

Millungera Basin – a frontier area

Melanie Fitzell¹

Acknowledgements: S. Faulkner¹, A. Troup¹, R. Smith¹, B. Talebi¹, S. Gopalakrishnan¹, O. Dixon¹, M. Goldman¹, M. Maxwell¹, P. Green¹.

C. Boreham², R. Korsch²

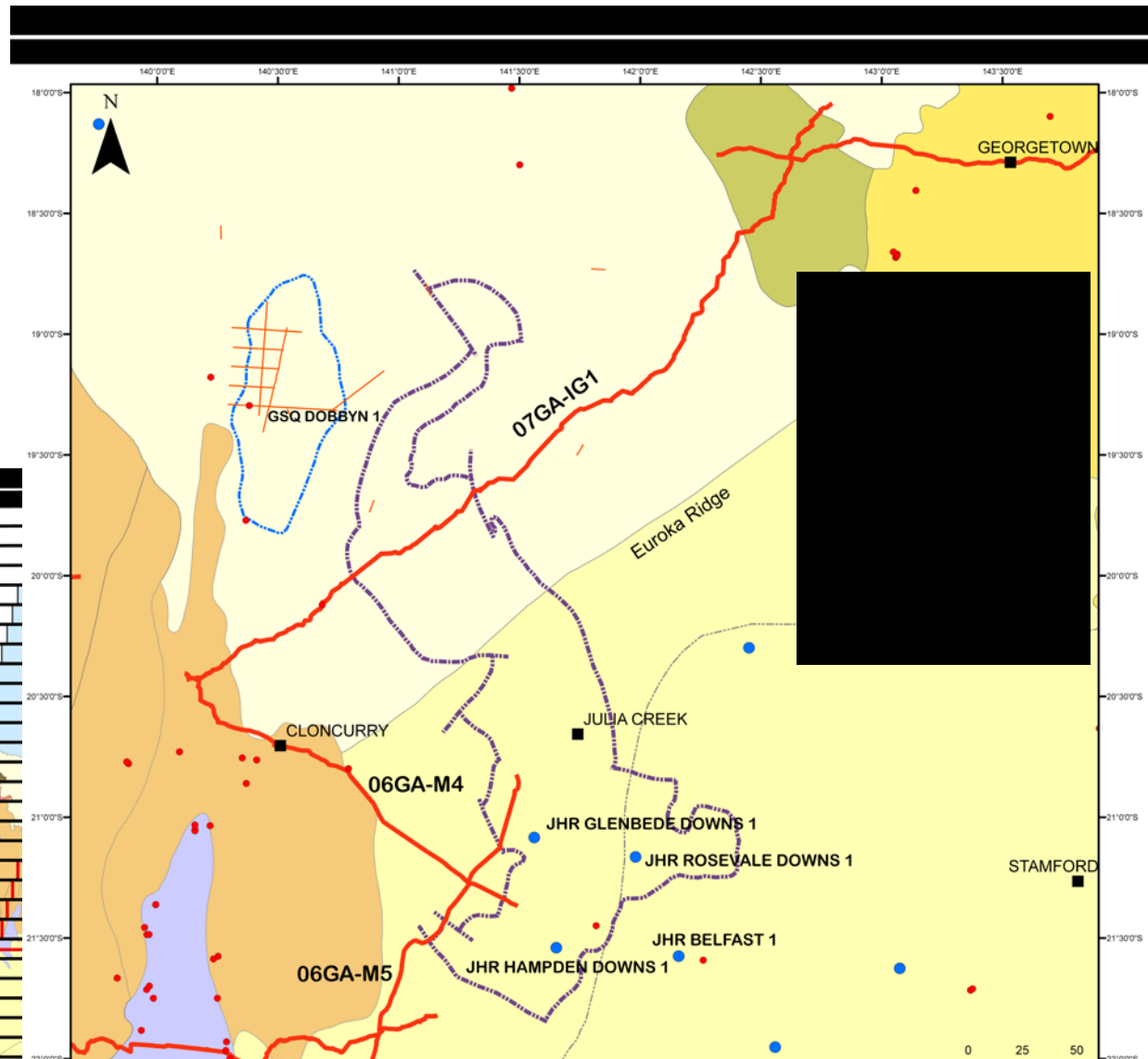
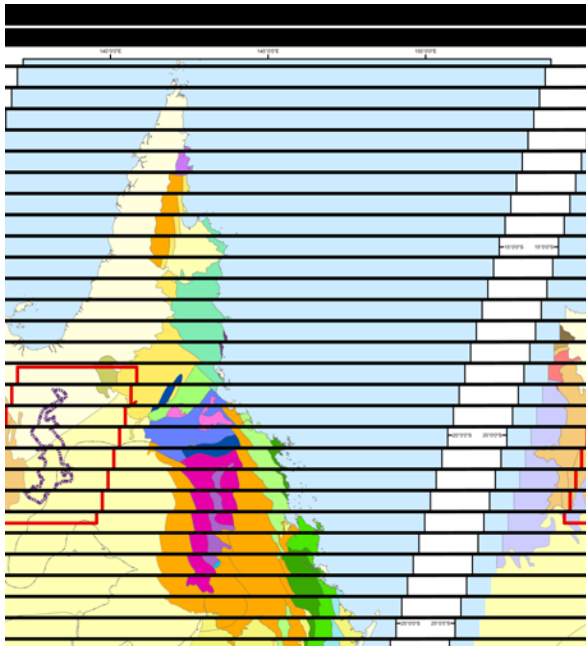
¹Geological Survey of Queensland

²Geoscience Australia

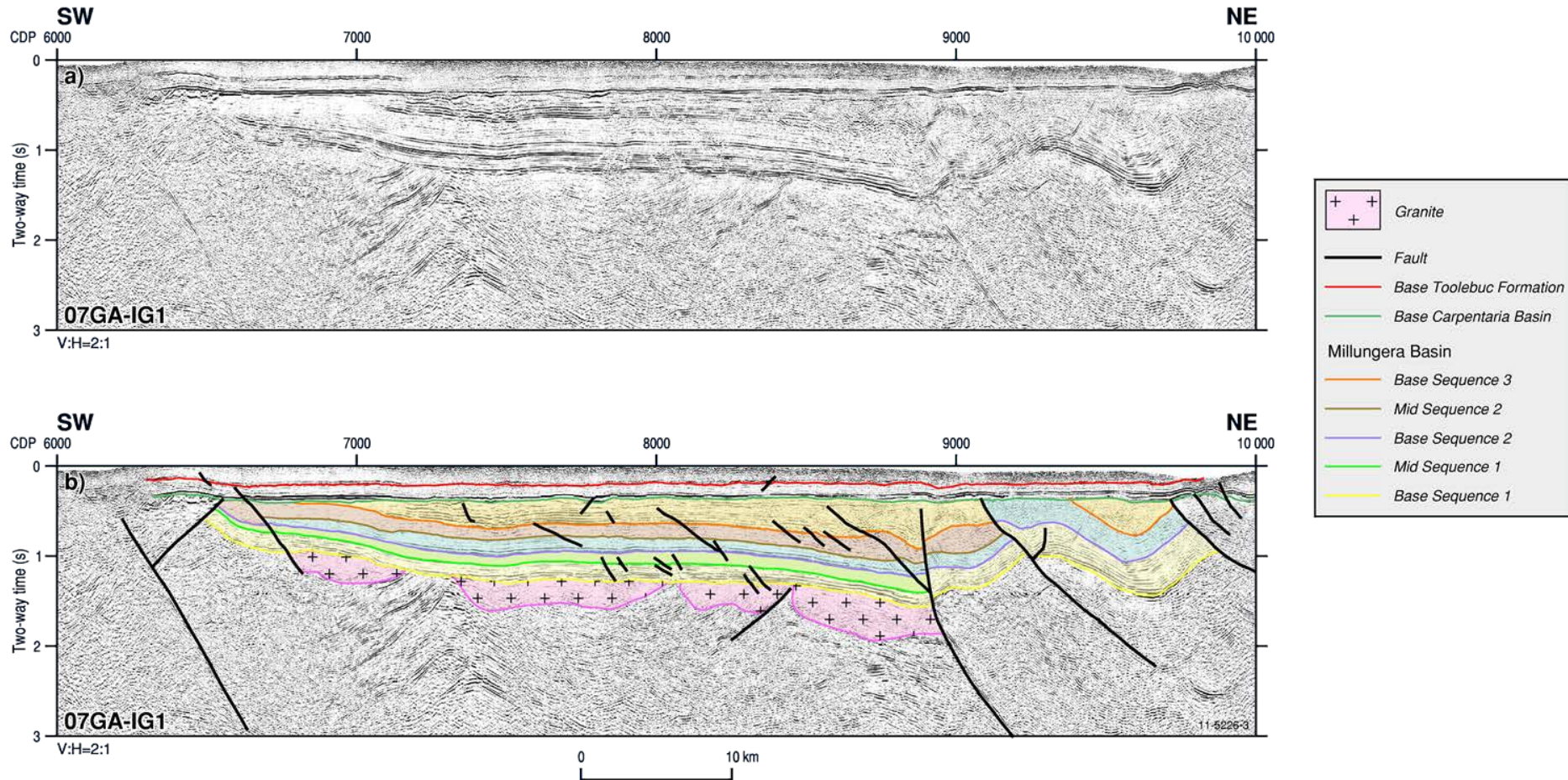


Millungera Basin

- Discovery-2006 and 2007 deep seismic reflection surveys
- Distribution map from gravity and aeromagnetic data
- 250km NS x 85km EW



