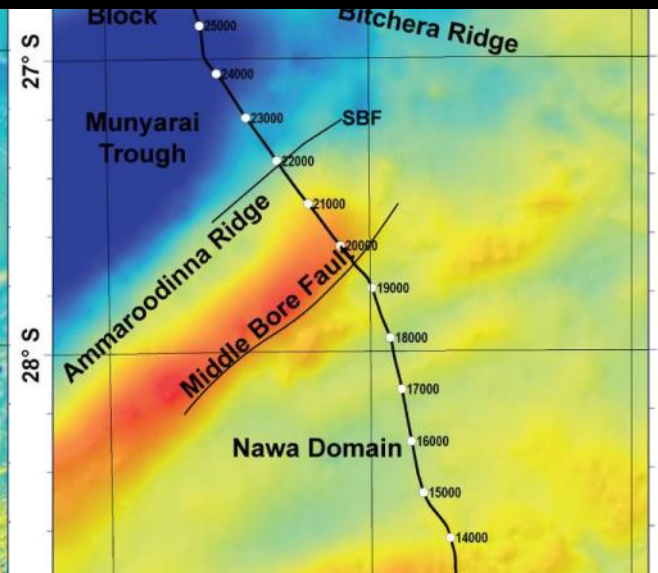


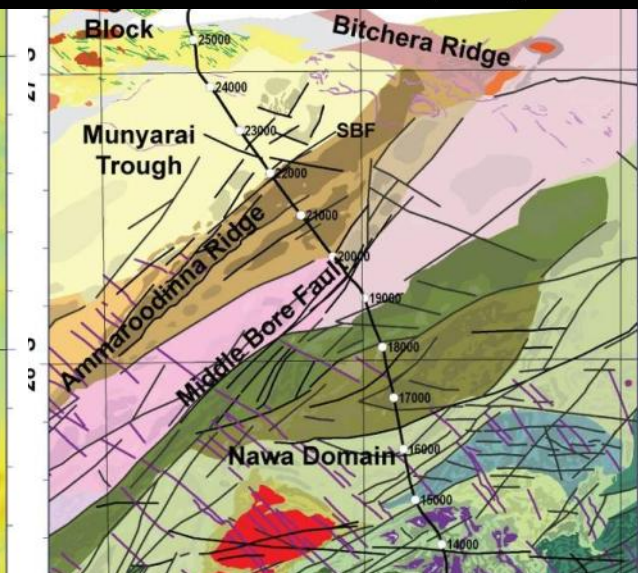
Baines et al. (Submitted PCR)

