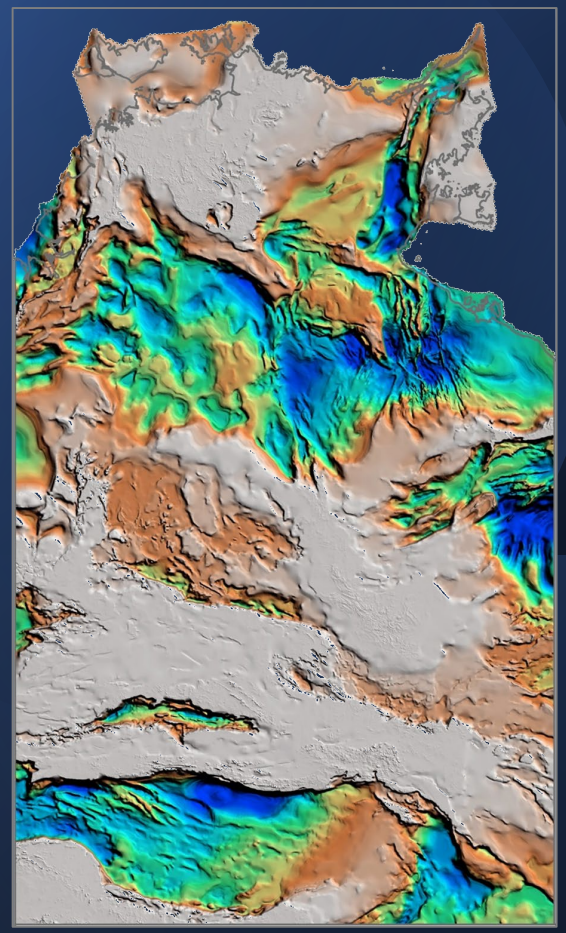
AGES 2021



Northern Territory SEEBASE® Study

Tim Debacker[1], Karen Connors[2], Lynn Pryer[1], Jane Blevin[1], Phil Henley[1] and Zhiqun Shi[1]

[1] Geognostics Australia Pty Ltd
[2] Sustainable Minerals Institute, University of Queensland

NORTHERN TERRITORY GOVERNMENT

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Geognostics
Exploration through Innovation

NT SEEBASE Study

Acknowledgements

Northern Territory Geological Survey with funding support from the NT Government's *Resourcing the Future* initiative

Santos Limited: McArthur Basin and Amadeus Basin SEEBASE studies

Pangaea Resources Pty Ltd: McArthur Basin SEEBASE Study

Empire Energy and Sweetpea Petroleum: Proprietary seismic datasets made available for McArthur Update

Santos
We have the energy.

PANGAEA
RESOURCES PTY Ltd.

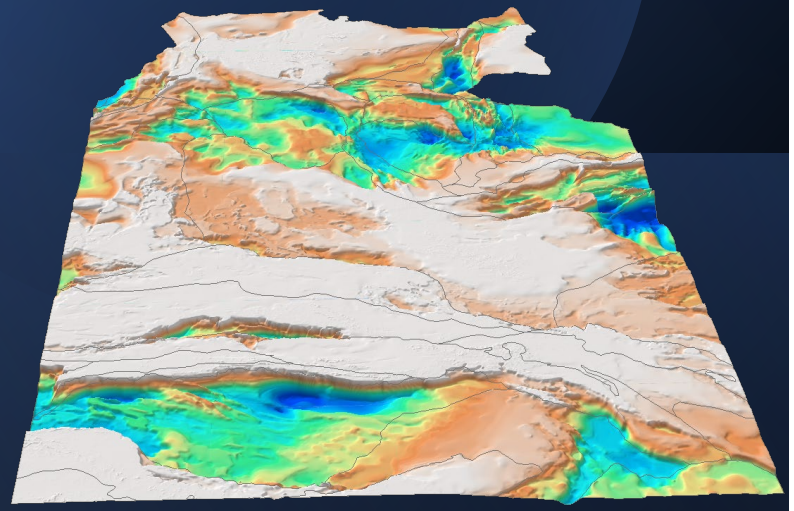
EMPIRE
Energy

SWEETPEA
PETROLEUM

AGES 2021

NT SEEBASE

Territory-wide depth to basement interpretation



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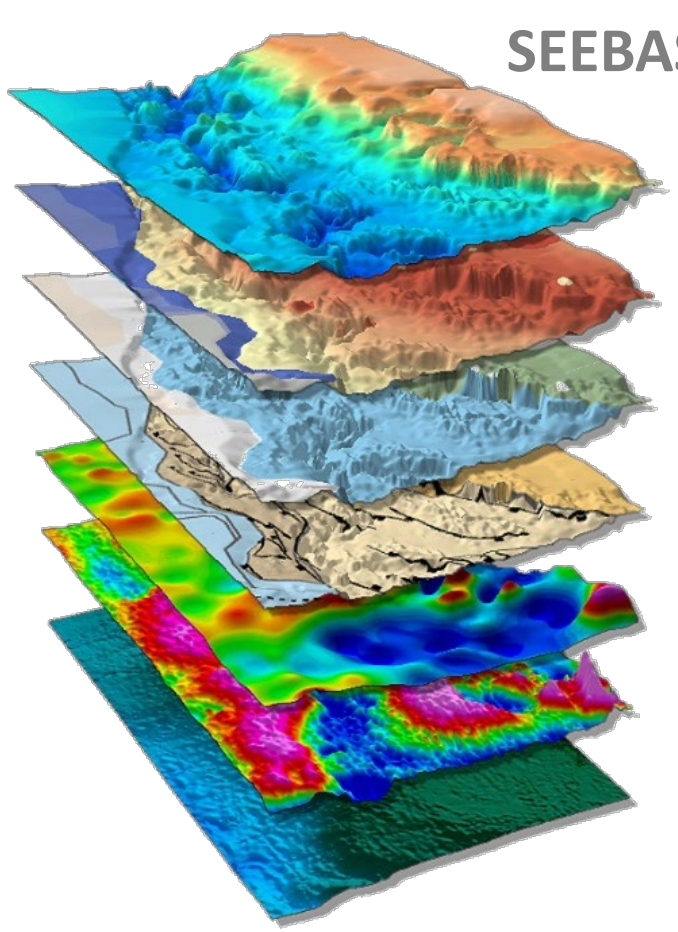
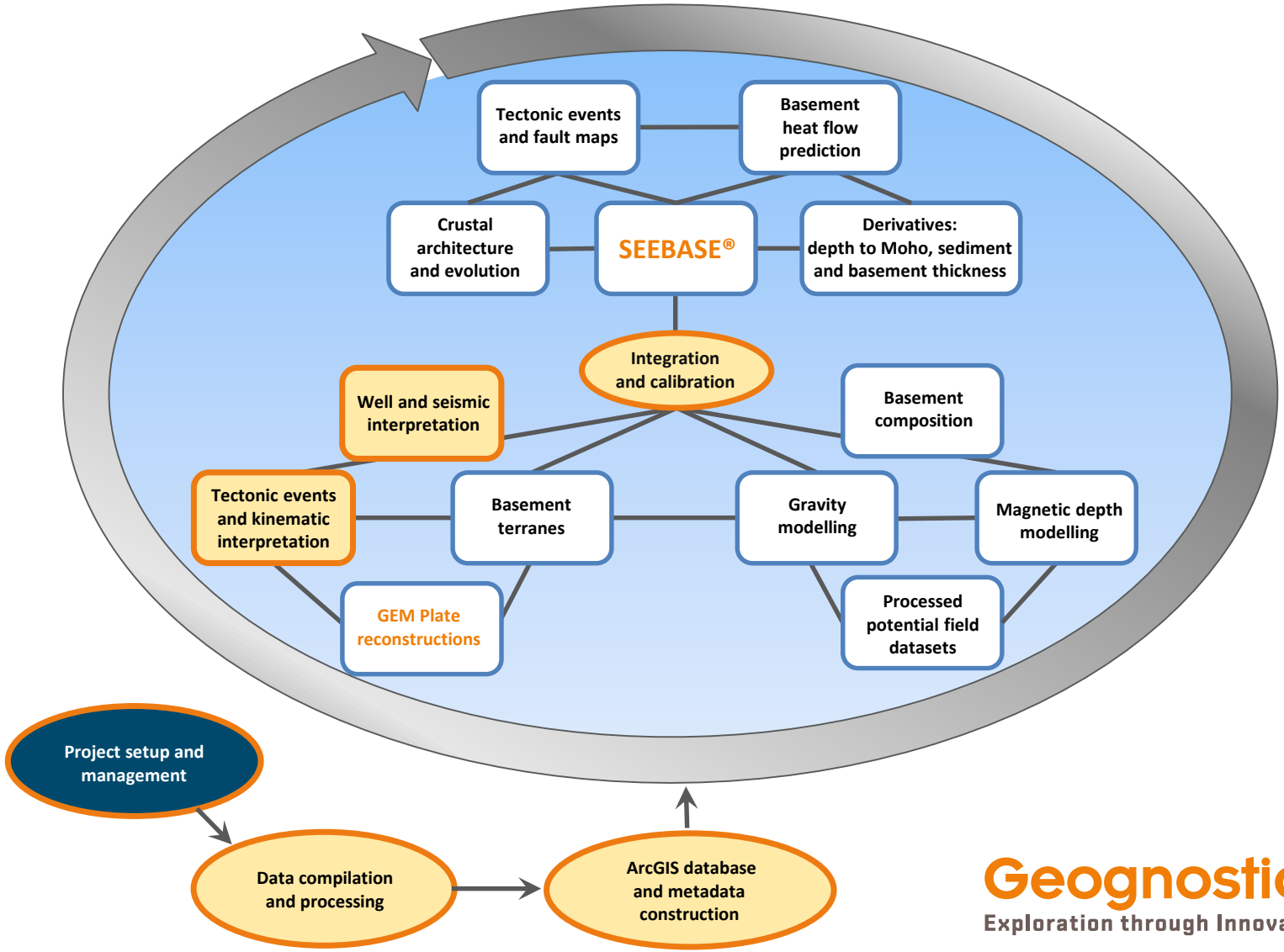
SEEBASE® stands for Structurally Enhanced view of Economic BASEment.

- SEEBASE® integrates all available open-file geophysical and geological data with intelligent surface interpretation.
- SEEBASE® is a hand-contoured grid that emphasises basement structure.
- SEEBASE® develops an integrated understanding of basement and basin evolution.
- SEEBASE® defines basin shape and size, as well as source kitchens, migration pathways and charge focus areas.

Geognostics
Exploration through Innovation

SEEBASE® - An Iterative Interpretation Workflow





Geognostics
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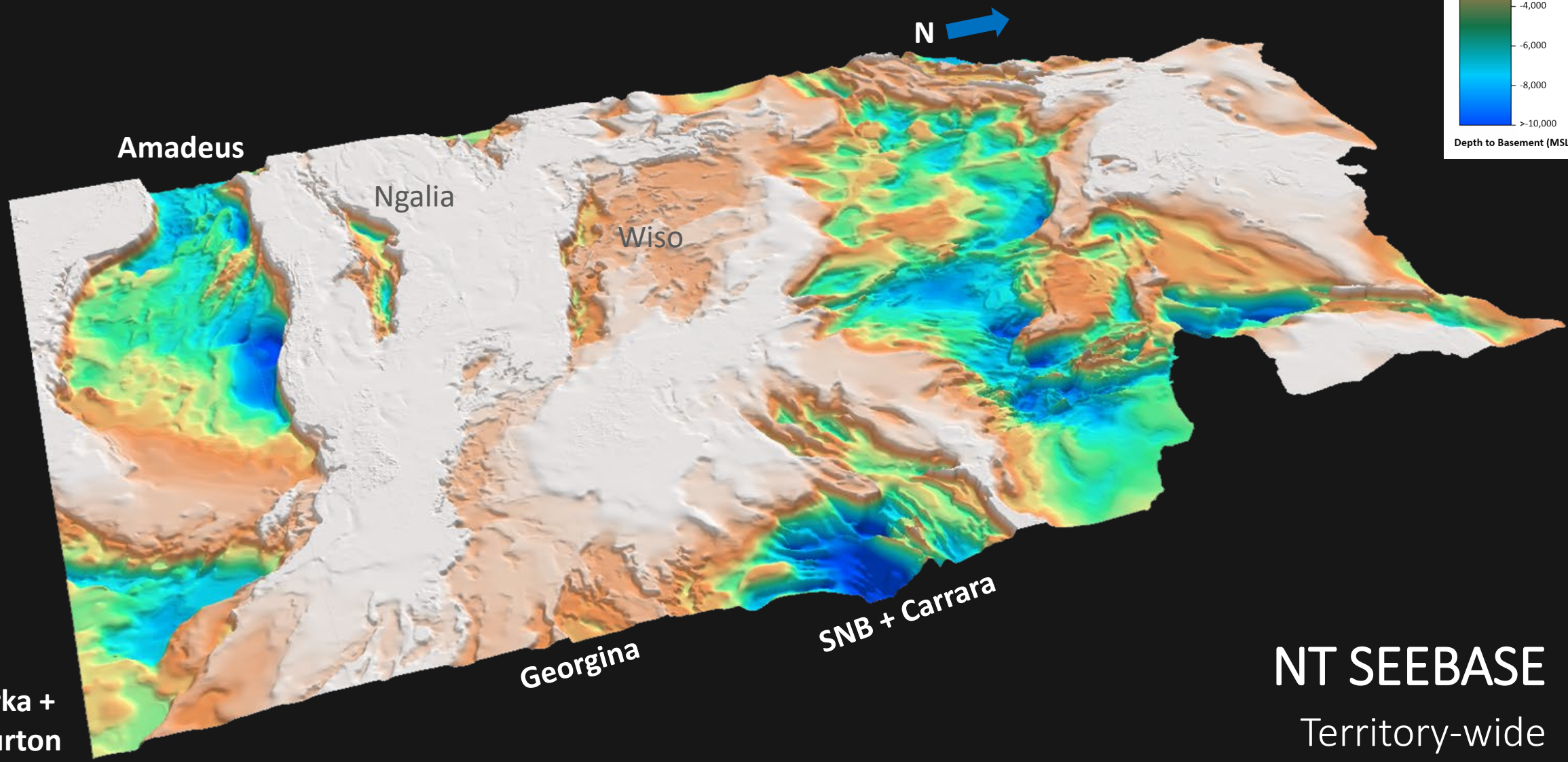
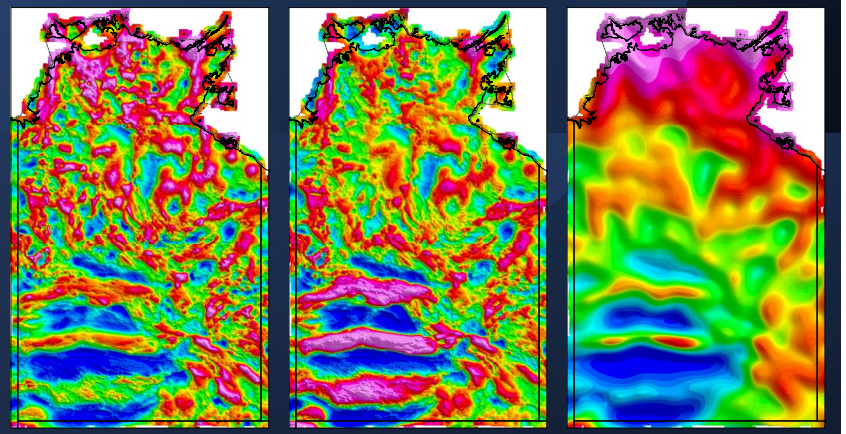