07GA-IG1

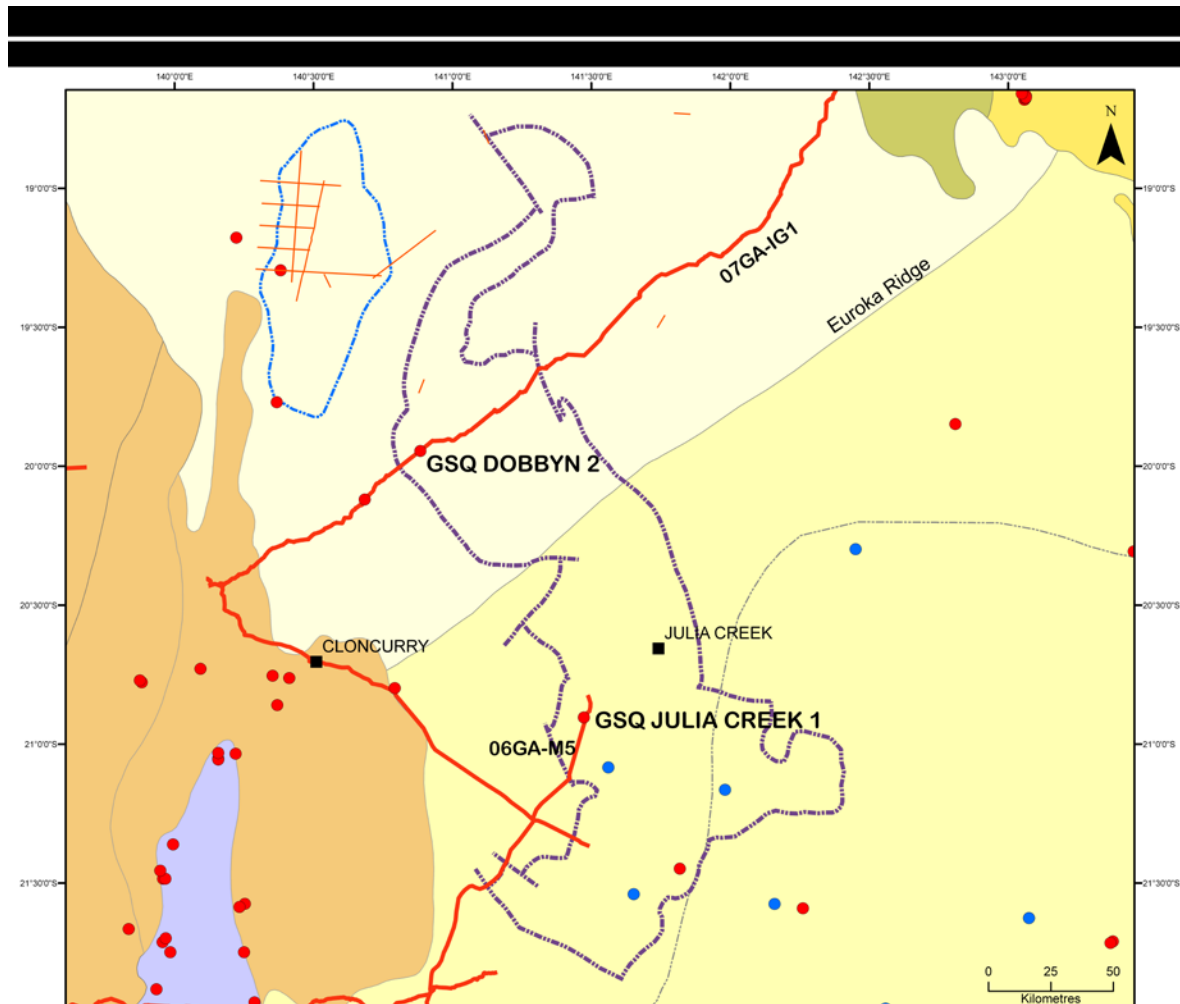


Source: R.J. Korsch and others, 2011.

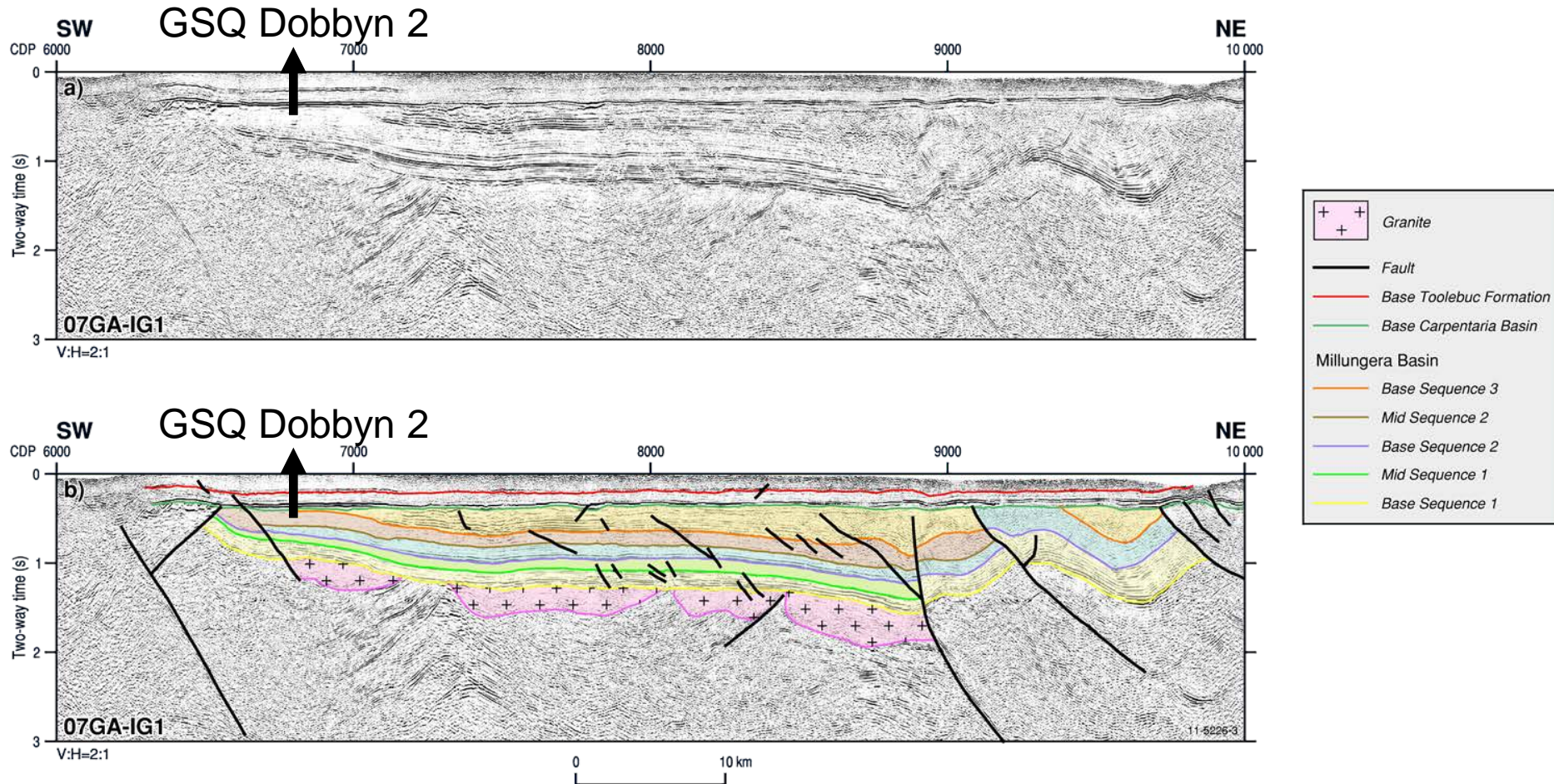
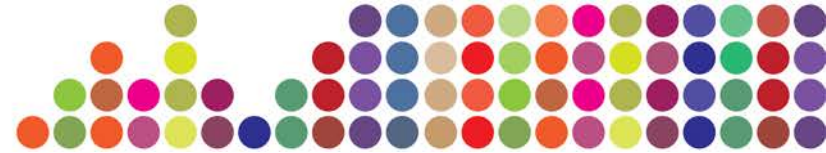
GSQ Drilling Program



- Two new stratigraphic bores:
 - **GSQ Dobbyn 2** and
 - **GSQ Julia Creek 1**
- Located on or close to deep seismic lines
- Full HQ core from casing to TD
- 500m TD
- **Aim:**
 - **Lithological Information**
 - **Age**