Nawa to Musgrave Block

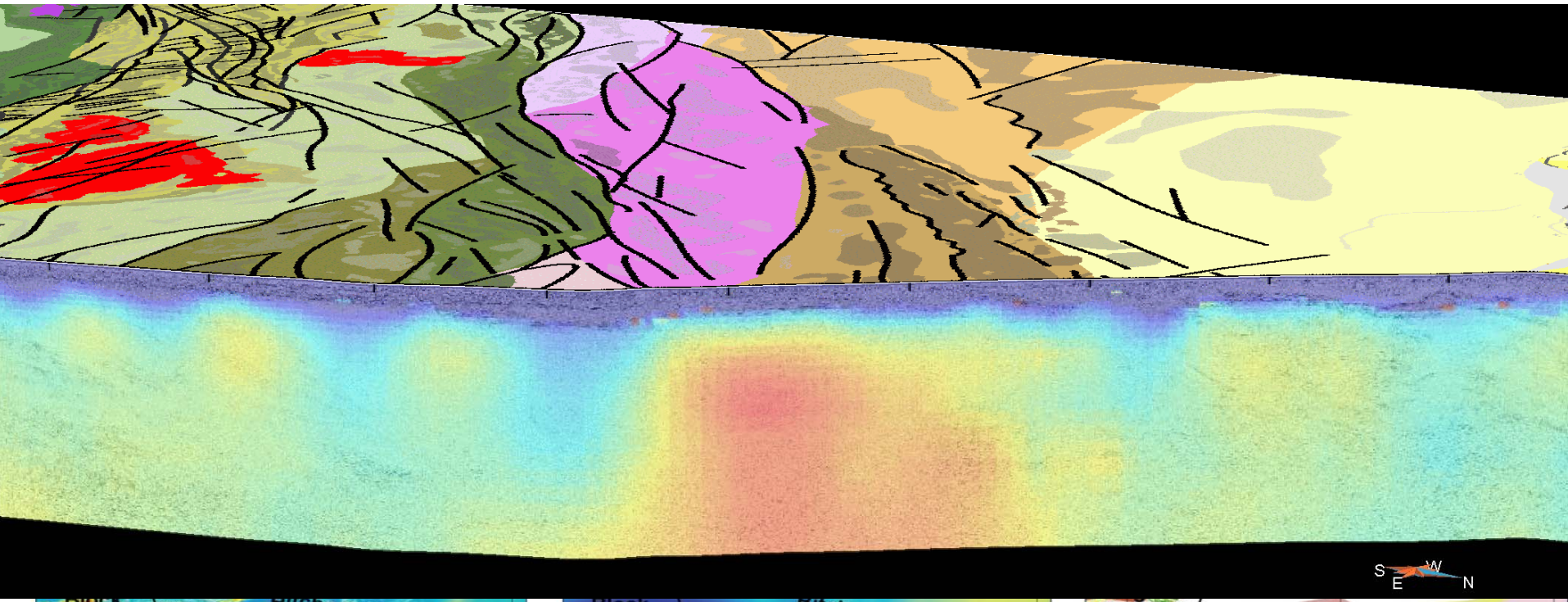


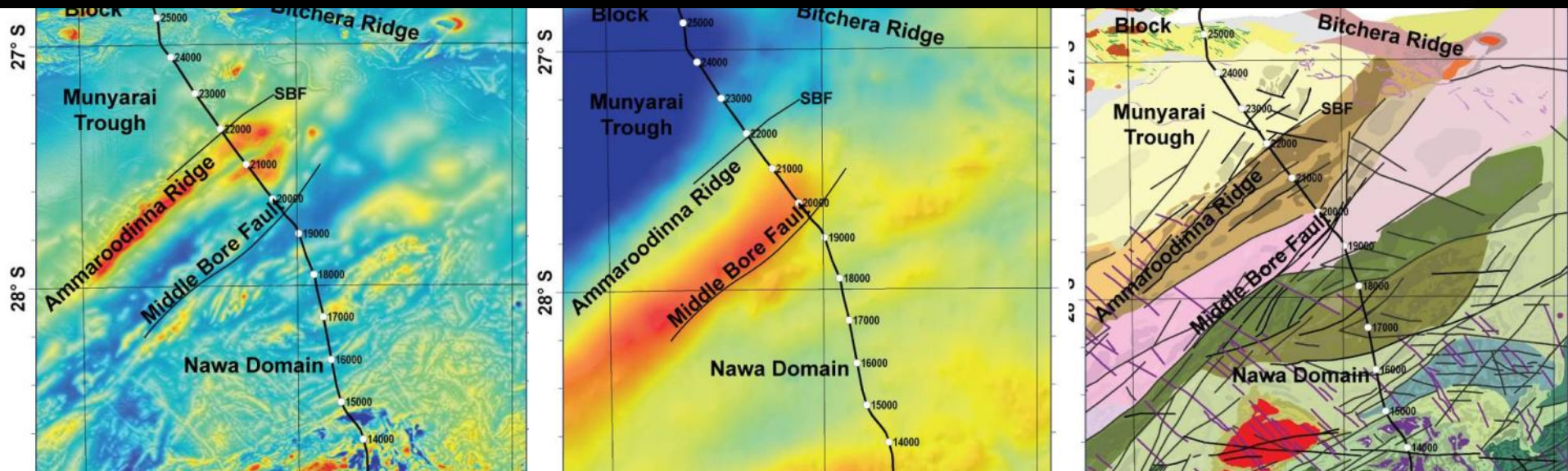






Nawa to Musgrave Block





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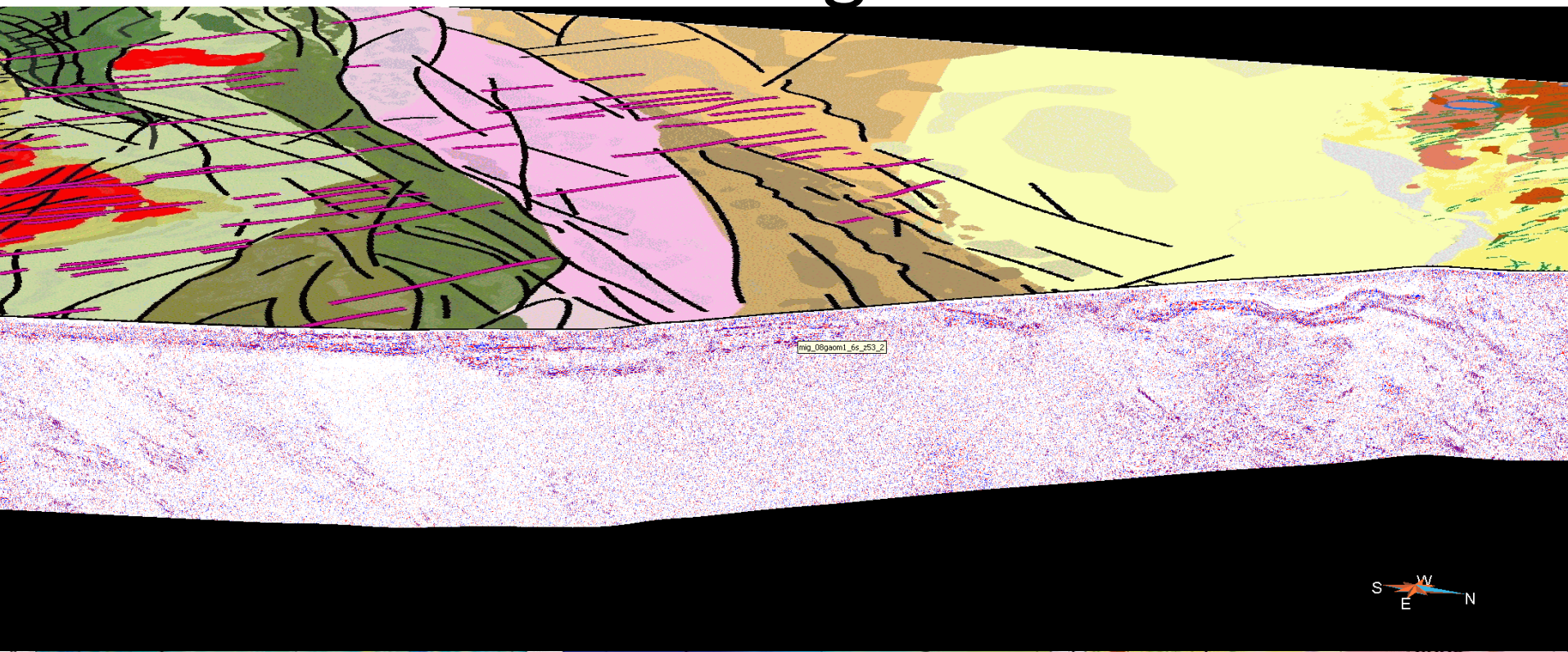