NT SEEBASE

Territory-wide
depth to basement interpretation

Input Datasets



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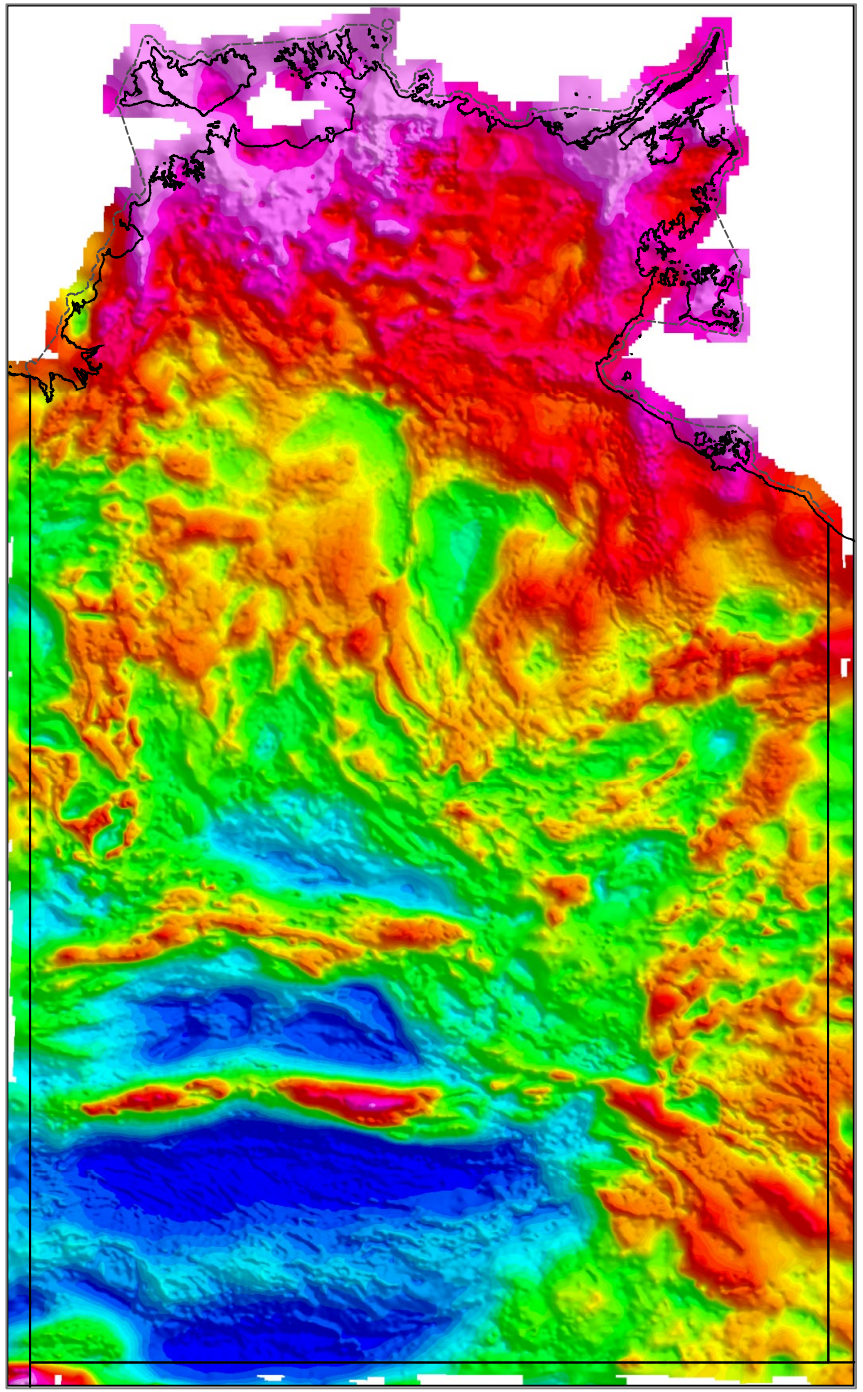
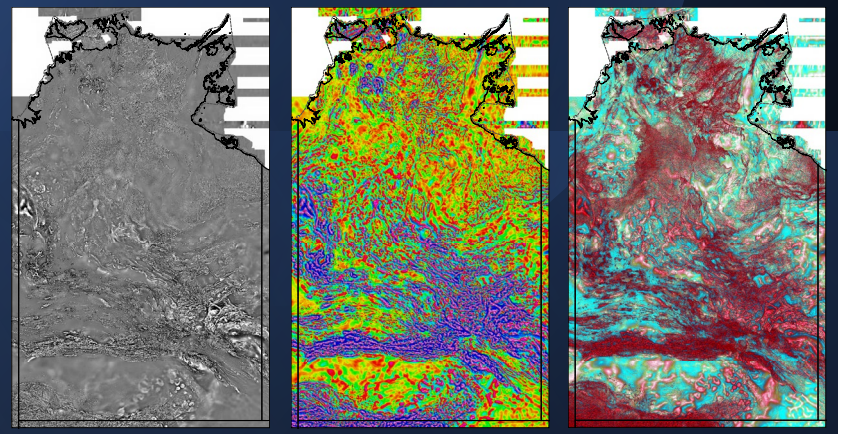


Bouguer Gravity

Full suite of Geognostics gravity enhancements, including:

- Automatic Gain Control filters
- High and low pass filters

Input Datasets



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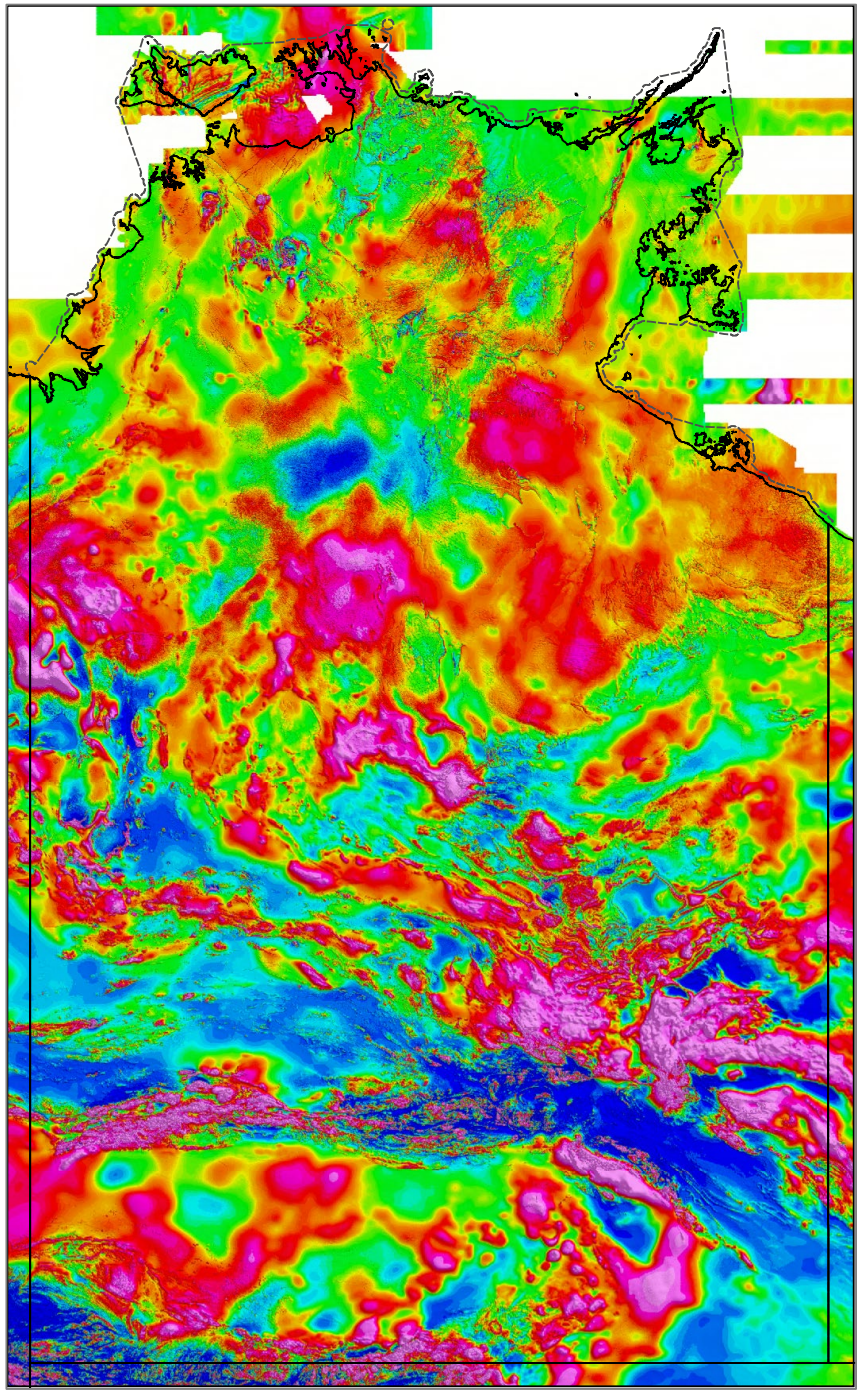
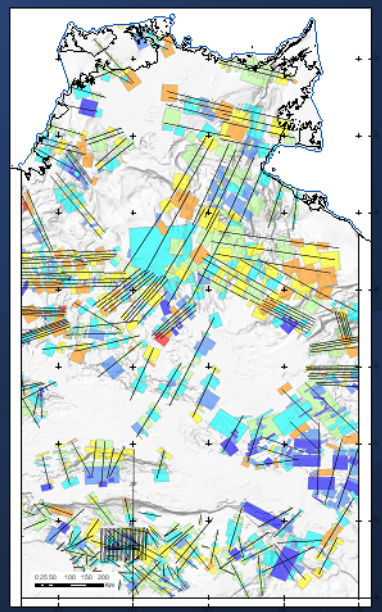


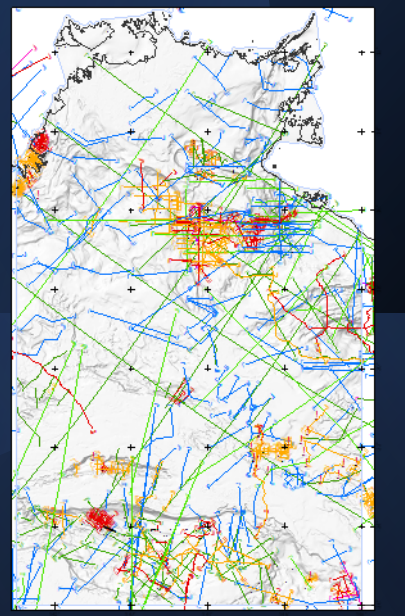
Magnetics

Full suite of Geognostics filters and enhancements, including:

- 1st vertical derivative
- Compound anomaly
- Band-pass filters
- Proprietary ternary enhancements

Constraining Datasets





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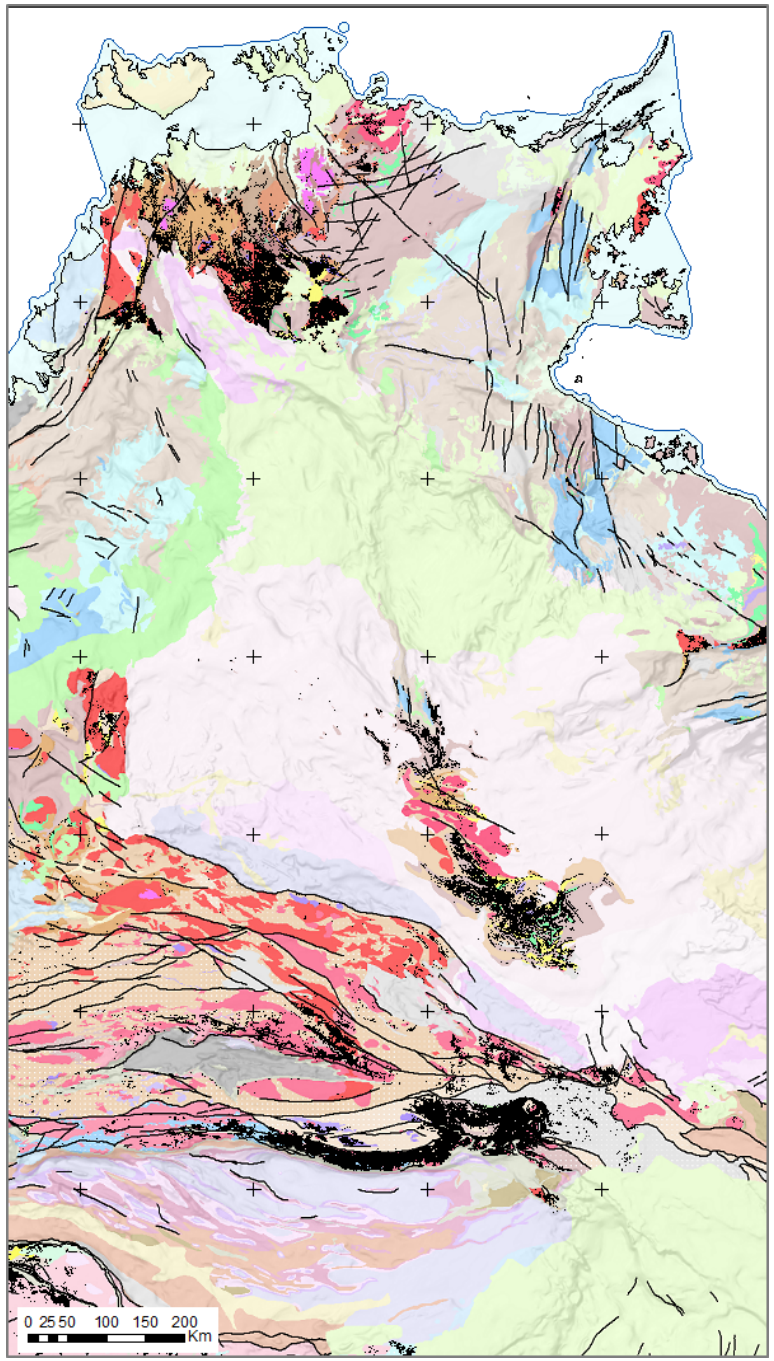