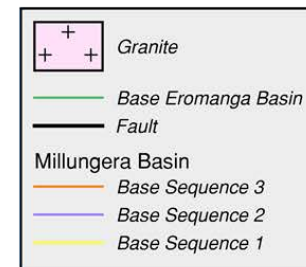
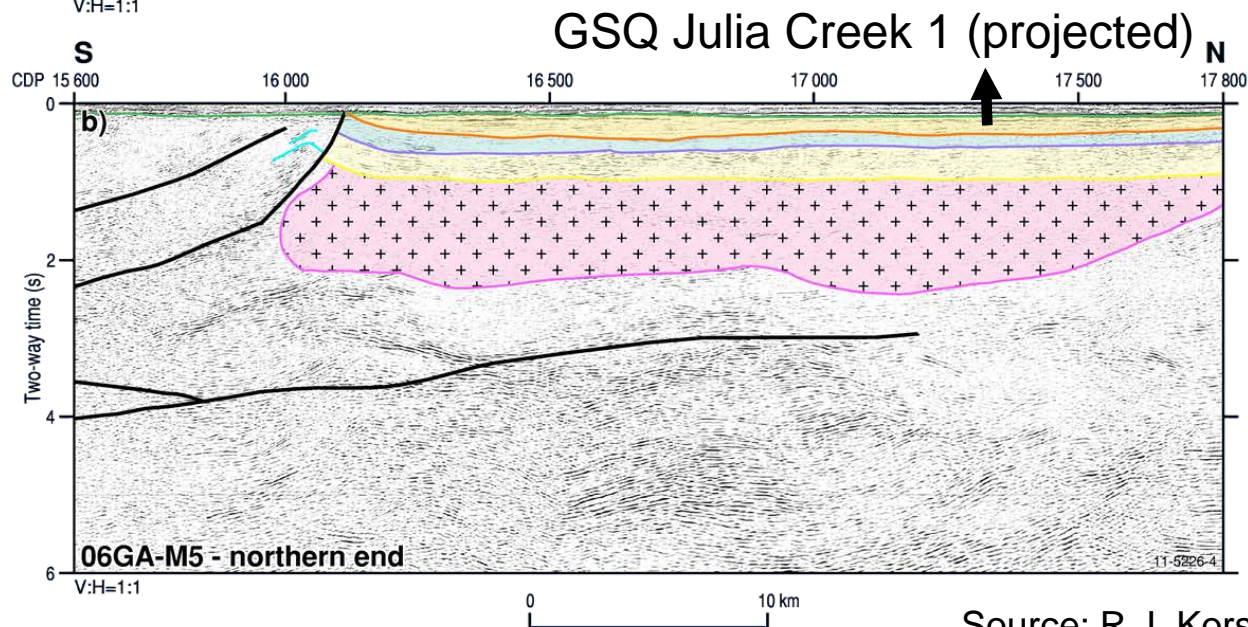
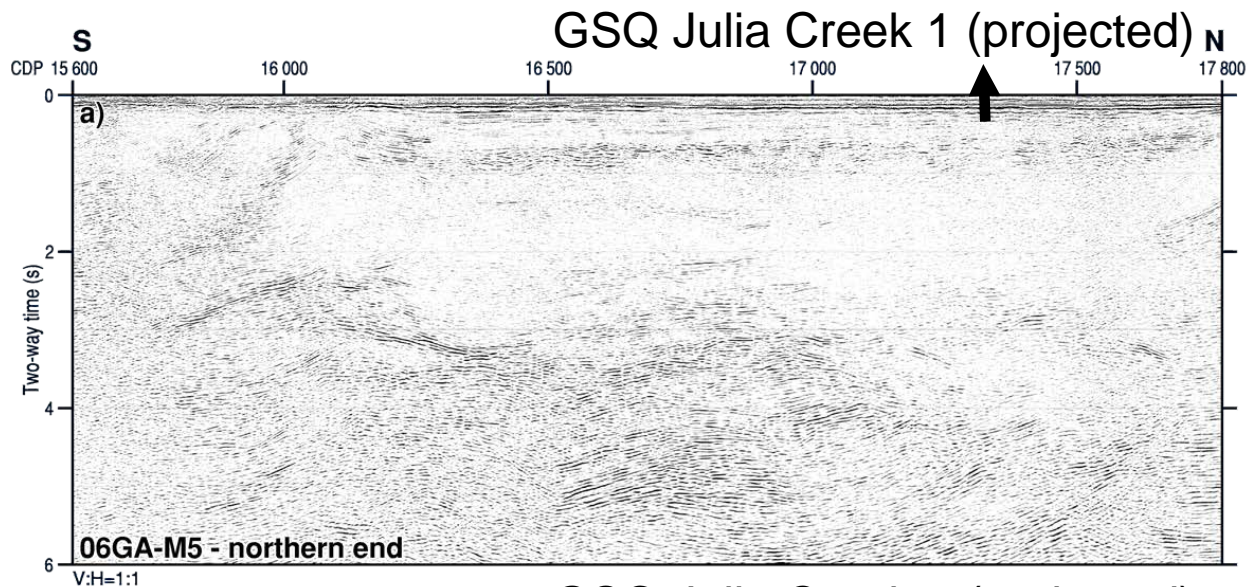


07GA-IG1



Source: R.J. Korsch and others, 2011.

06GA-M5



Source: R.J. Korsch and others, 2011.