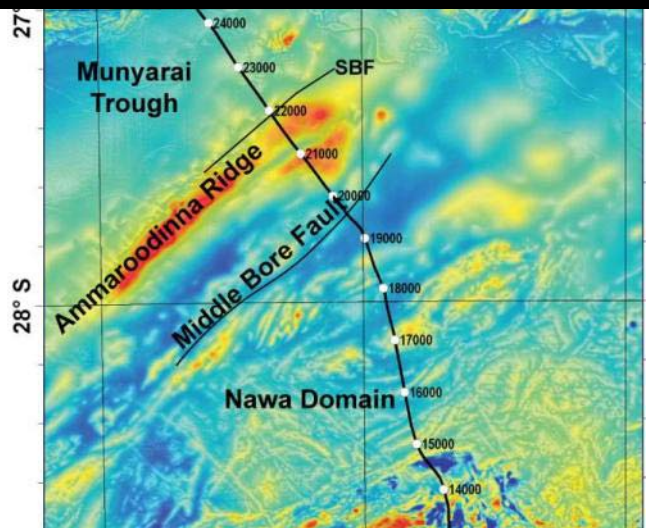

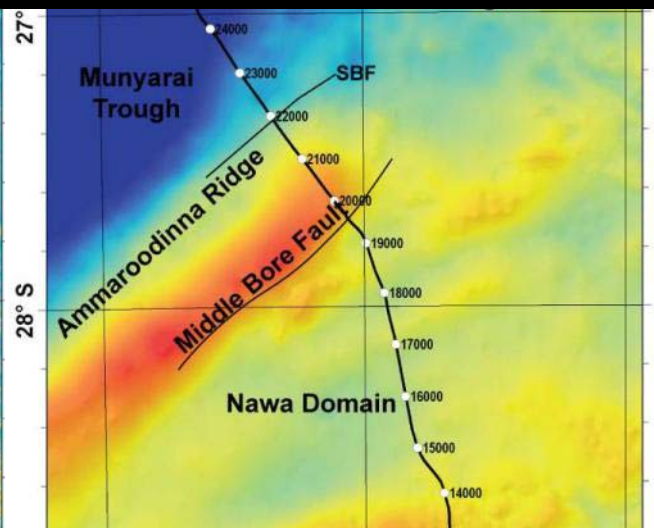

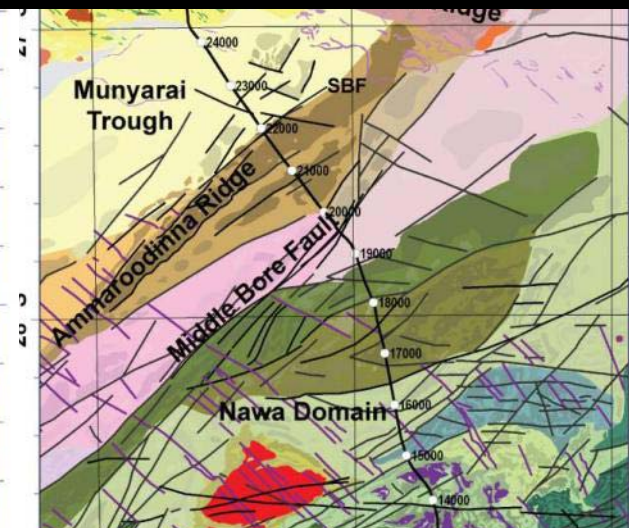

Conclusions

- Potential Field Modelling provides additional constraints on the sub-surface structure
- Reasonable agreement with interpreted seismic structure
- But agreement is not 100%, an integrated interpretation adds valuable information.

Acknowledgements

- Funding from ARC Linkage Project #0882000
- PIRSA
  - Including Martin Fairclough, Stephen Petrie, Wolfgang Preiss, Rian Dutch, Marc Davies, Pru Freeman,....
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