Geological Datasets and Models

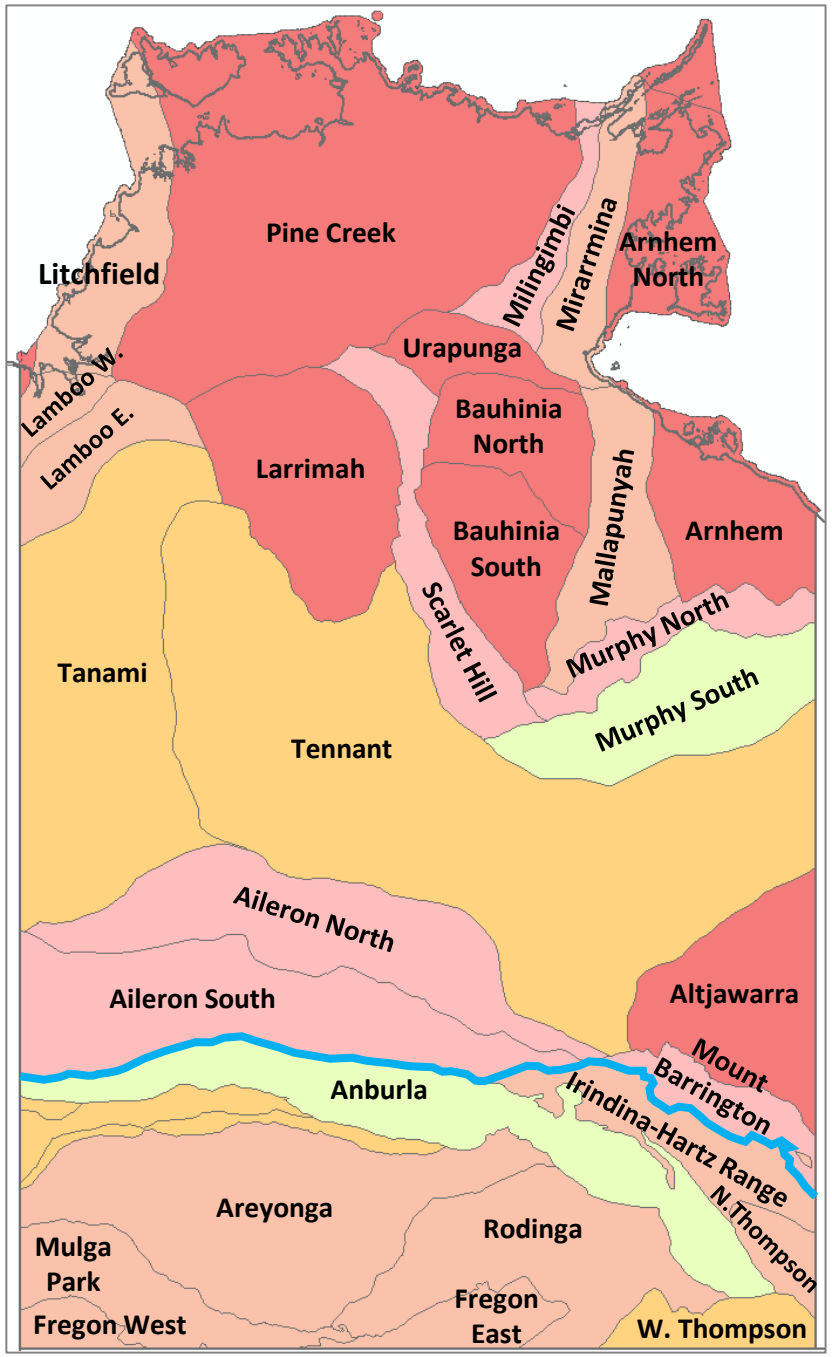
- Surface geology
- Solid Earth model
- Subsurface cross-sections
- Seismic data
- Wells
- Magnetic modelling

Basement Terranes

35 basement terranes identified
New terranes compared to the NTGS Geological Regions

- 23 terranes form part of the NAE
- 10 terranes for part of the CAE
- Two terranes in the SE corner form the NW margin of the Thompson Orogen (Tasmanides)

AGES 2021



Type
Craton
Highly Attenuated
Unspecified Continental
Unspecified Orogenic Belt
Accretion Complex
Cratonised Arc