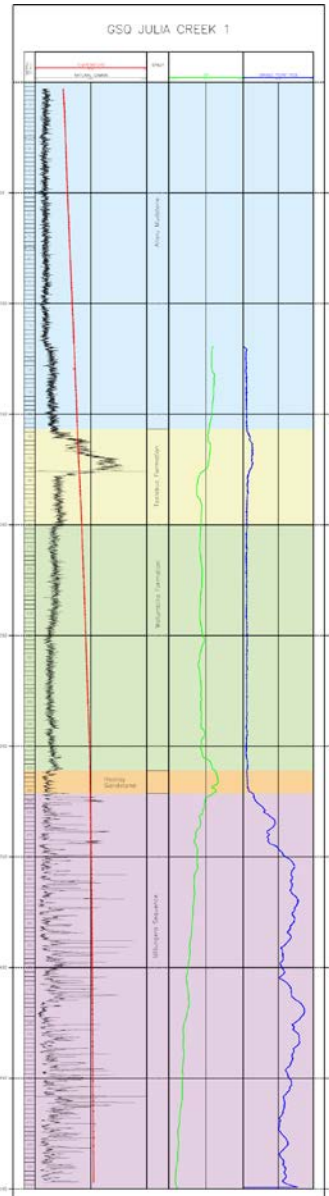
Wireline Logs

GSQ Julia Creek 1

Eromanga Basin

Millungera Basin
~180m

BHT 54°C

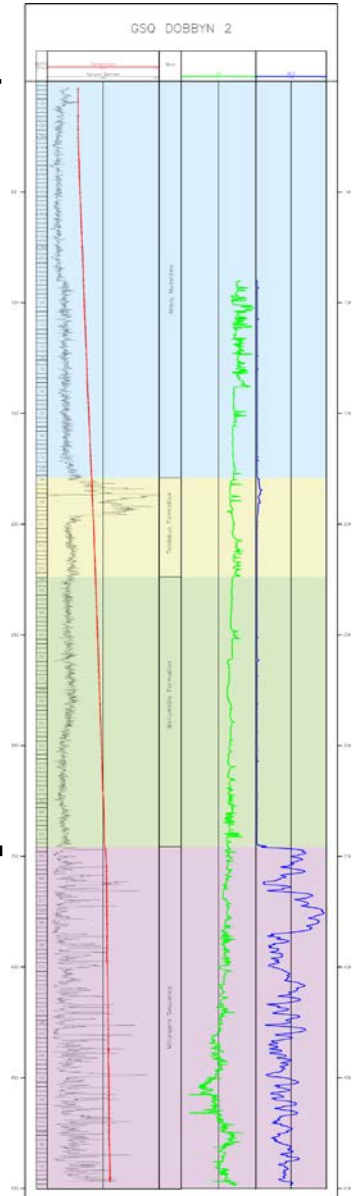


GSQ Dobbyn 2

Carpentaria Basin

Millungera Basin
~160m

BHT 56°C



~125km

GSQ Dobbryn 2



Unconformity between Carpentaria Basin and Millungera Basin



Wallumbilla Formation

Millungera Sequence



siliceous to hematitic quartzose sandstones

GSQ Julia Creek 1



Unconformity= top Millungera Basin



Hooray Sandstone

indurated siliceous quartzose sandstone



highly siliceous quartzose sandstone



hematitic quartzose sandstone



GSQ Julia Creek 1



micaceous siltstone



hematite altered claystone

GSQ Dobbryn 2

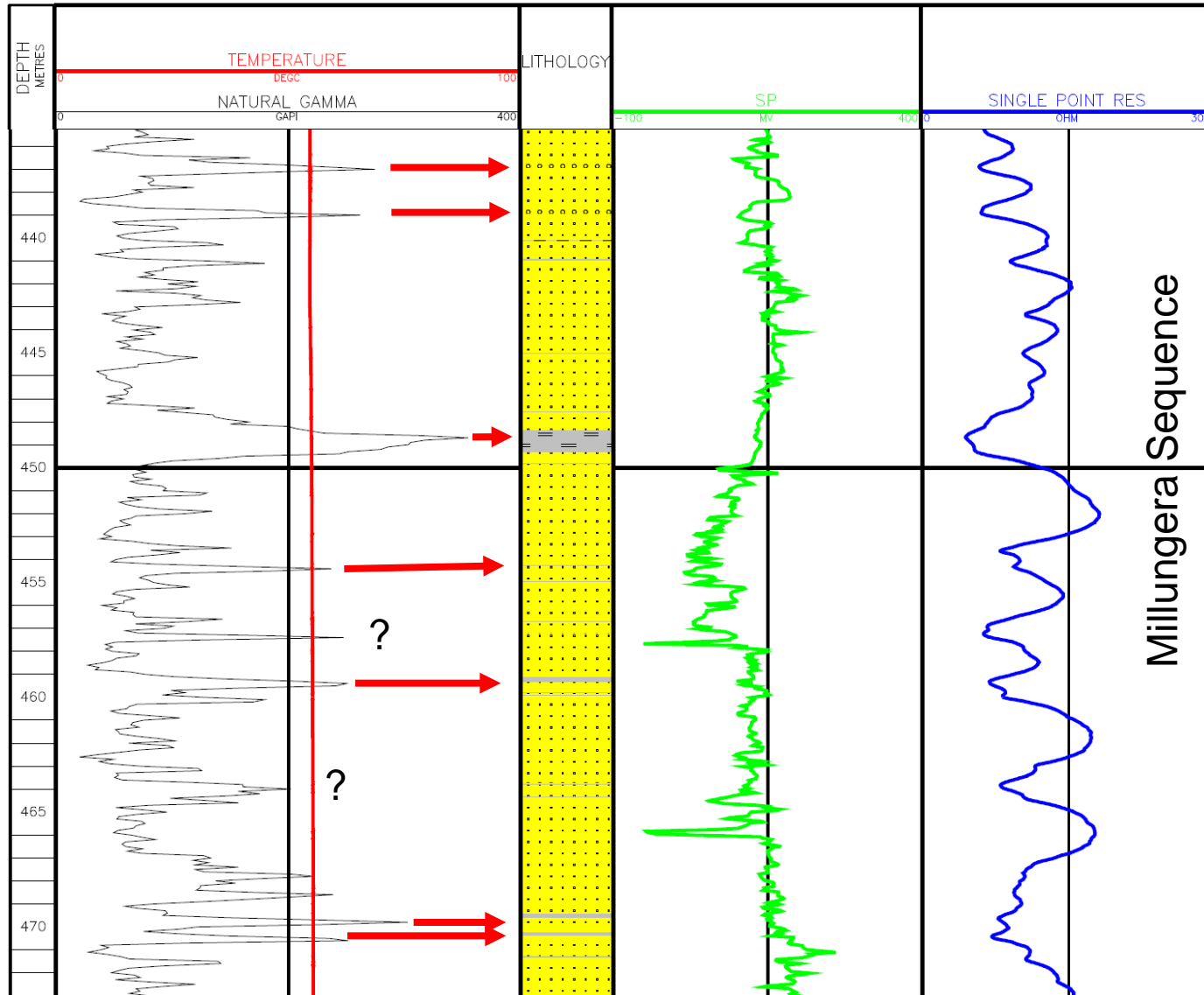


red micaceous siltstone



clay bands

Gamma-ray peaks



- Apparent correlation between micaceous siltstones and clay bands with high gamma-ray peaks
- High thorium content

Vitrinite Reflectance

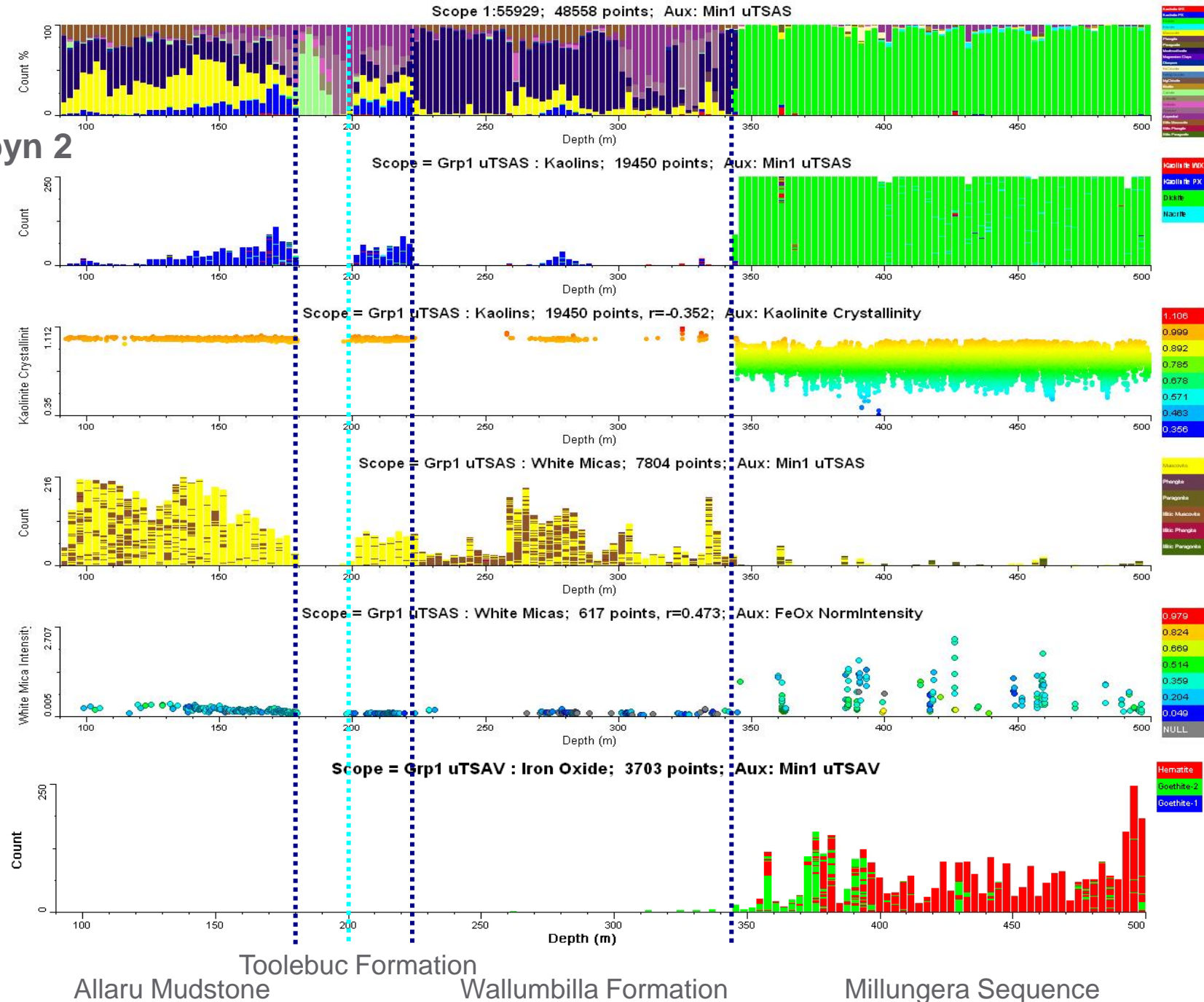


- Carpentaria Basin:
 - GSQ Dobbyn 2
 - $R_v, \text{max} = 0.37\%$ from Allaru Mudstone @168.2m
- Eromanga Basin:
 - GSQ Julia Creek 1
 - $R_v, \text{max} = 0.26\%$ from Hooray Sandstone @312.8m
- Millungera Basin Sequence
 - No visible vitrain found in samples.