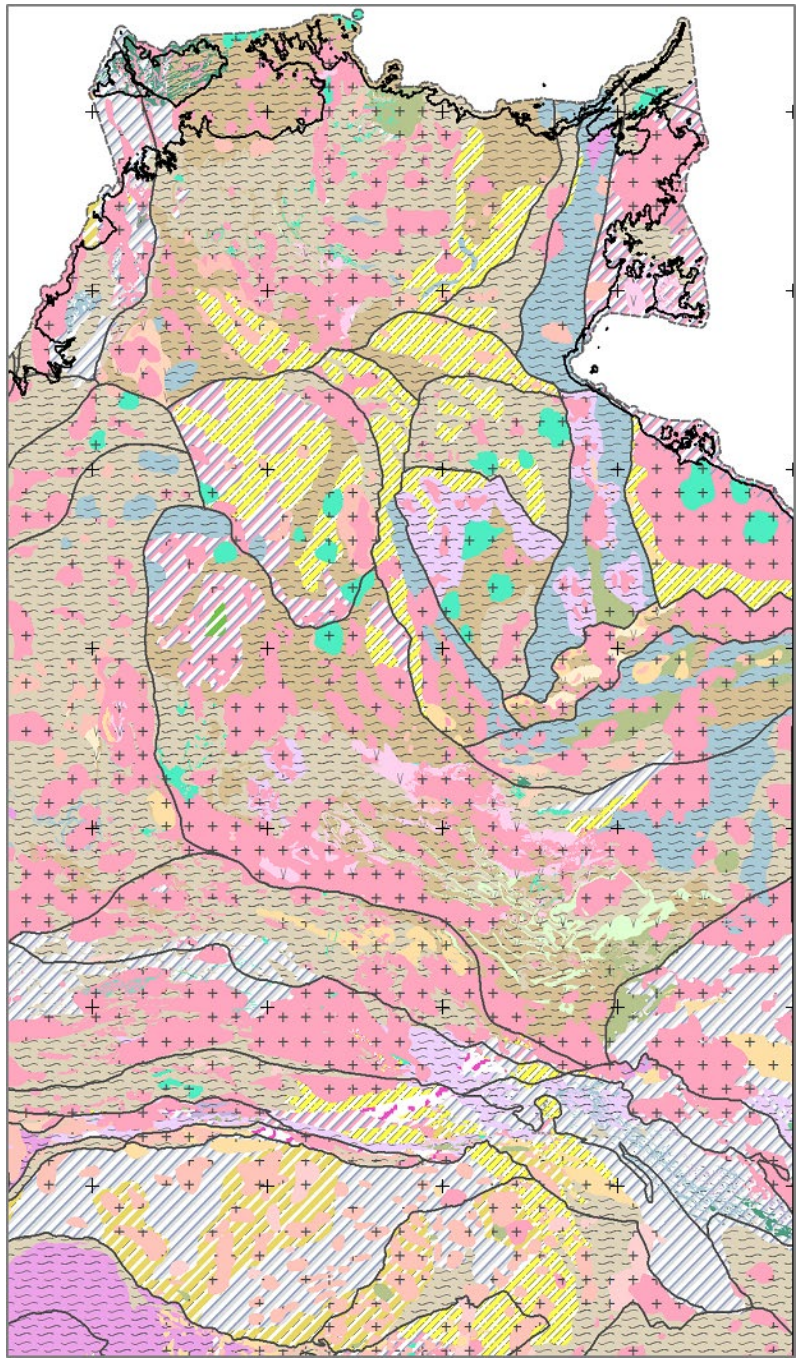
Basement Composition

Basement composition

Description

Terrane

Age



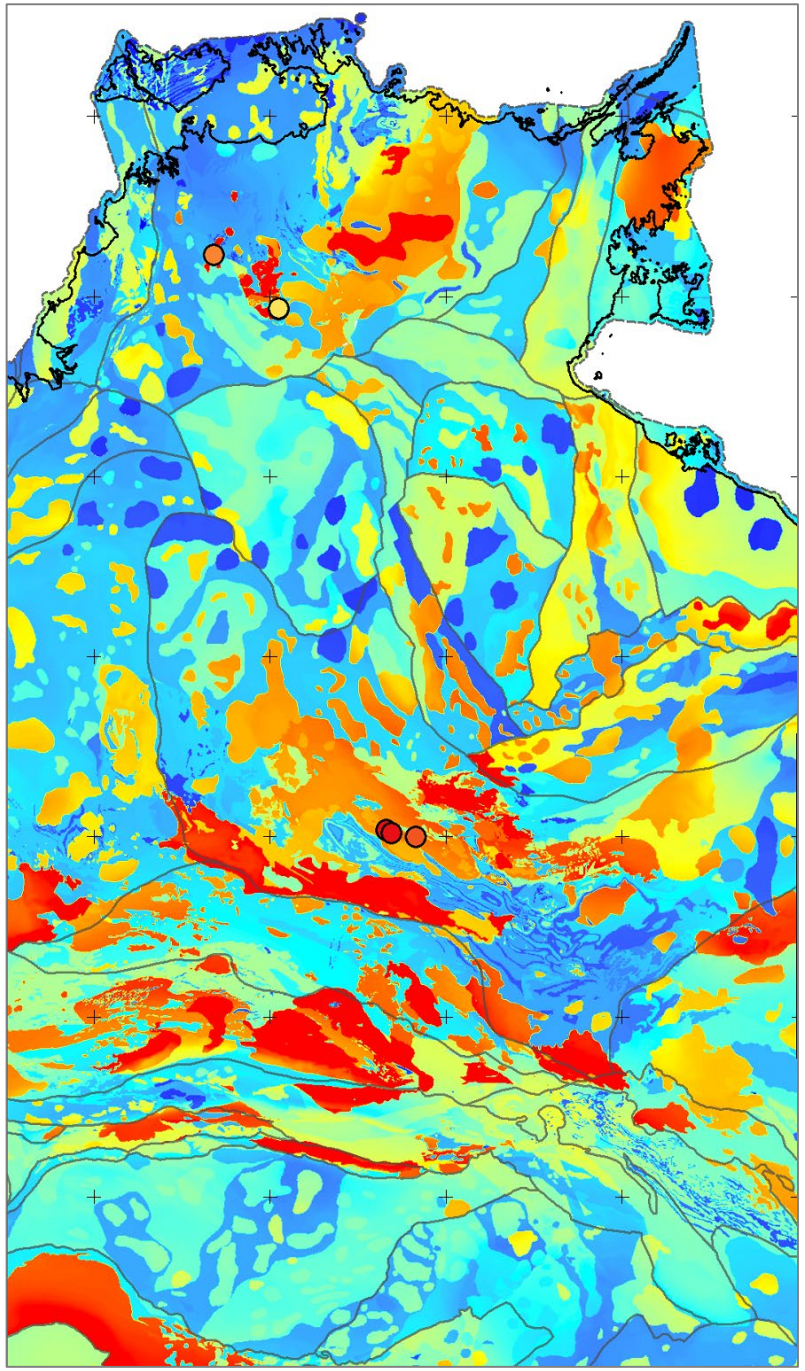
AGES 2021

Basement Heat Flow

Radiogenic Heat Flow

Mantle Heat Flow

Basement Heat Flow



AGES 2021

Tectonic Events

23 tectonic events defined from c.a. 1870 to 270 Ma

Fault maps showing regional kinematics and fault response

Faults attributed by age

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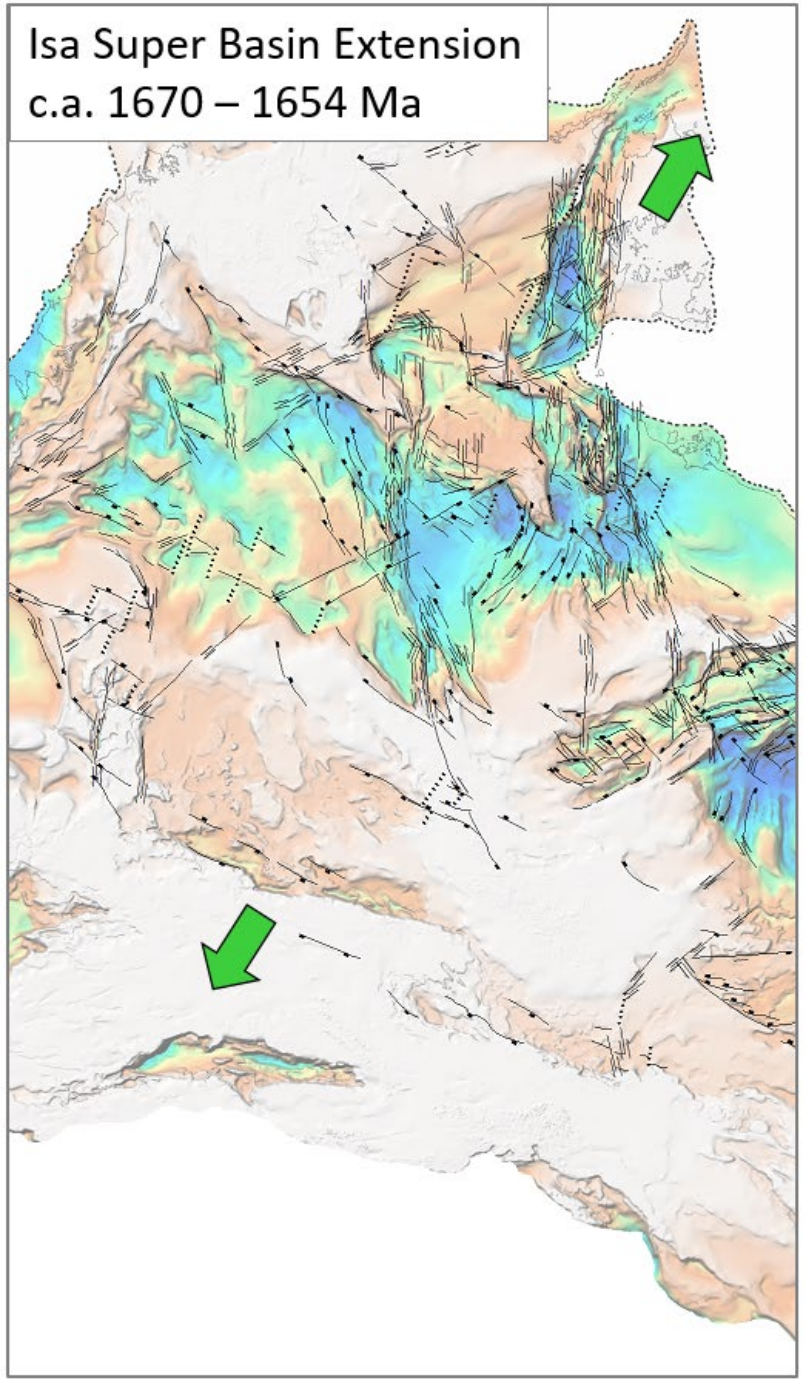
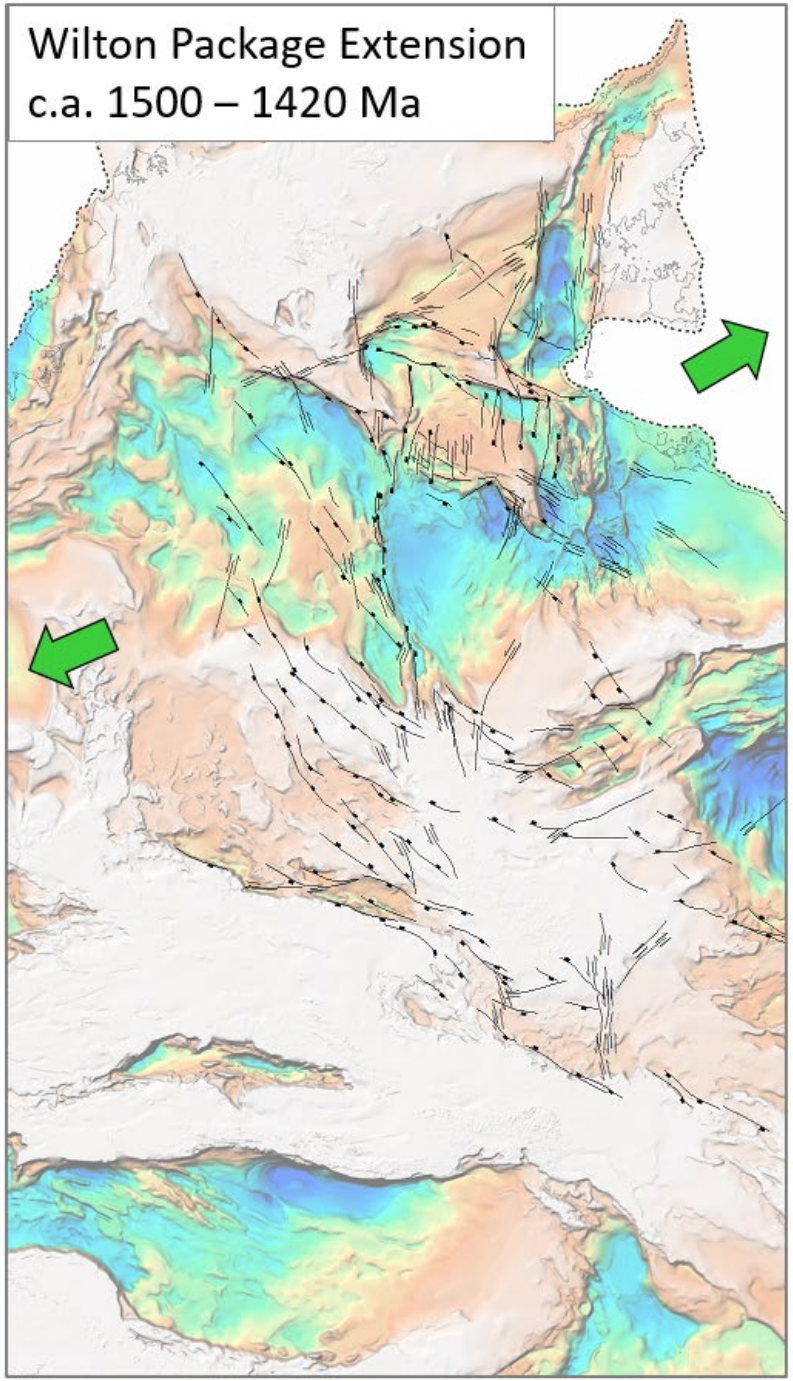
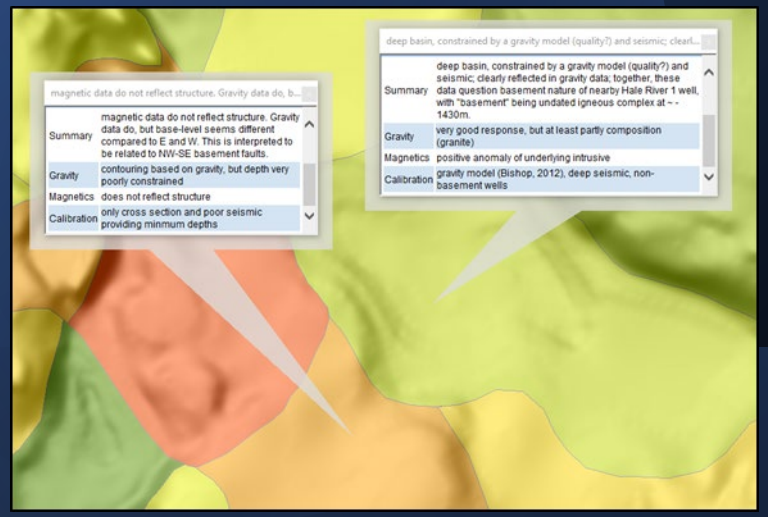
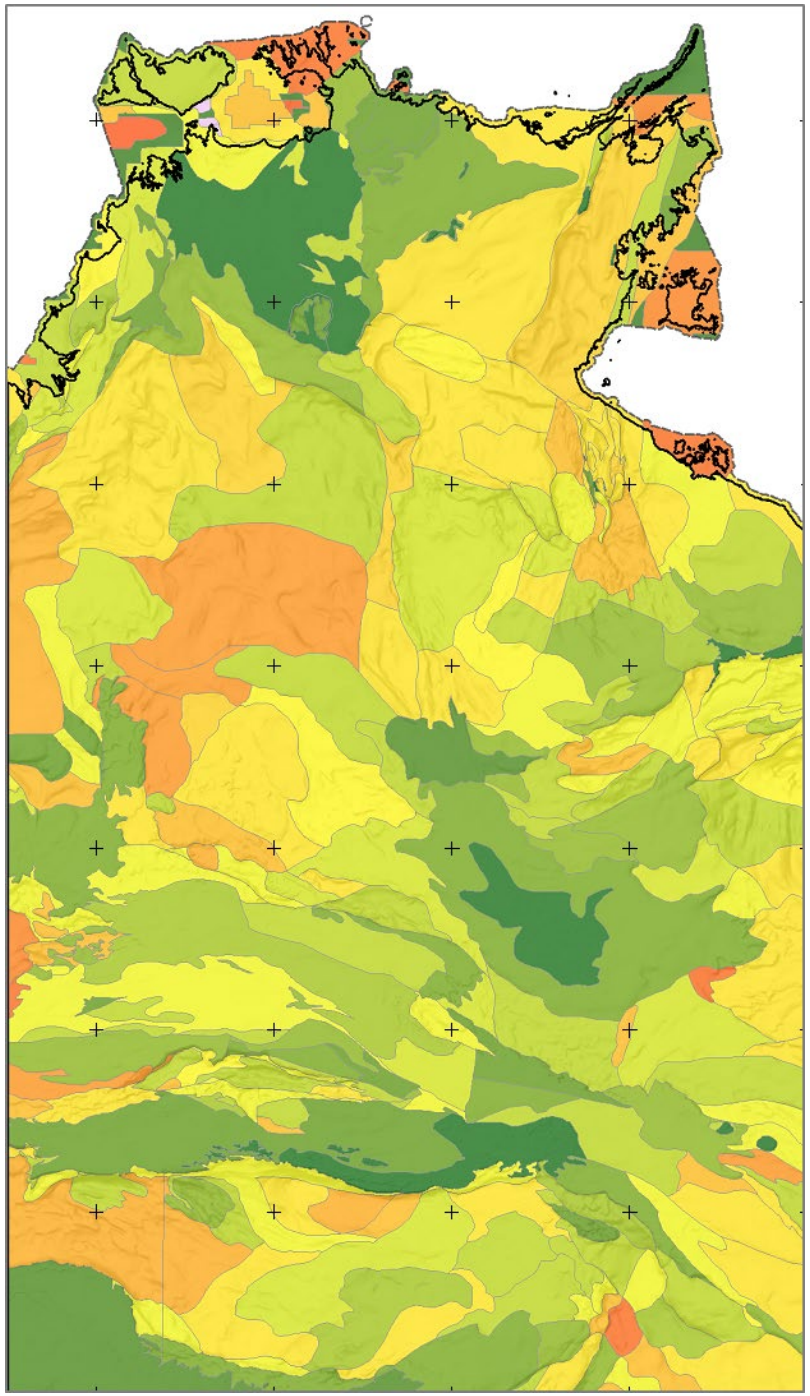




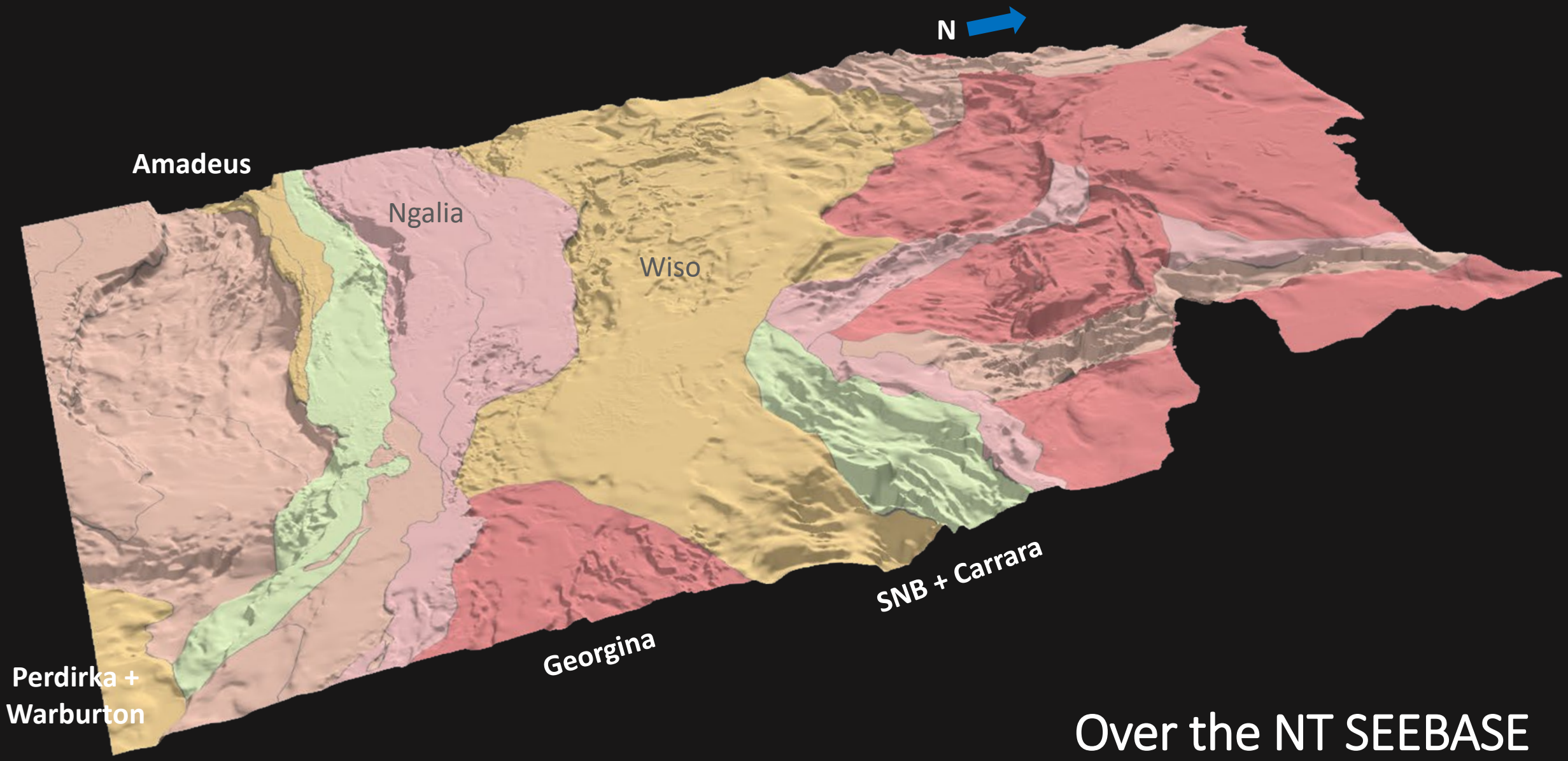
Confidence Map



AGES 2021



BASEMENT TERRANES



Over the NT SEEBASE

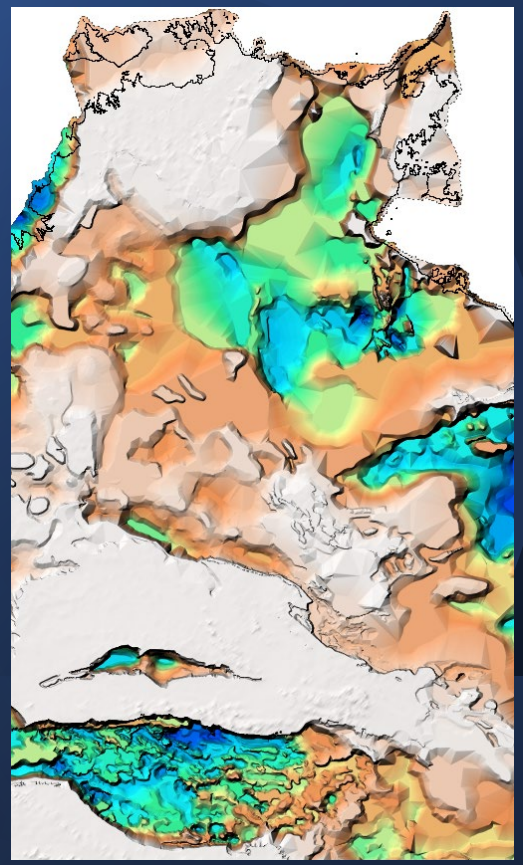
NT SEEBASE

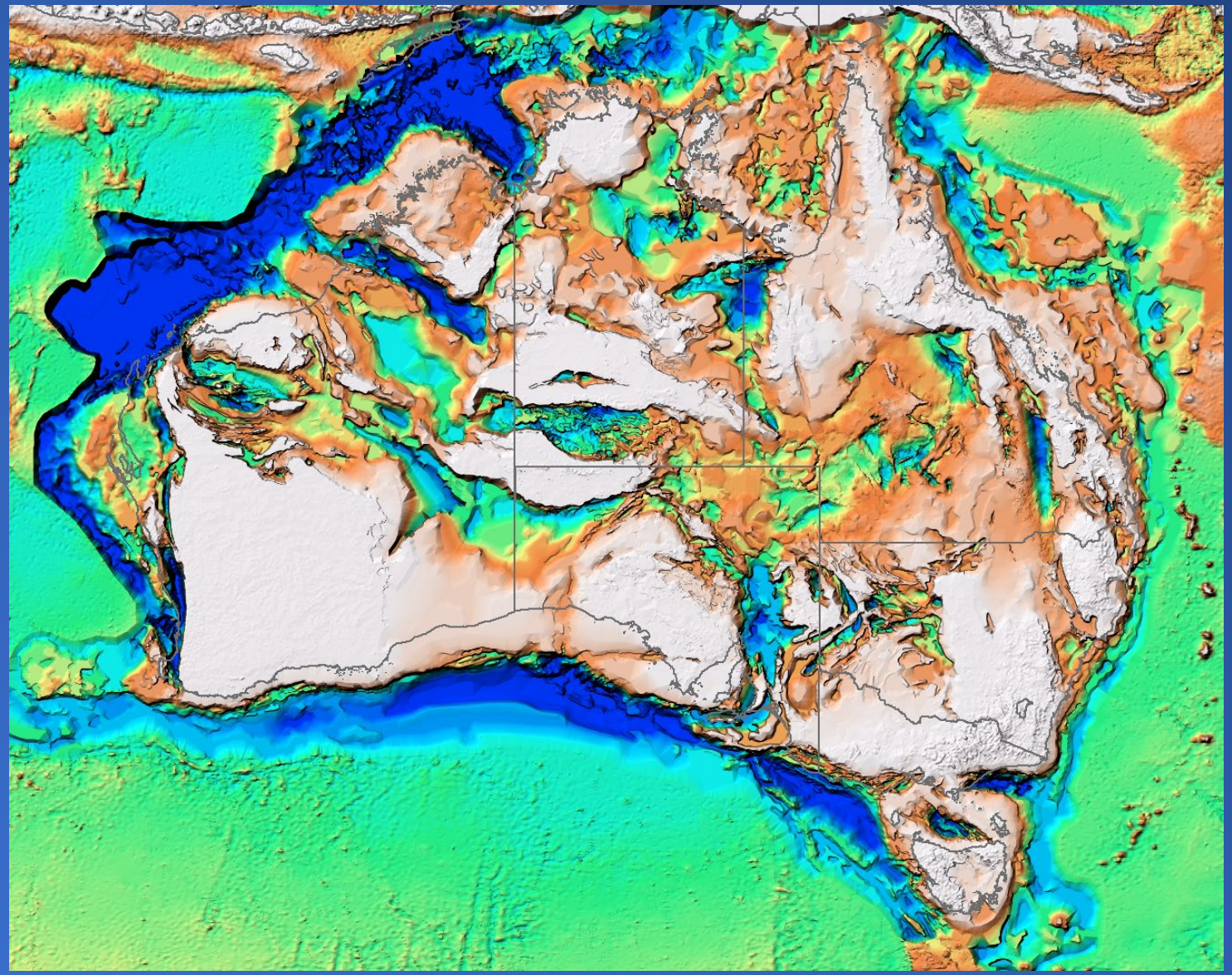
AGES 2021

Evolution of the NT SEEBASE Update

- OZ SEEBASE (2005) and OZ Proterozoic SEEBASE (2006) released as open-file studies
- 10 NT SEEBASE studies for clients 2010-18
- 2018 NTGS-funded greater McArthur Study
- 2020/21 NTGS-funded whole of NT SEEBASE
- 2021 Geognostics OZ SEEBASE released

OZ Proterozoic SEEBASE (2006)



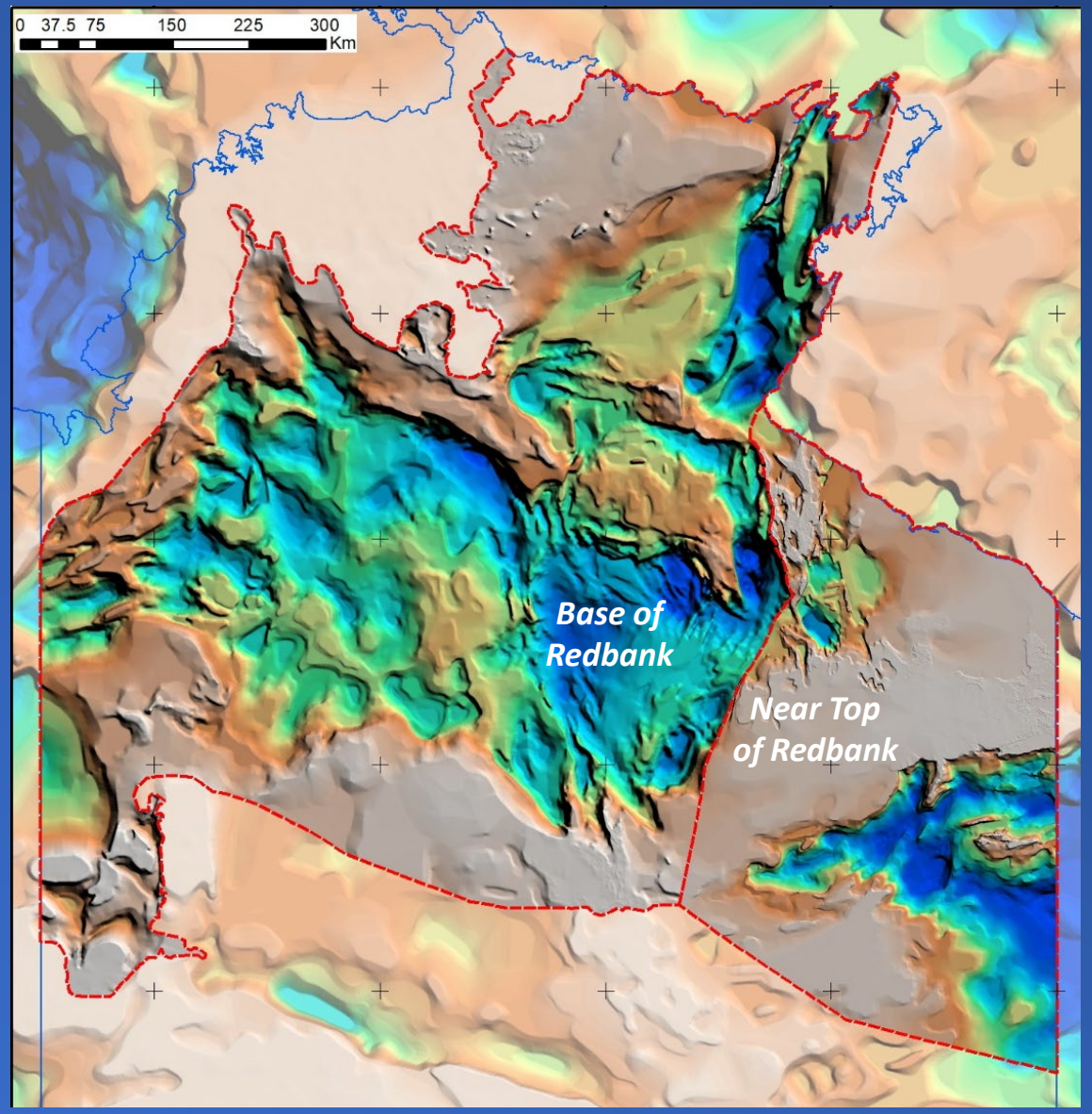


AGES 2021

greater McArthur SEEBASE (2018)

Two different basement surfaces in 2018 GMA Study

- **Base of Redbank**
- **Near Top of Redbank**



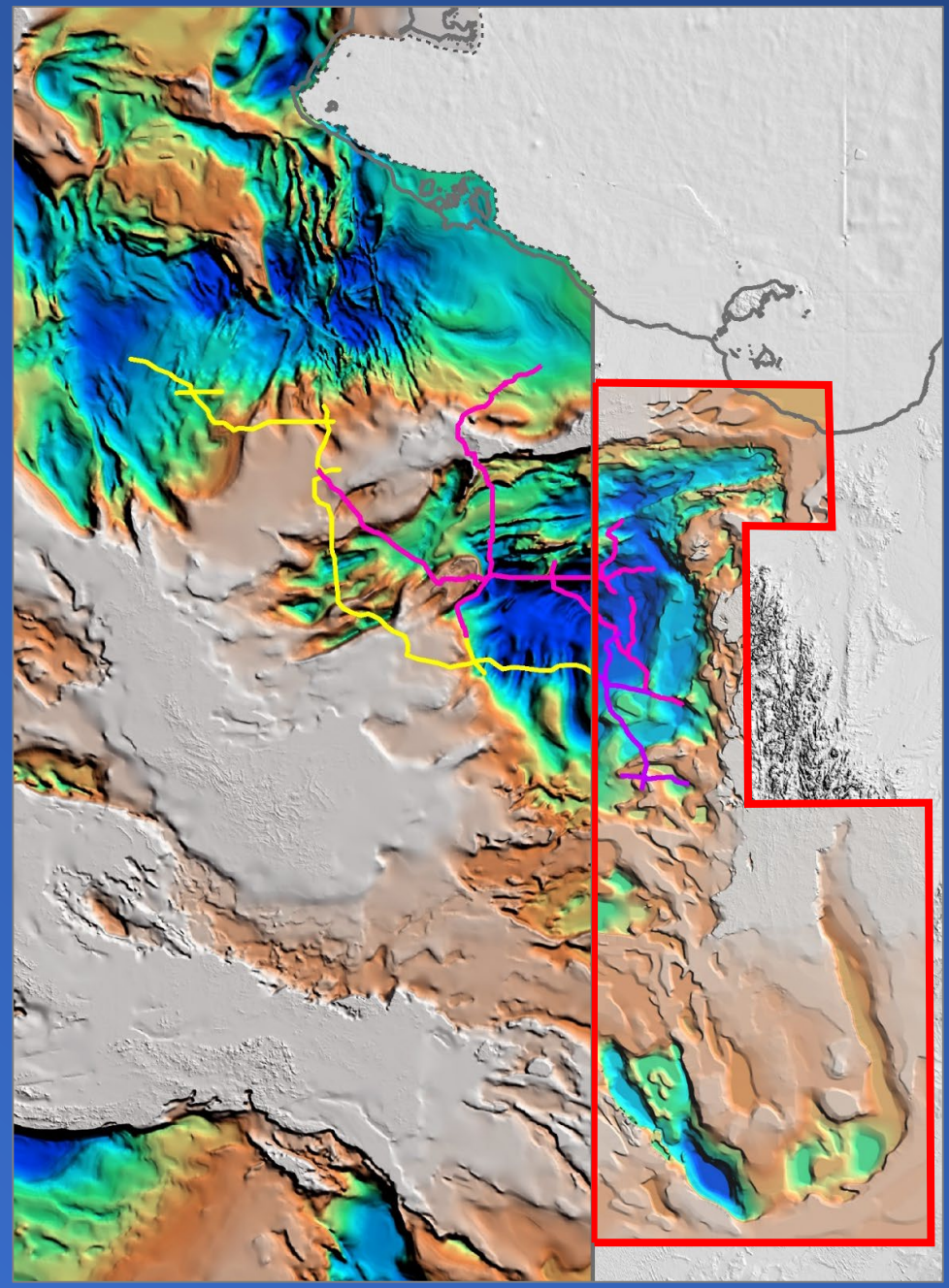
AGES 2021

New Datasets and Studies

Deep seismic surveys

New gravity data

NW Queensland SEEBASE



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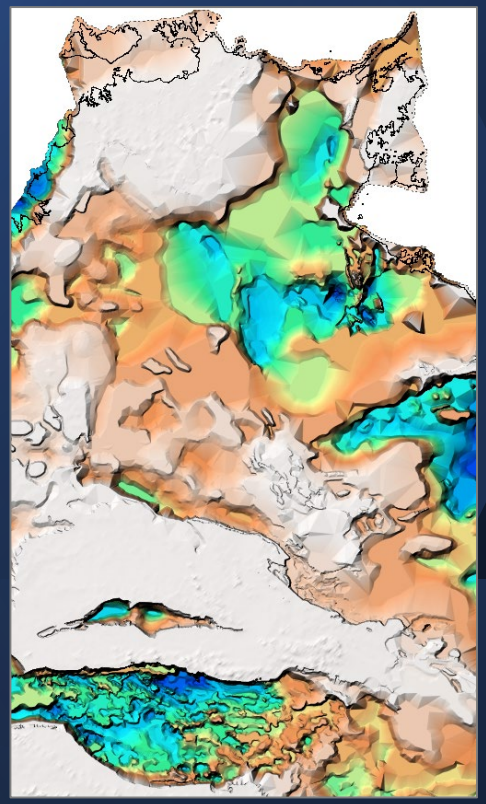
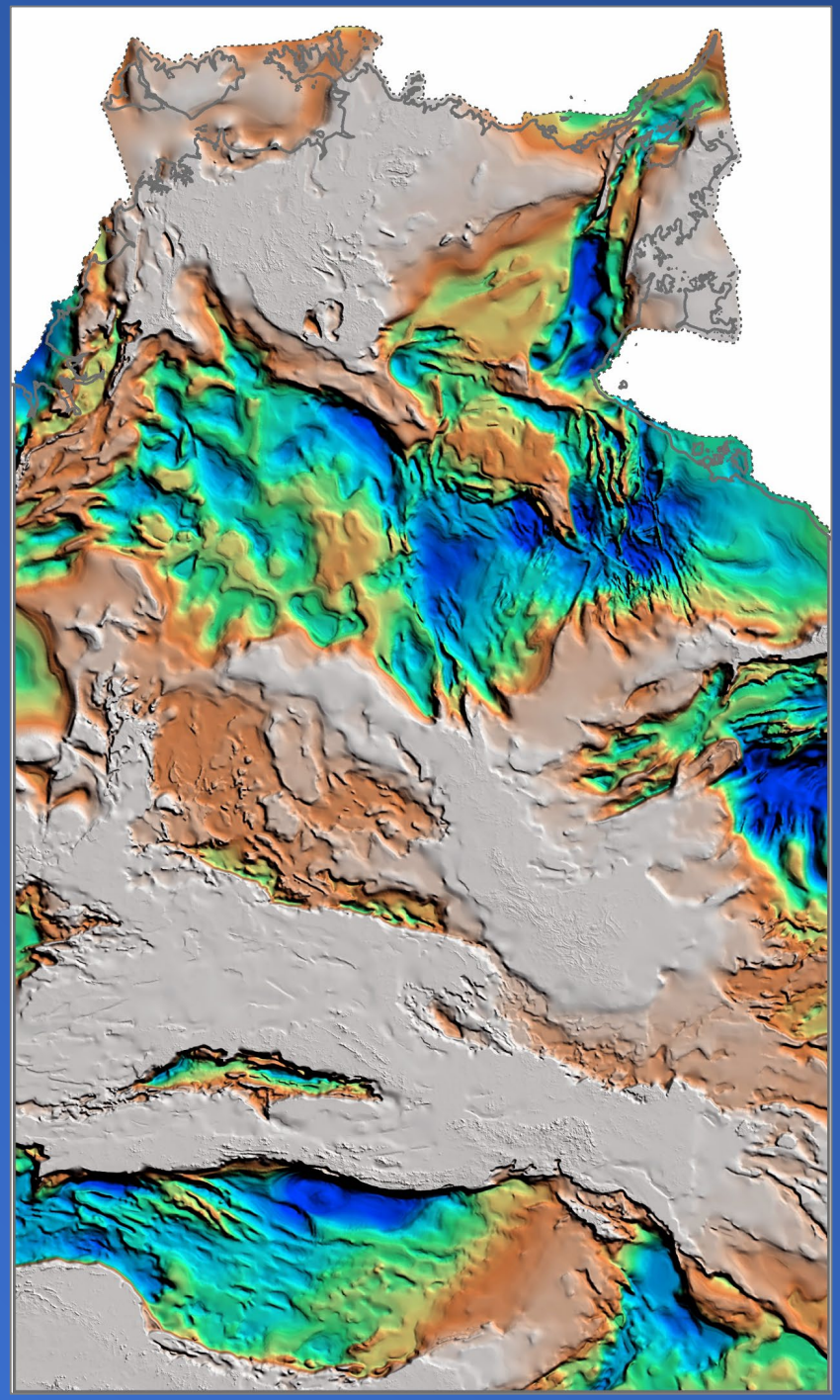
2006
OZ Proterozoic SEEBASE



AGES 2021



NT SEEBASE 2021

Northern Territory Geological Survey and Geognostics Australia Pty Ltd, 2021. Northern Territory SEEBASE and GIS. *Northern Territory Geological Survey, Digital Information Package* DIP 030.