} sub-bituminous



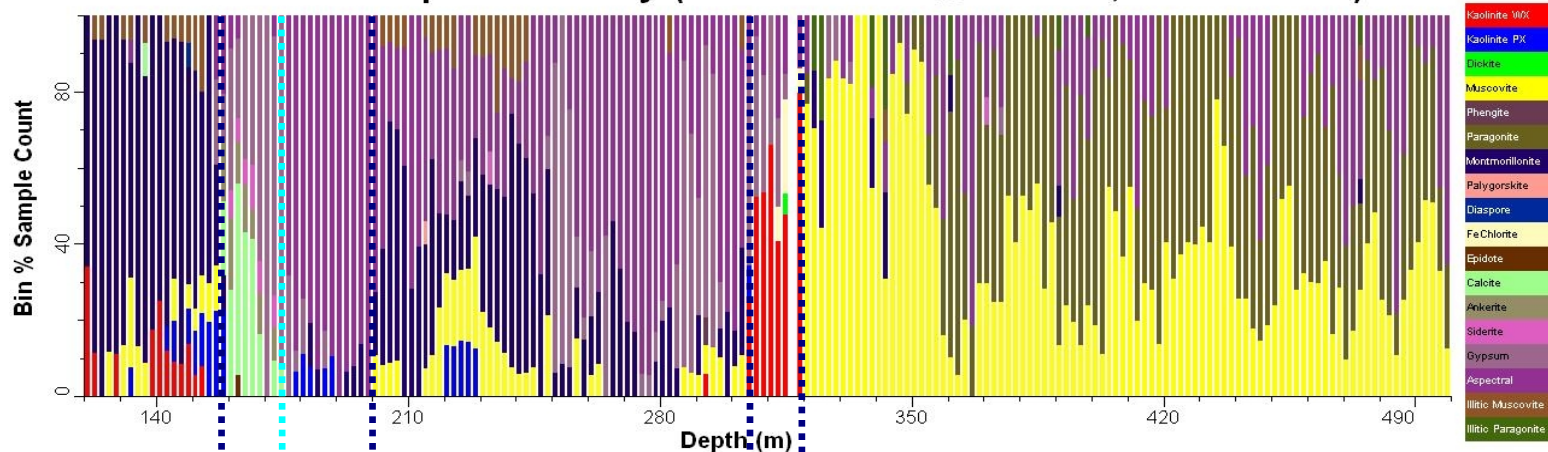
GSQ Dobbyn 2



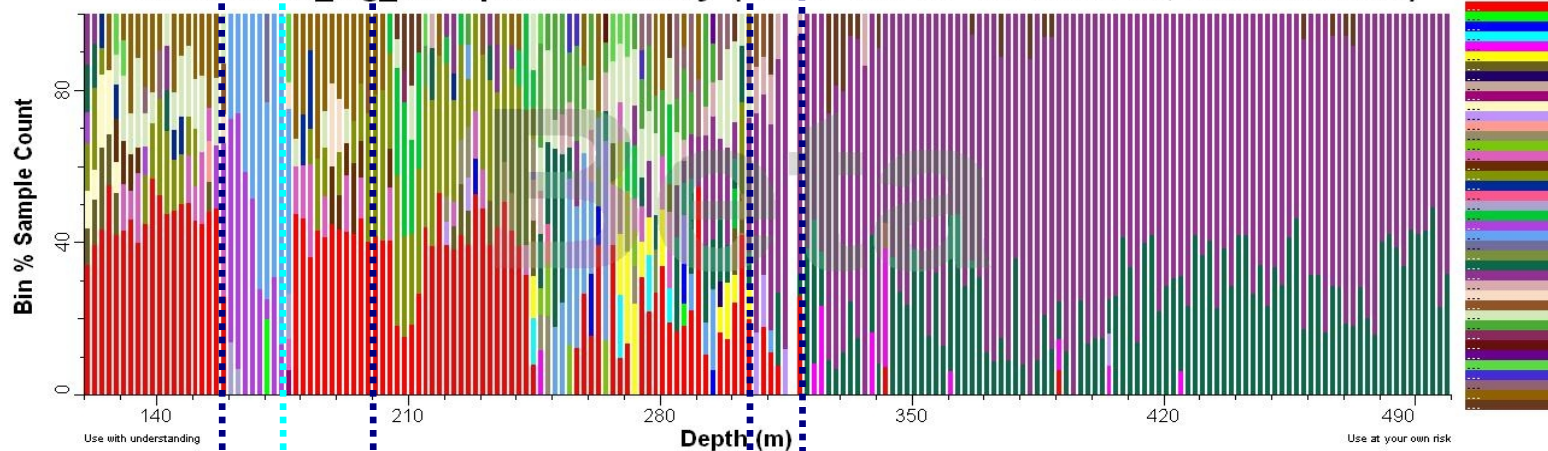
HyLogger – preliminary results



JuliaCreek1: Spatial Summary (Bin=2 MinBin=5% uTSA 7.0, Mineral Subset)



JuliaCreek1_tsq_tir: Spatial Summary (Bin=2 MinBin=5% sTSA 7.0, Mineral Subset)



Use with understanding

Use at your own risk

Allaru Mudstone

Wallumbilla Formation

Millungera Sequence

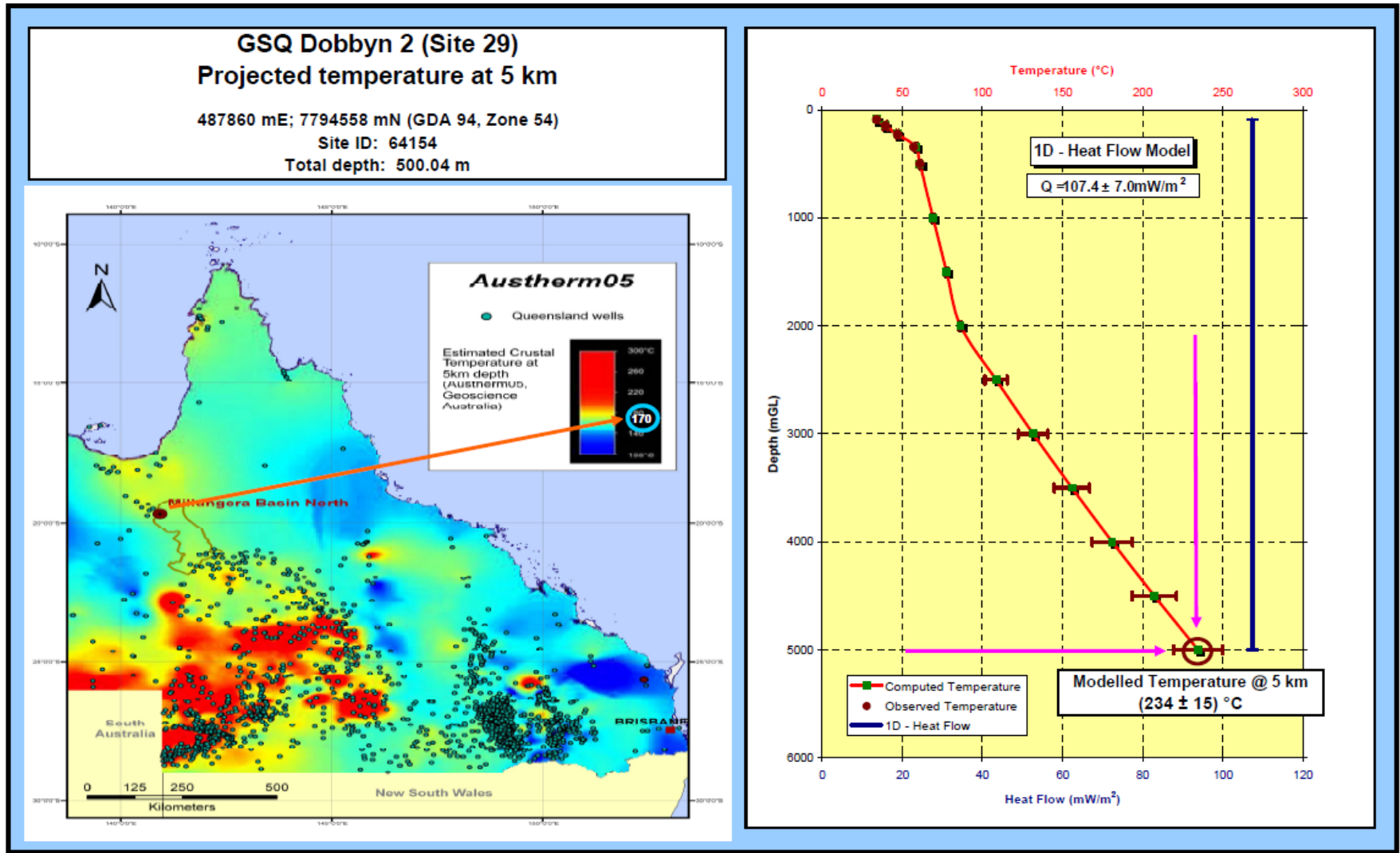
Toolebuc Formation

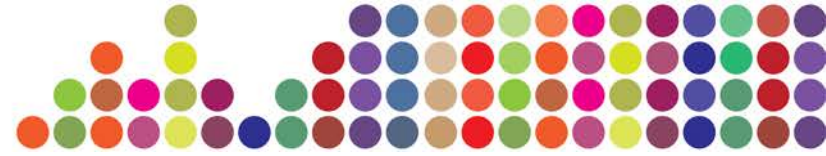
Hooray Sandstone

GSQ Julia Creek 1 - Millungera sequence dominated by quartz, muscovite & paragonite



GSQ Dobbyn 2 – modelled temperature @ 5km





GSQ Dobbyn 2 – Heat Flow Model

GSQ Dobbyn 2 (Site 29)