Basin Definition

The NT SEEBASE provides a platform to evolve the Geological Regions into defined sub-surface basin systems.

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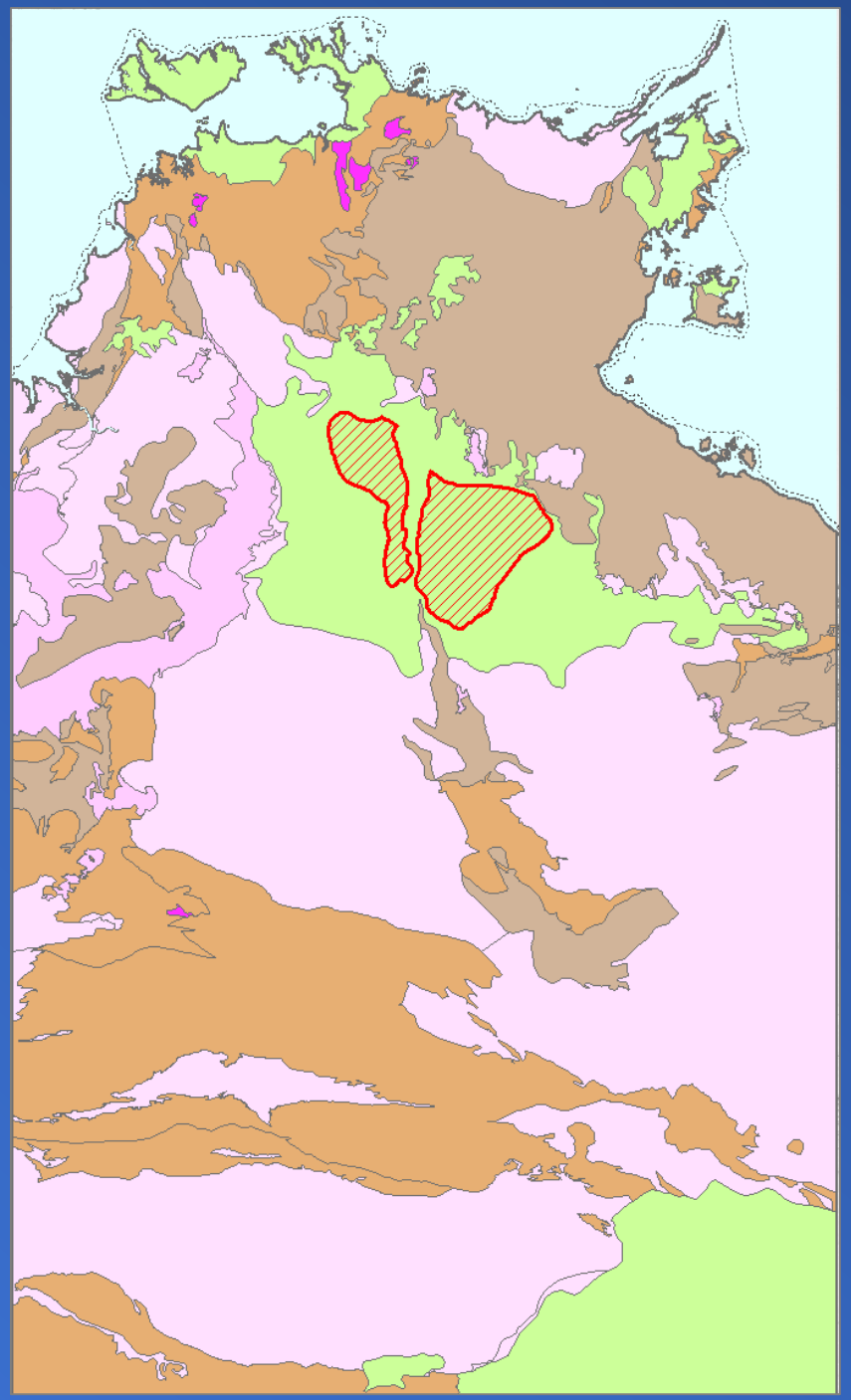
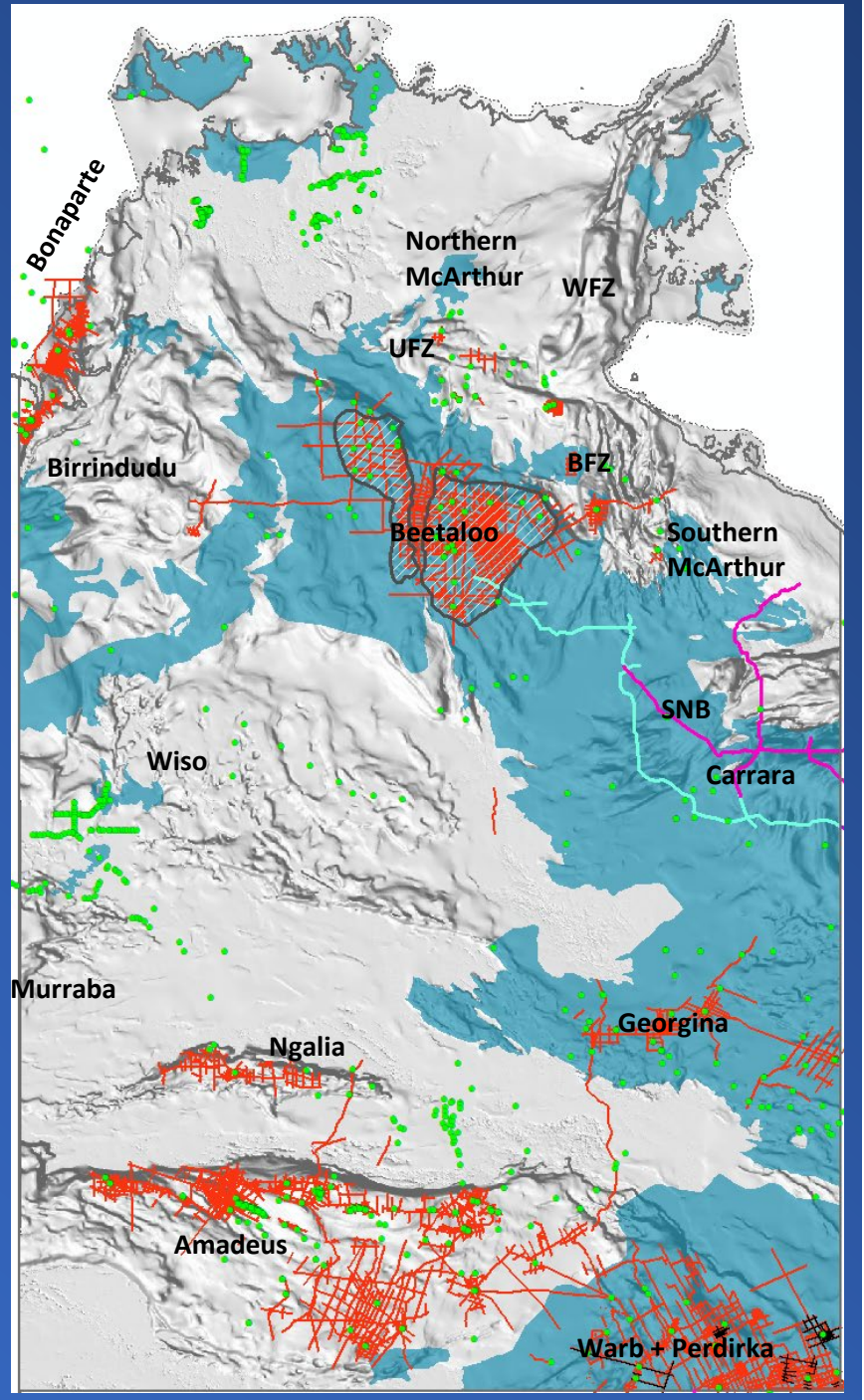
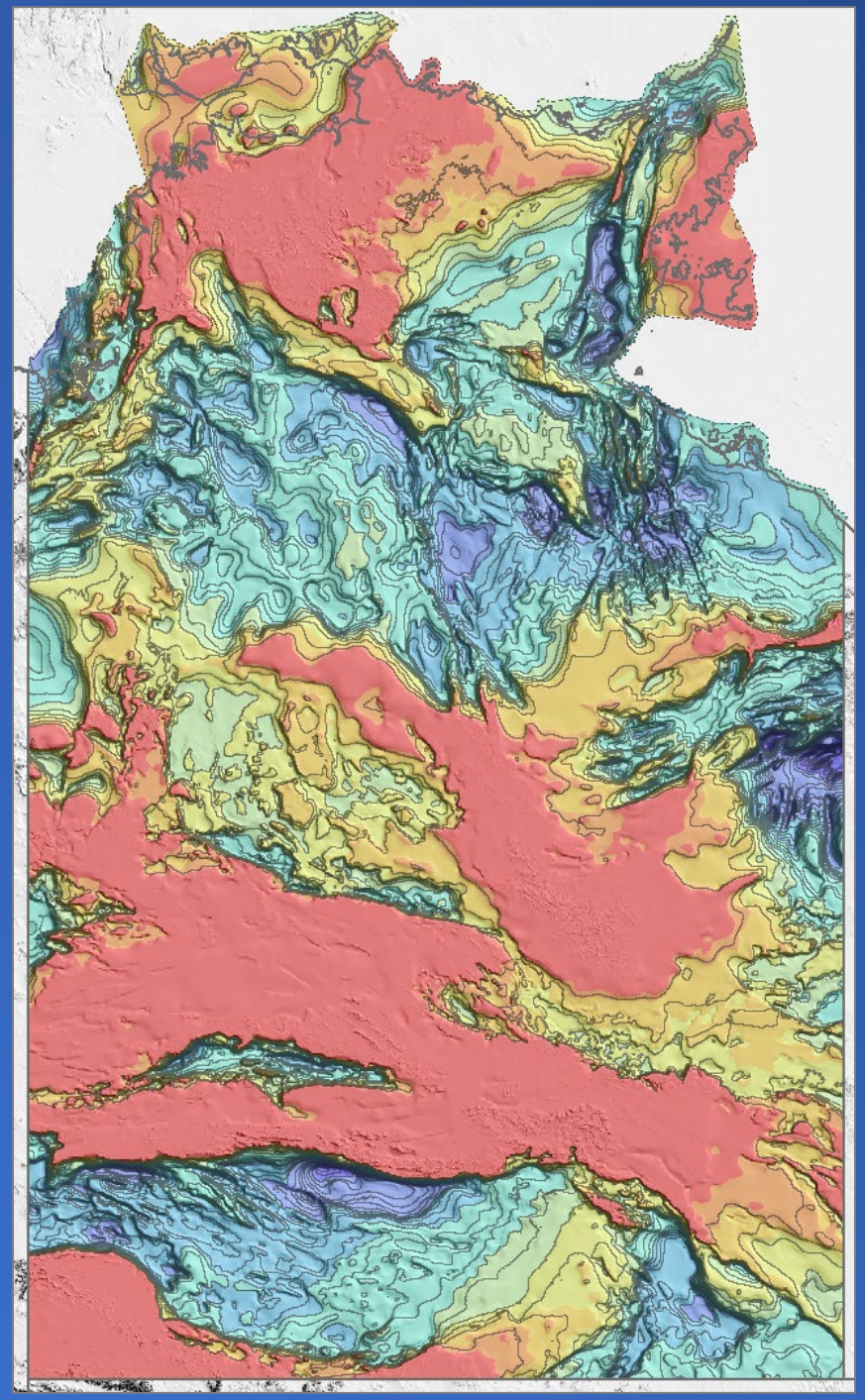




Total Sediment Thickness

Many basins are obscured by stacked basins, thinner cover basins and/or widespread volcanic sequences.



Basin depths and extent

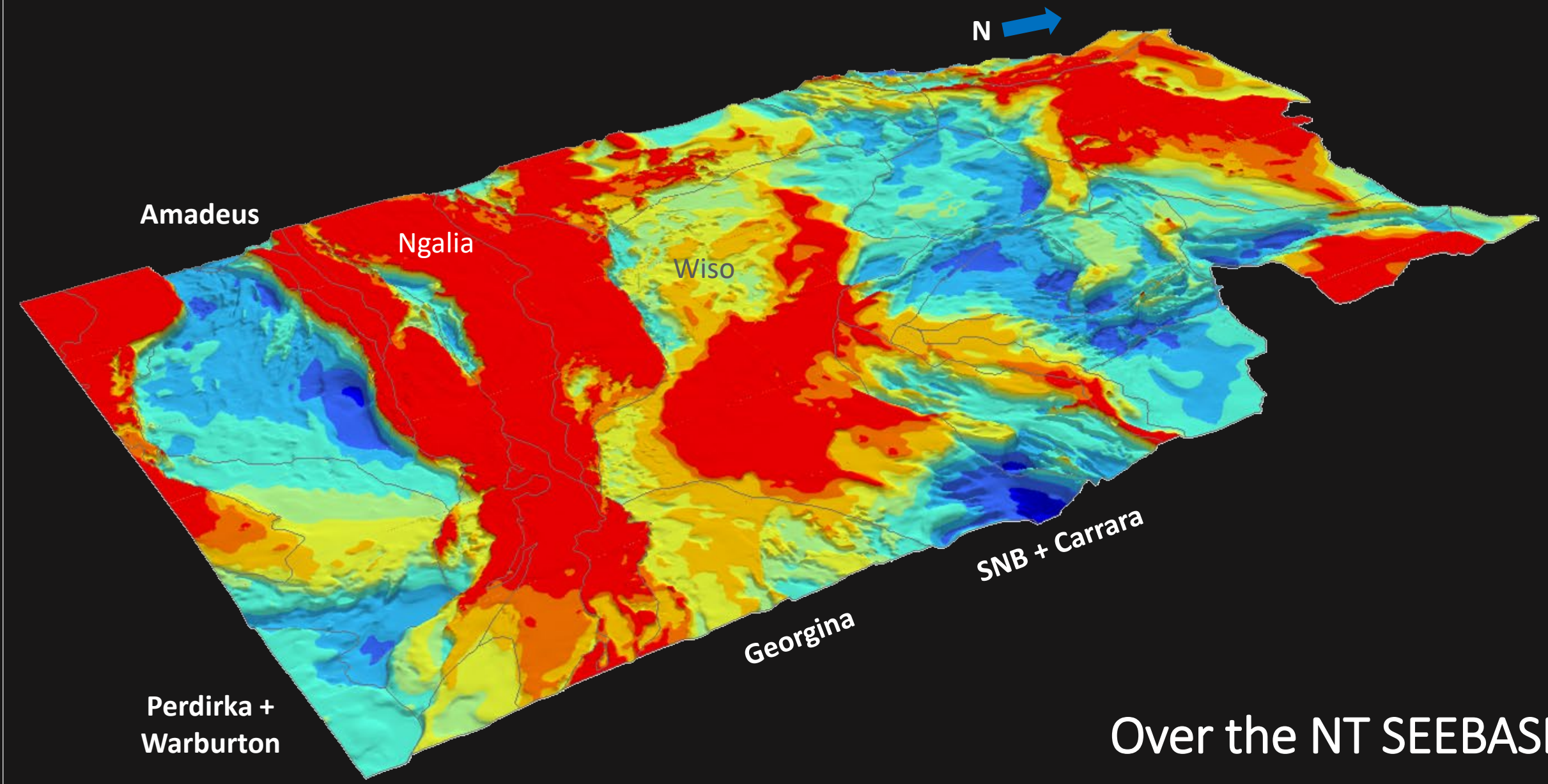
Depocentre geometries

Structural boundaries and intra-basinal features

AGES 2021

SEEBASE – DEM

TOTAL SEDIMENT THICKNESS



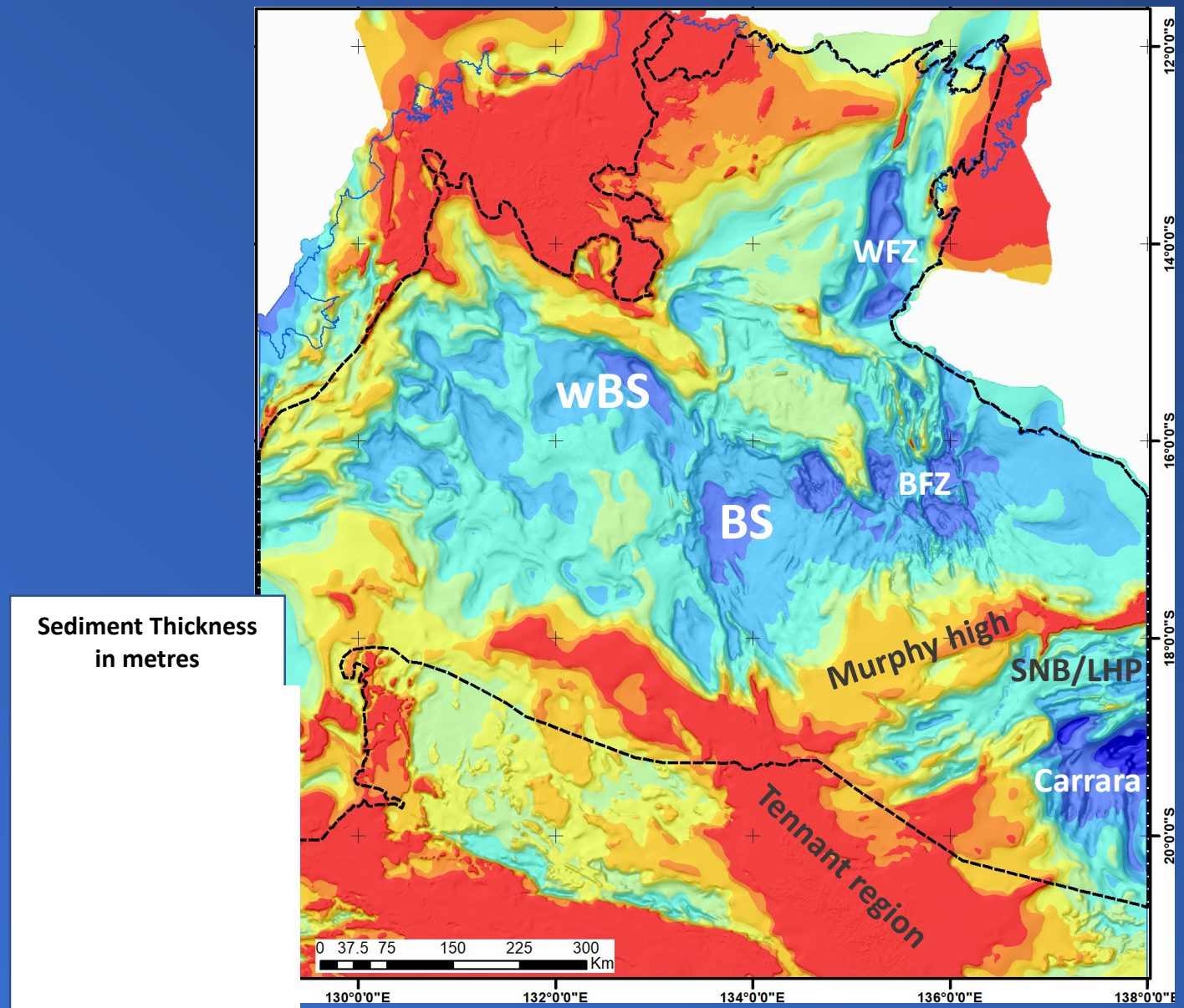
Over the NT SEEBASE

Total Sediment Thickness

Maximum thickness in the Cararra Sub-basin, Beetaloo, Batten FZ and the Walker FZ.

AGES 2021

Greater McArthur Update



Sediment Thickness in metres

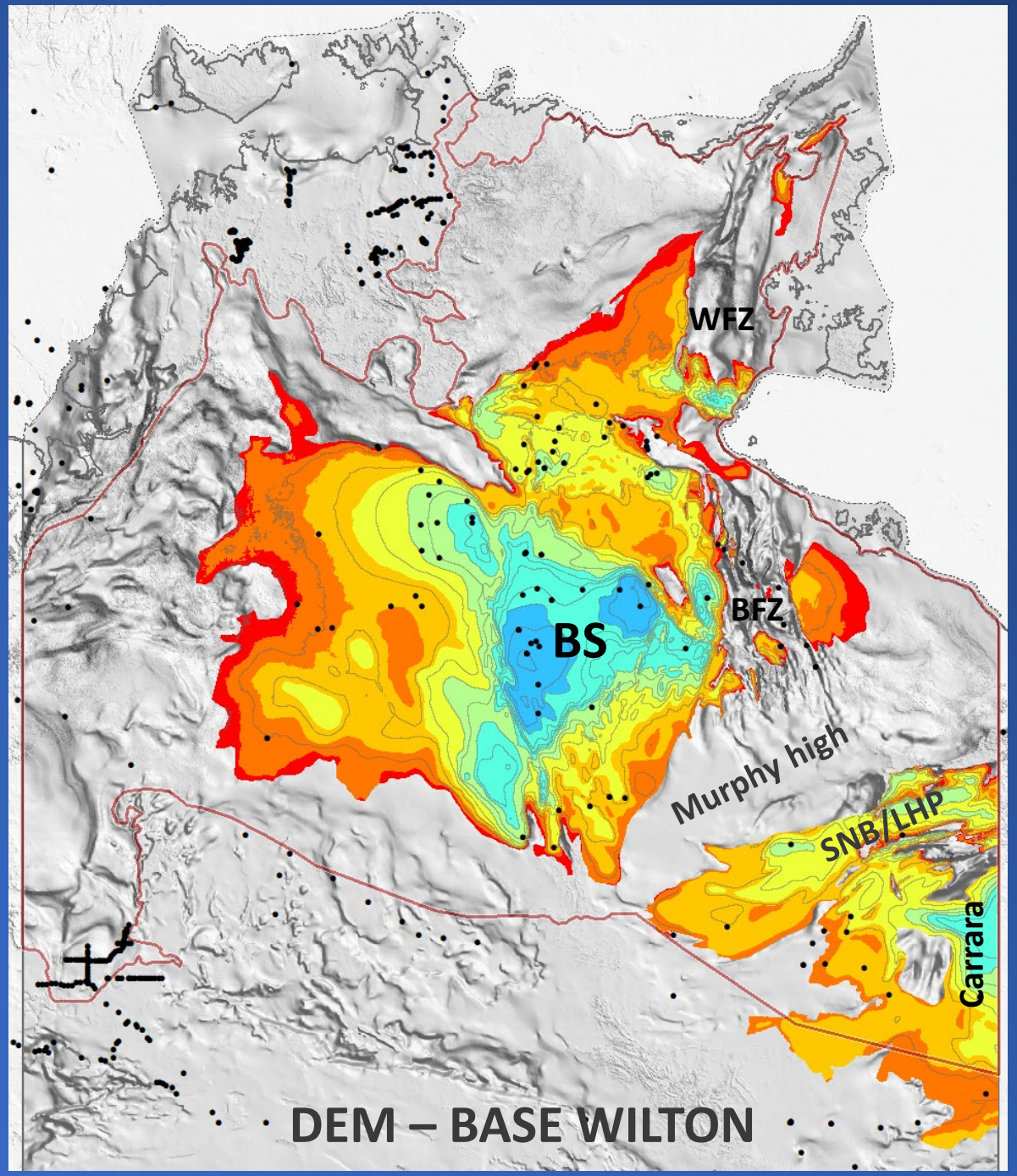
SEEBASE – DEM

GMA Isopachs

- Thickest in Beetaloo
- Some thickening may be younger sediment
- Absent over Murphy High, BFZ and WFZ
- Thinned margins are both depositional and structurally controlled