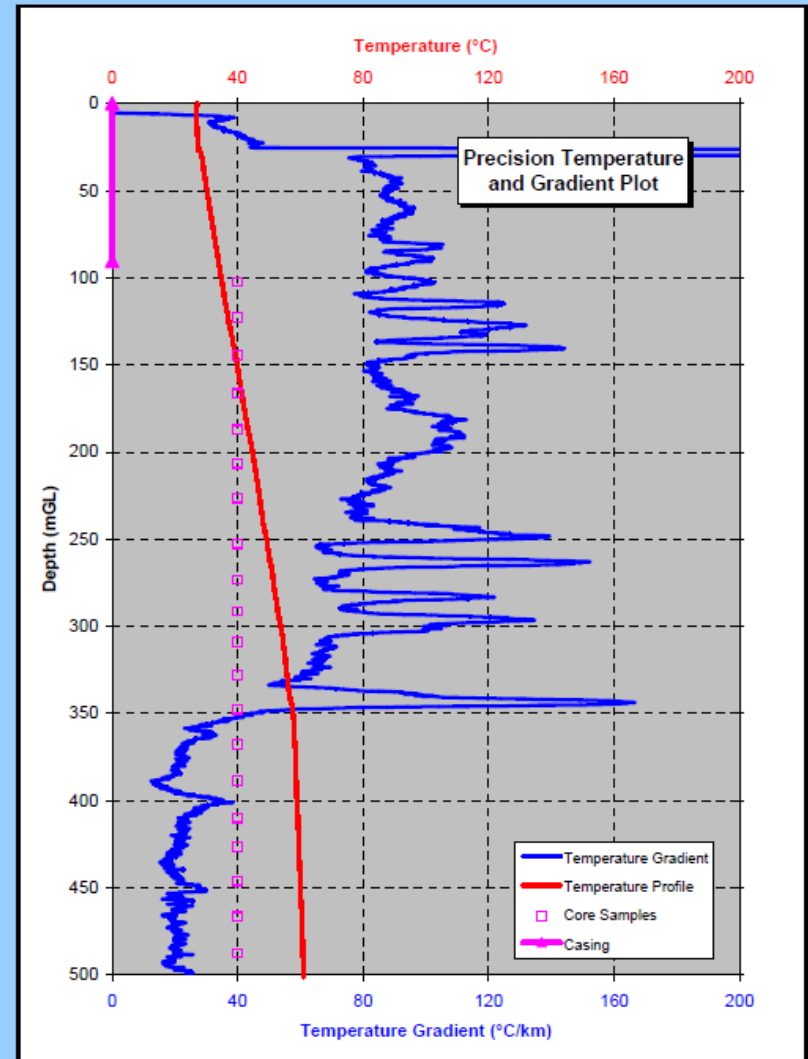
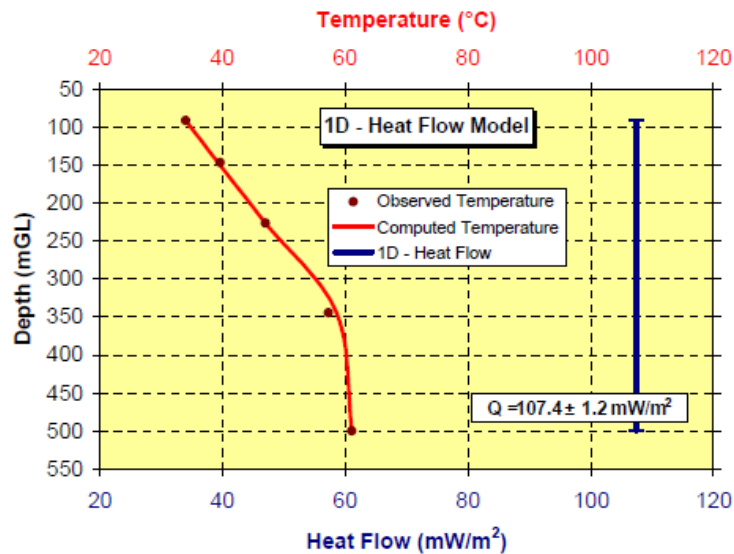
487860 mE; 7794558 mN (GDA 94, Zone 54)

Site ID: 64154

Total depth: 500.04 m

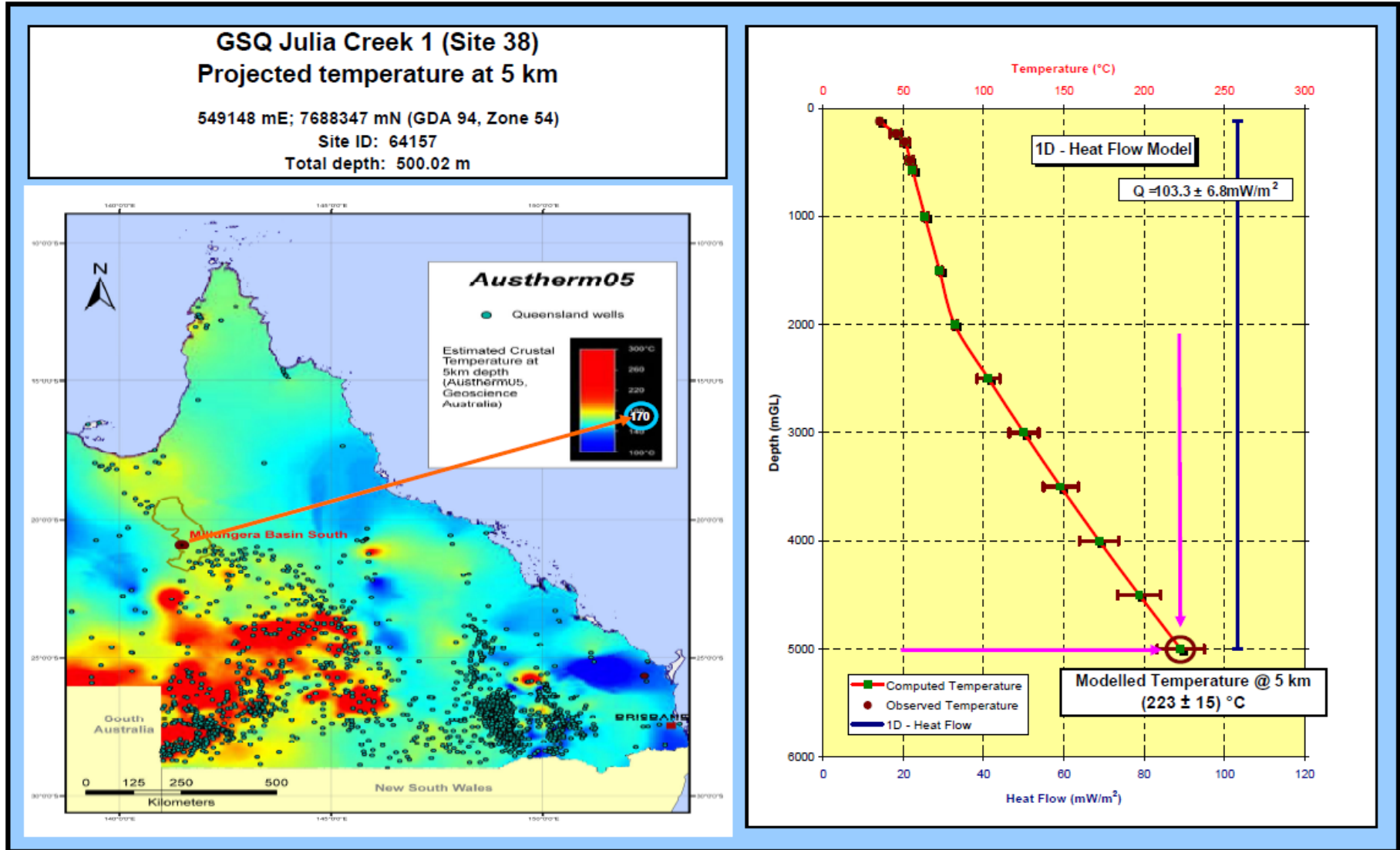
Precision temperature log: 0 - 500.04 m

GSQ Dobbyn 2 (Site 29)		Depth to top of modelled interval (m)		91.50	
Heat Flow: 107.4 ± 1.2 mW/m2		Depth to base of modelled interval (m)		500.04	
Lithology	Top (m)	Conductivity @ 25°C (W/mK)	Uncertainty (W/mK)	Obs. T (°C)	Comp. T (°C)
Mudstone	91.50	1.13	0.04	33.99	33.99
Mudstone	146.60	1.11	0.01	39.59	39.24
Mudstone, Sandstone	226.50	1.10	0.02	46.99	46.99
Sandstone, Quartzite	344.40	7.40	0.22	57.24	58.55
	500.04			61.07	61.07





GSQ Julia Creek 1 – modelled temperature @ 5km





GSQ Julia Creek 1 – Heat Flow Model

GSQ Julia Creek 1 (Site 38)