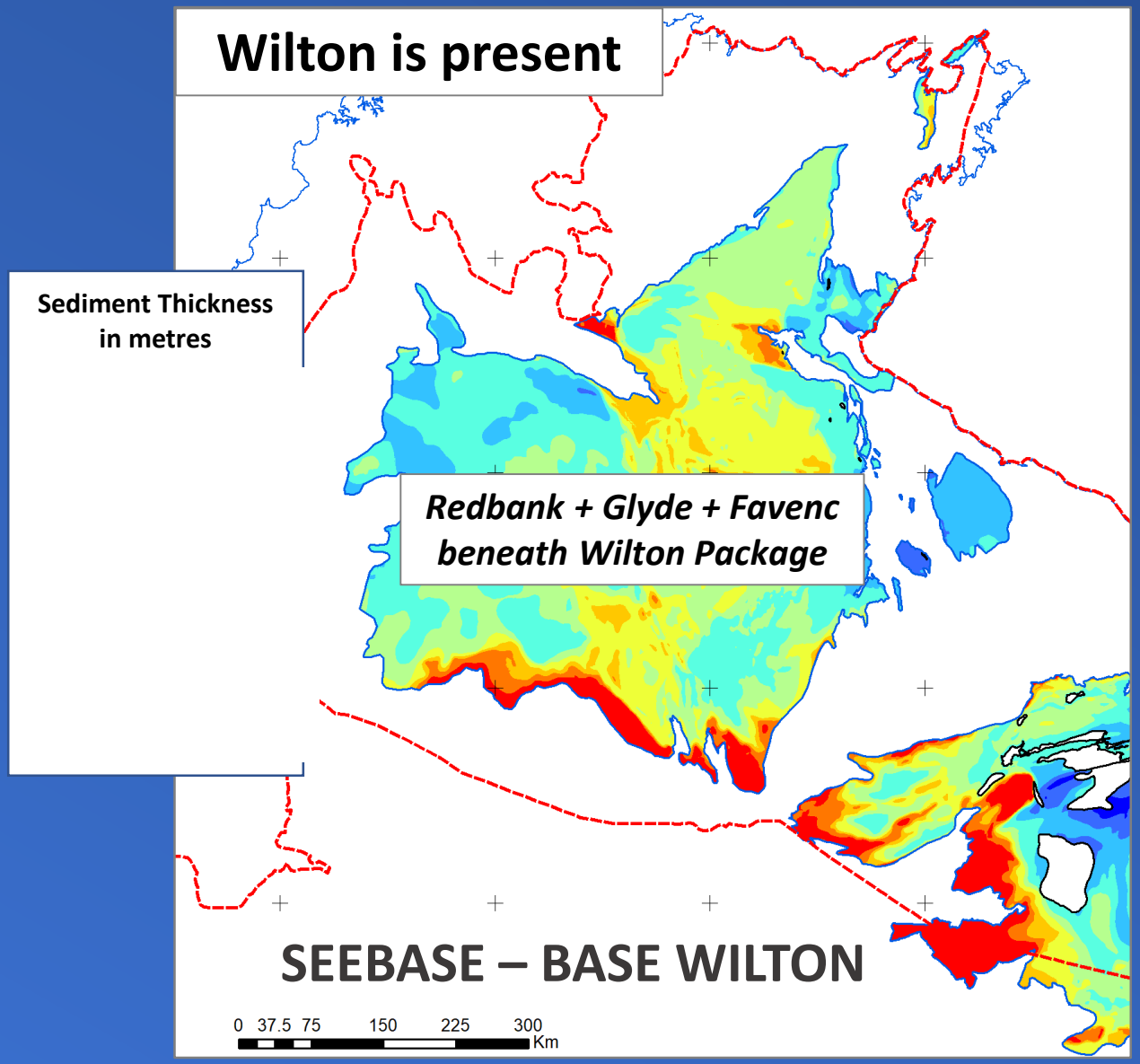
AGES 2021

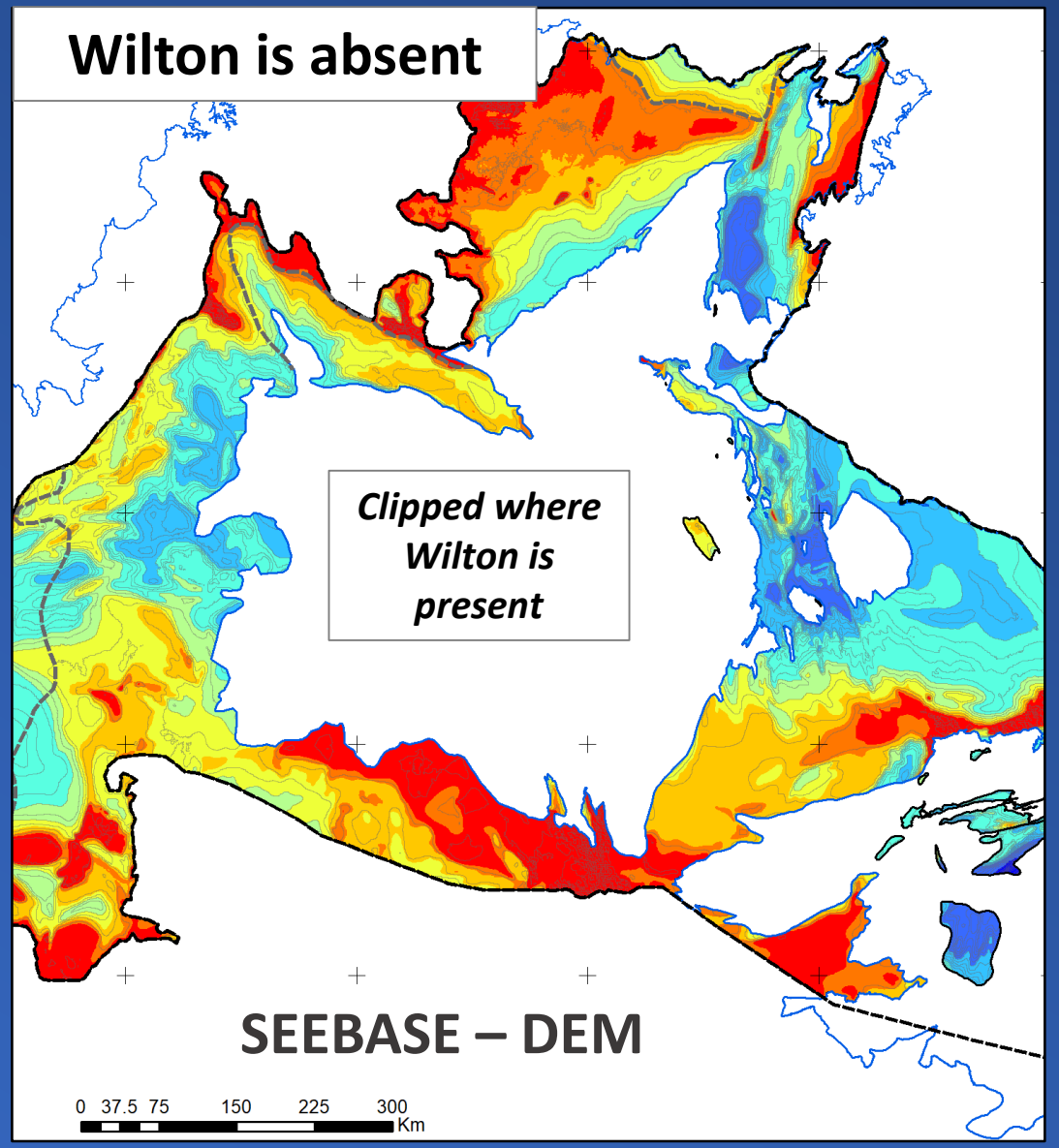
Wilton Package and overlying units

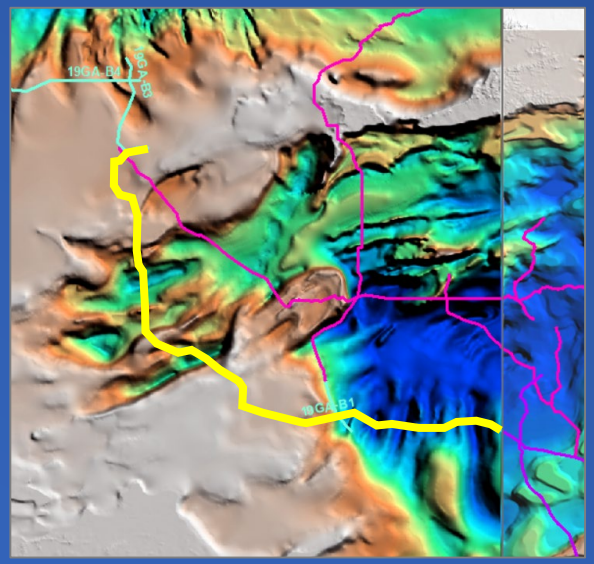


Sediment Thickness in metres

Redbank + Glyde + Favenc Isopach – In Two Parts



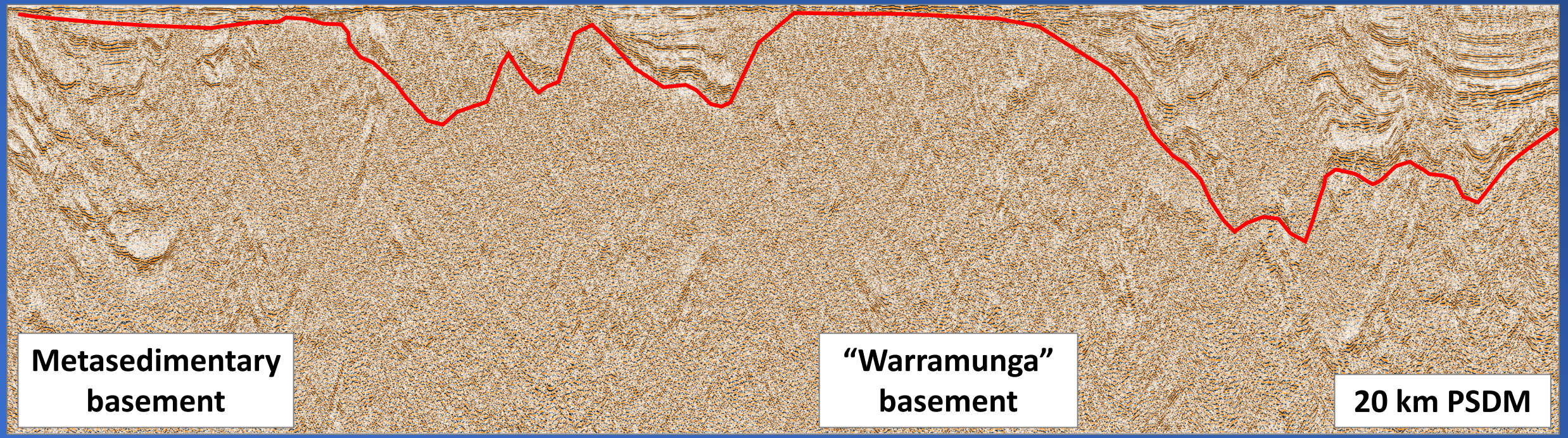


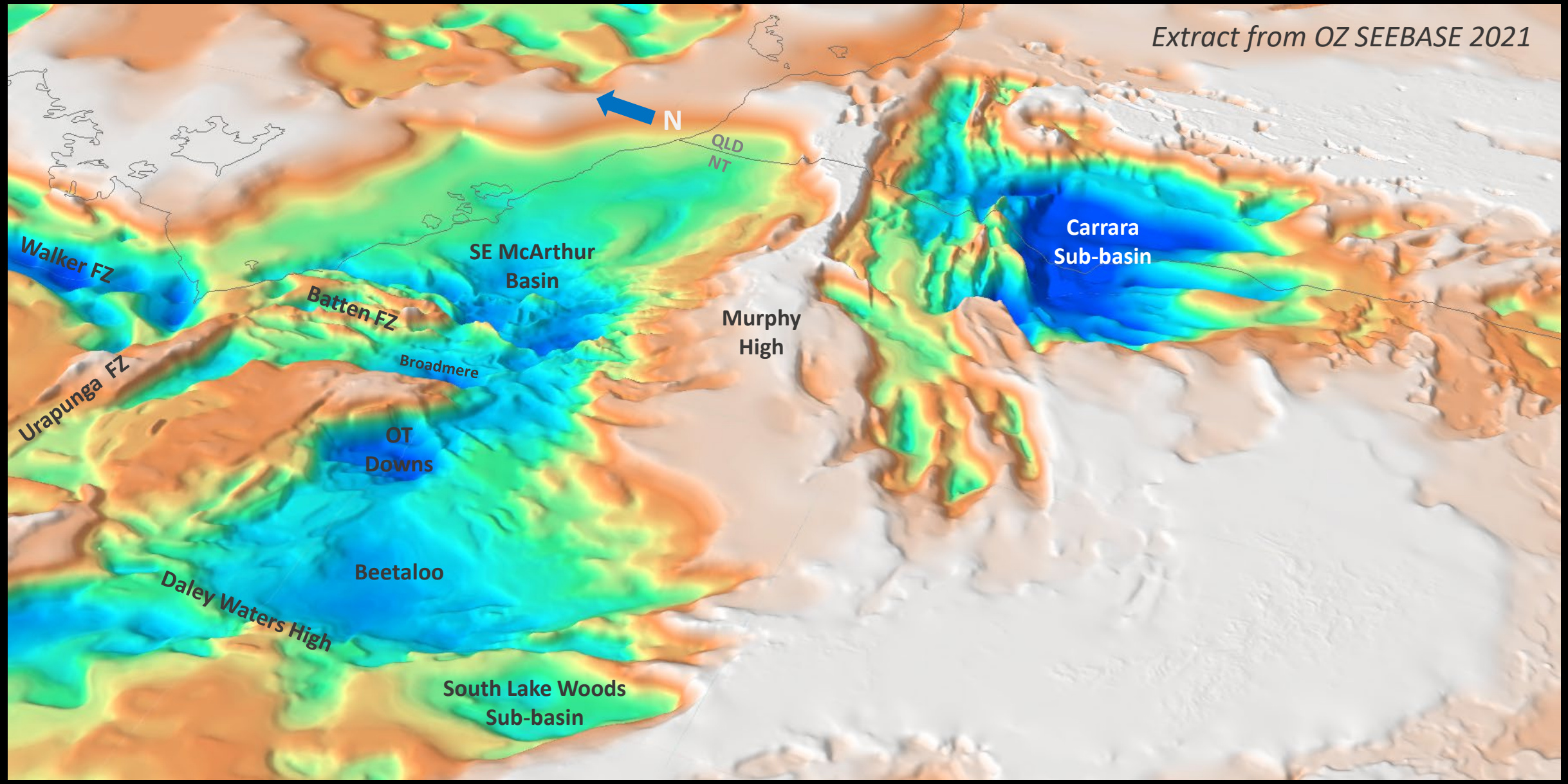


Line 19GA-B1

- EFTF deep seismic integrated within the timeframe of NT project

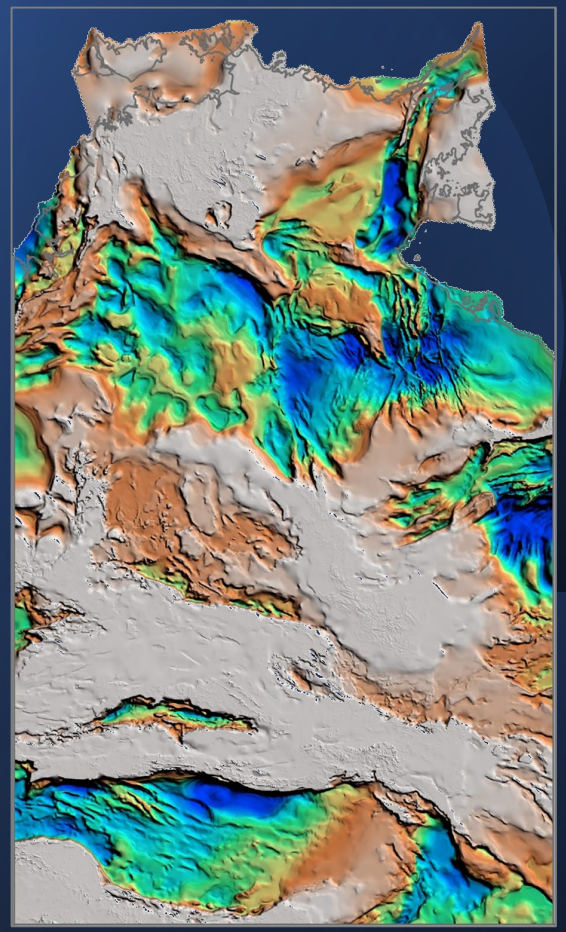
- Probably consistency in basement depth
- Some variation in Isa/Glyde and Calvert/Redbank packages
- Difference in basement depth across the Murphy High




Extract from OZ SEEBASE 2021
N
QLD
NT
Walker FZ
Batten FZ
SE McArthur
Basin
Carrara
Sub-basin
Murphy
High
Broadmere
Urapunga FZ
OT
Downs
Beetaloo
Daley Waters High
South Lake Woods
Sub-basin

NORTHERN TERRITORY GOVERNMENT GEMIS

Northern Territory SEEBASE®



Digital Information Package DIP 030. Northern Territory SEEBASE and GIS. Northern Territory Geological Survey,

Digital Information Package DPI 031. Northern Territory SEEBASE and GIS: Gravity and Magnetics. Requires a hard drive.

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NORTHERN TERRITORY GOVERNMENT

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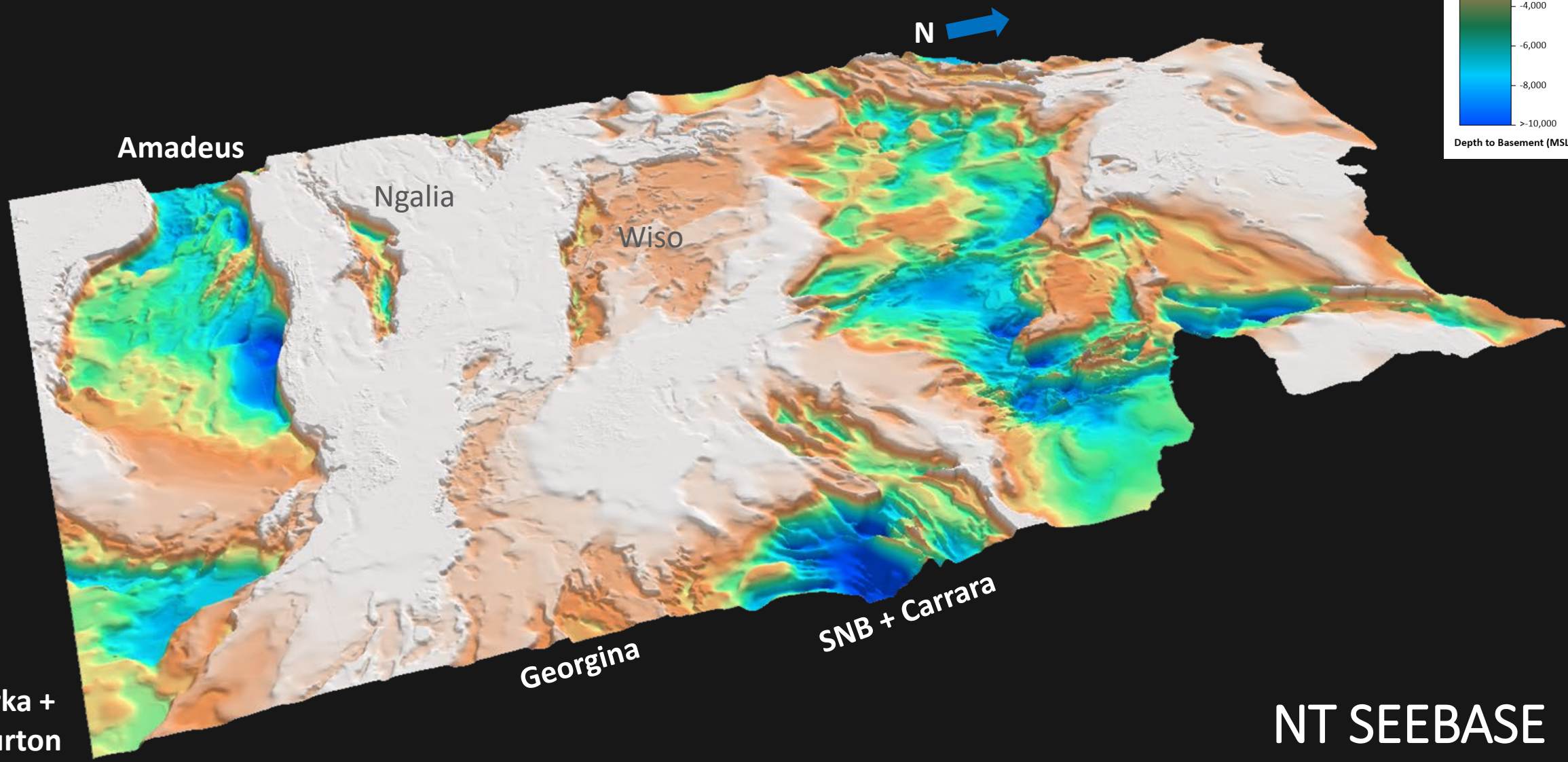
AUSTRALIA

DEPTH TO BASEMENT



NT SEEBASE

Territory-wide interpretation