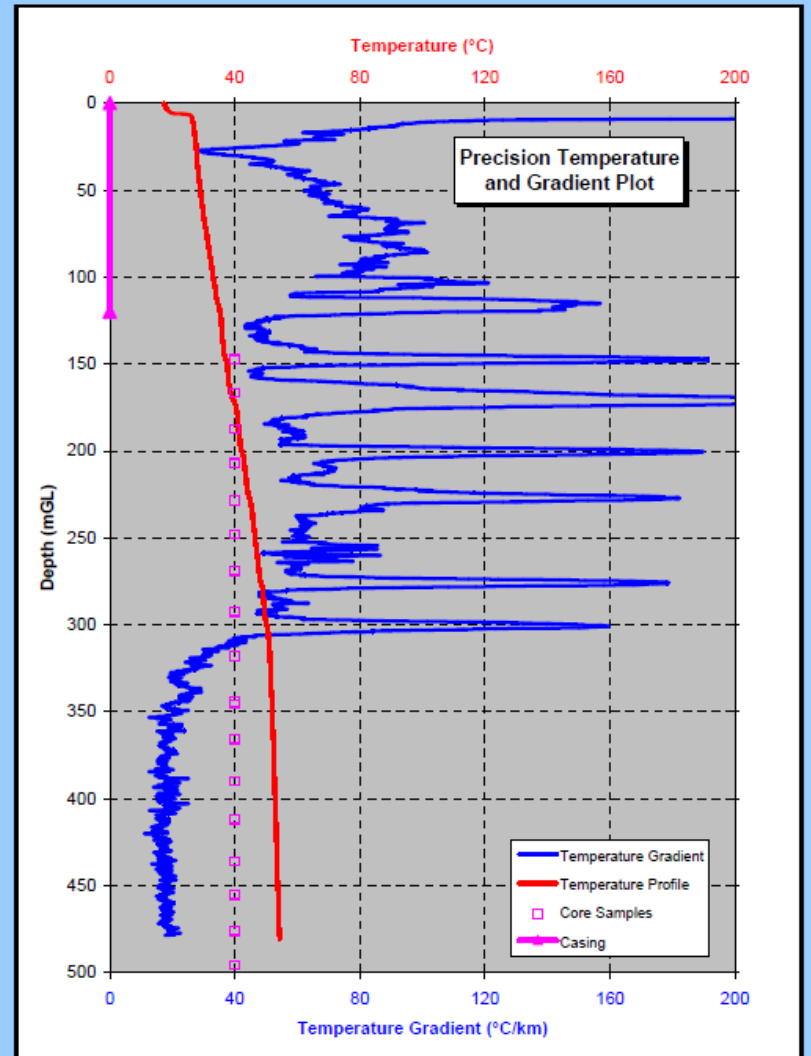
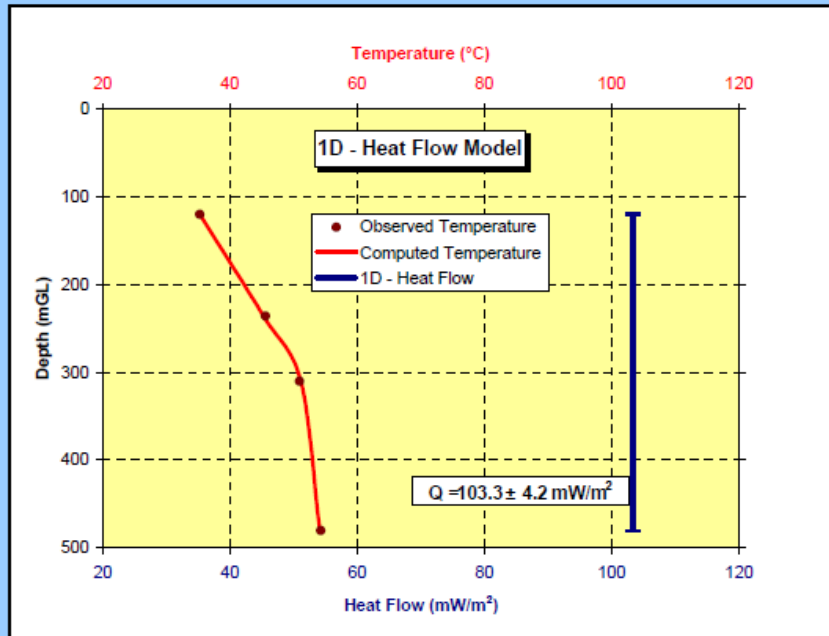
549148 mE; 7688347 mN (GDA 94, Zone 54)

Site ID: 64157

Total depth: 500.02 m

Precision temperature log: 0 - 480.44 m

GSQ Julia Creek 1 (Site 38)		Depth to top of modelled interval (m)		120.10	
Heat Flow: 103.3 ± 4.2 mW/m2		Depth to base of modelled interval (m)		480.44	
Lithology	Top (m)	Conductivity @ 25°C (W/mK)	Uncertainty (W/mK)	Obs. T (°C)	Comp. T (°C)
Mudstone	120.10	1.20	0.09	35.25	35.25
Mudstone	235.85	1.34	0.02	45.57	45.26
Quartzite	310.49	6.40	0.18	50.93	51.12
	480.44			54.28	54.11



Sampling



- SHRIMP dating zircons → • MDA
Awaiting Results

- Palynology → • Age

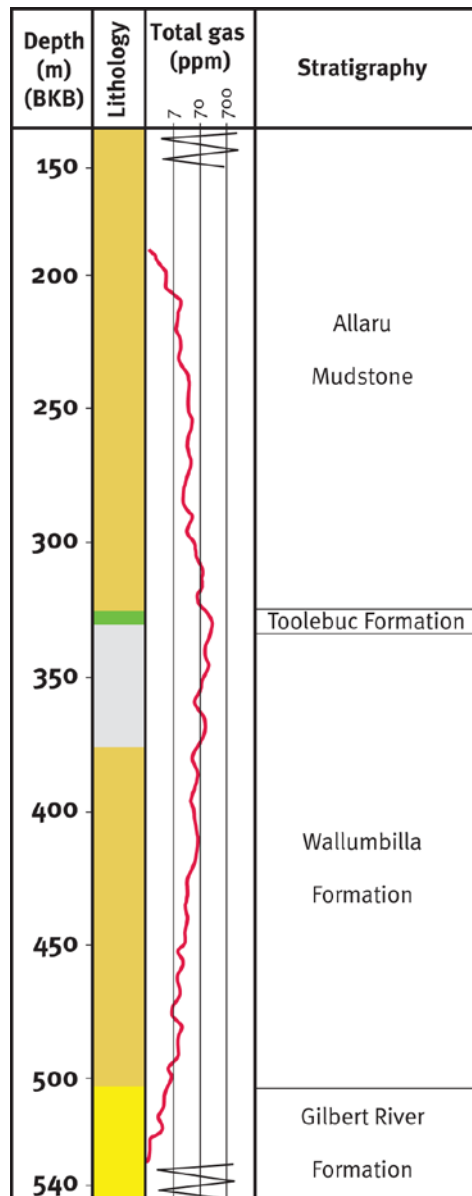
Preliminary Results: All samples appear to be barren of palynomorphs and no organic matter present

- Thin sections → • Composition
- Whole-rock geochemistry → • Permeability and porosity
- Gas desorption & analysis → • Provenance
- → • Alteration

COM Beamsbrook 1



Shale gas potential – Toolebuc Formation



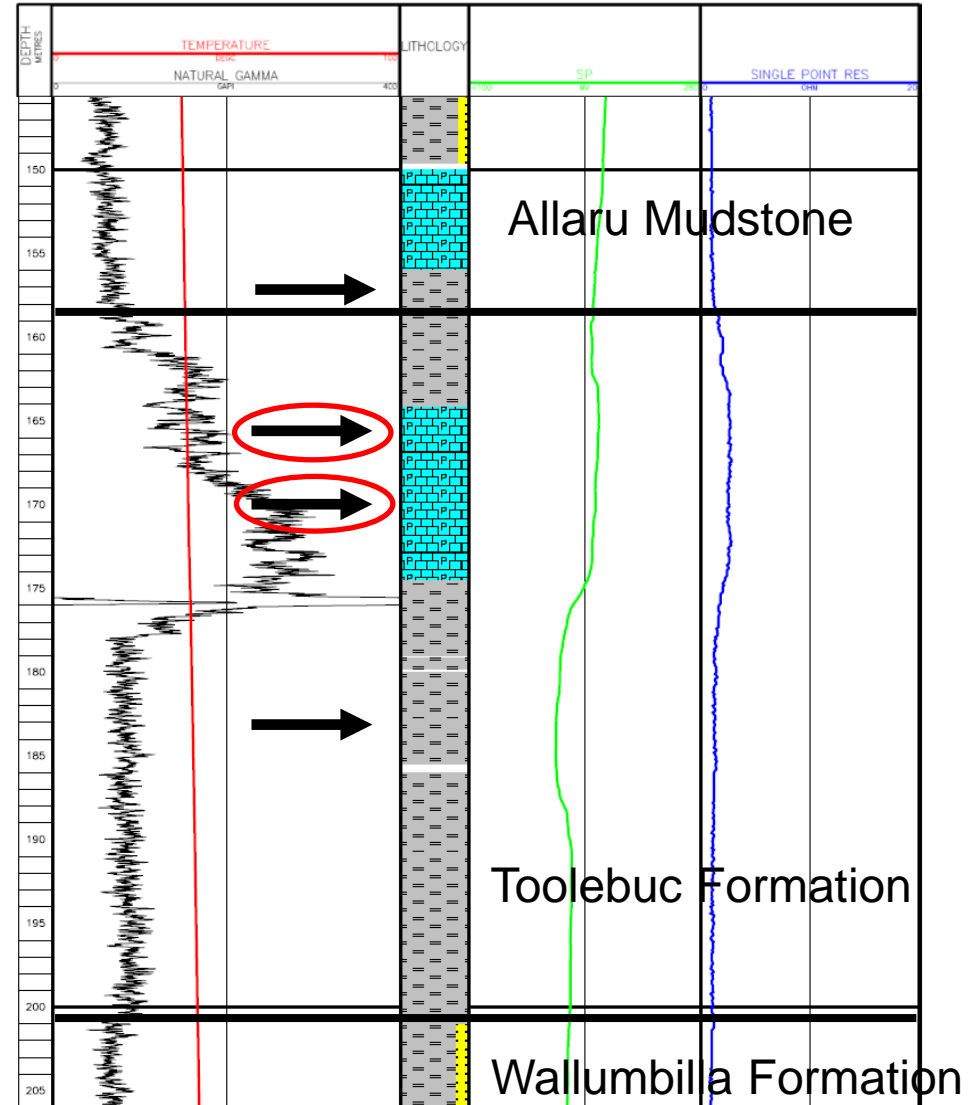
- Gas kicks from mud logs show gas present over Allaru Mudstone - Toolebuc Formation - Wallumbilla Formation interval
- Generation/Source: Toolebuc Formation
- Migrated: Allaru Mudstone and Wallumbilla Formation

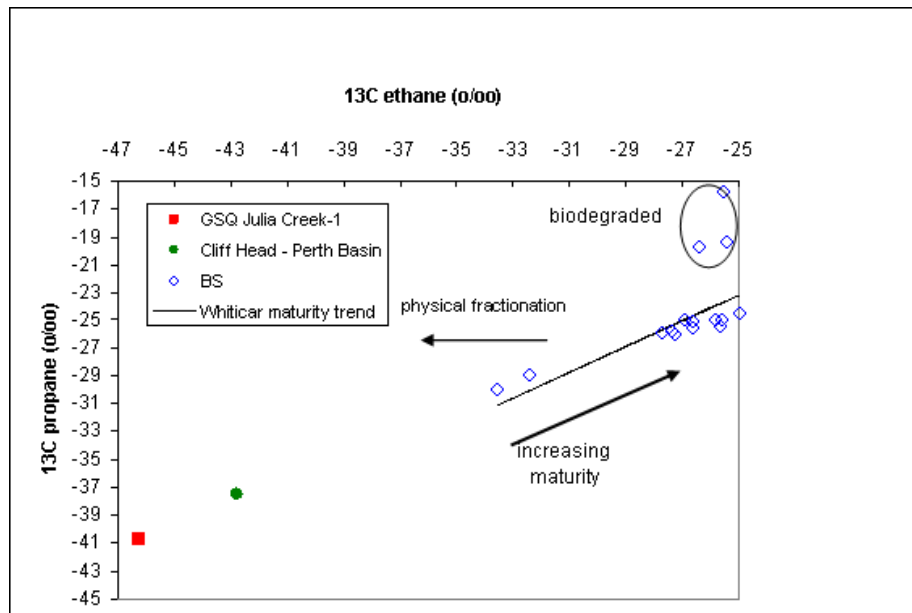
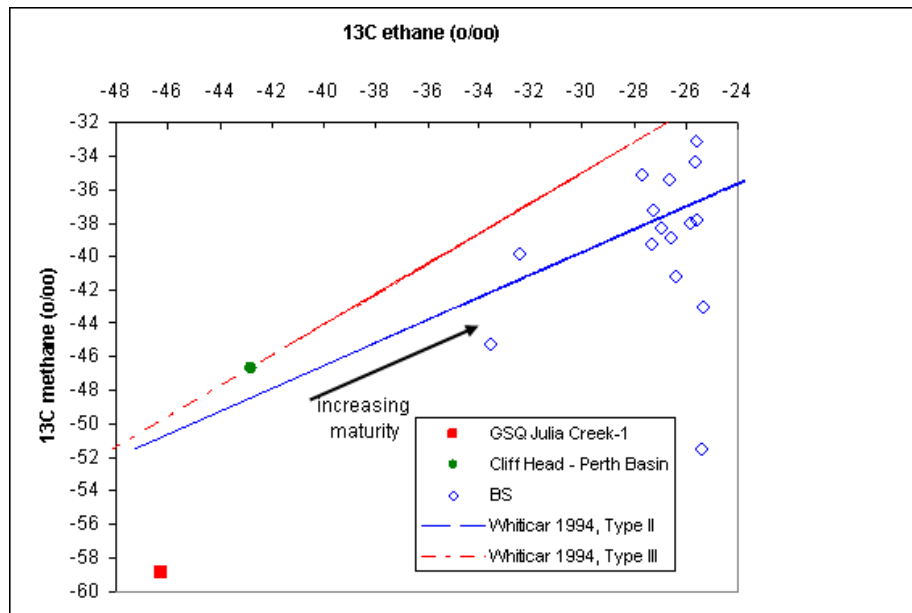
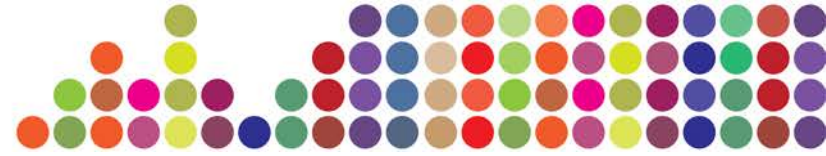
Origin of the gas?
Regional extent?



Shale Gas Potential - Toolebuc Formation

- GSQ Julia Creek 1
- Stage 1:
 - 4 x 0.70m length core samples collected for 1 week gas desorption (Q2)
 - Results:
 - No gas obtained from desorption
- Stage 2:
 - 2x 100g samples from Toolebuc Formation – crushed and purged with argon (Q3)
 - Results:
 - ~40ml gas liberated from each sample and collected





- Stage 3:
 - Analysis
 - Gas chromatography and GC-IRMS
 - Dr Chris Boreham, Geoscience Australia

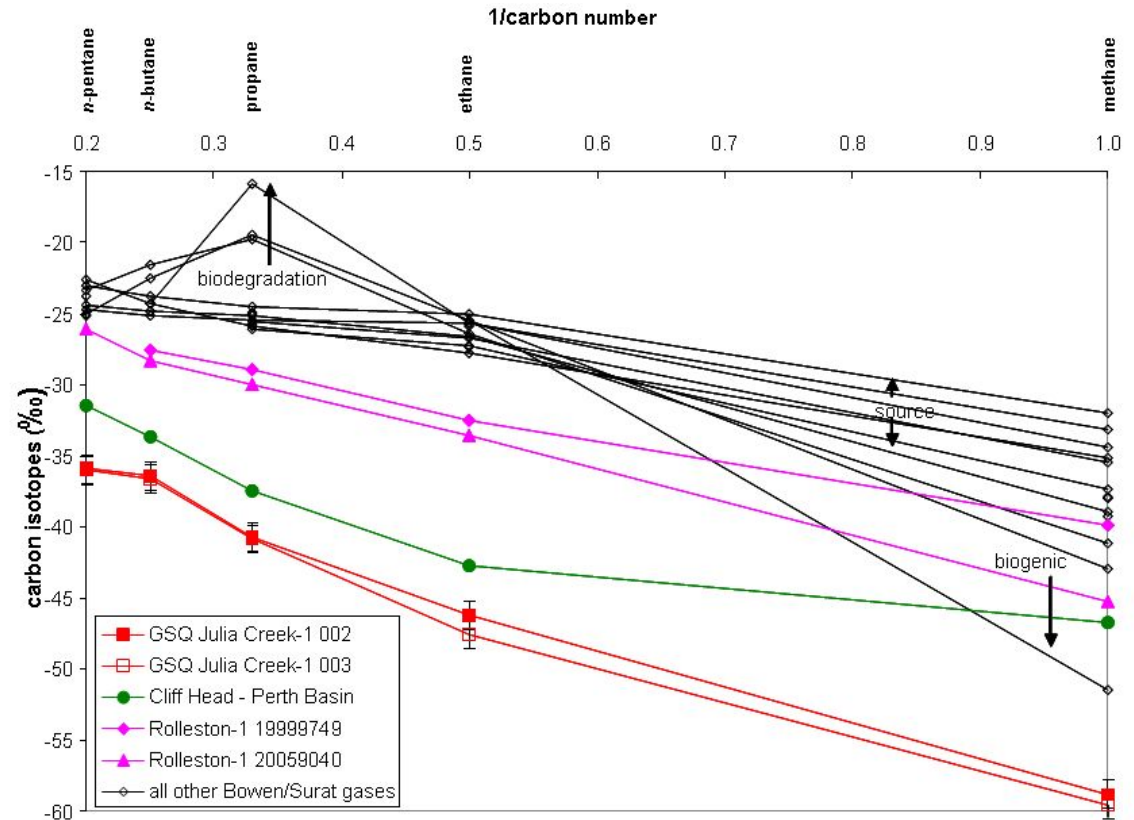
- Preliminary Results
 - carbon isotope ratios are consistent with a very **immature thermogenic gas**

Unpublished data courtesy of Dr Chris Boreham, Geoscience Australia



Shale Gas Potential - Toolebuc Formation

- Results cont
 - Single (early thermogenic) source with little to no biogenic component



Unpublished data courtesy of Dr Chris Boreham, Geoscience Australia



Shale Gas Potential - Toolebuc Formation

Gas migrated into Allaru Mudstone?

Or

Derived within Allaru Mudstone?

Origin of gas?

And

Regional extent?

GSQ Julia Creek 1

- Compositional analysis results of gas liberated from 100g (Q3) crush sample from Allaru Mudstone

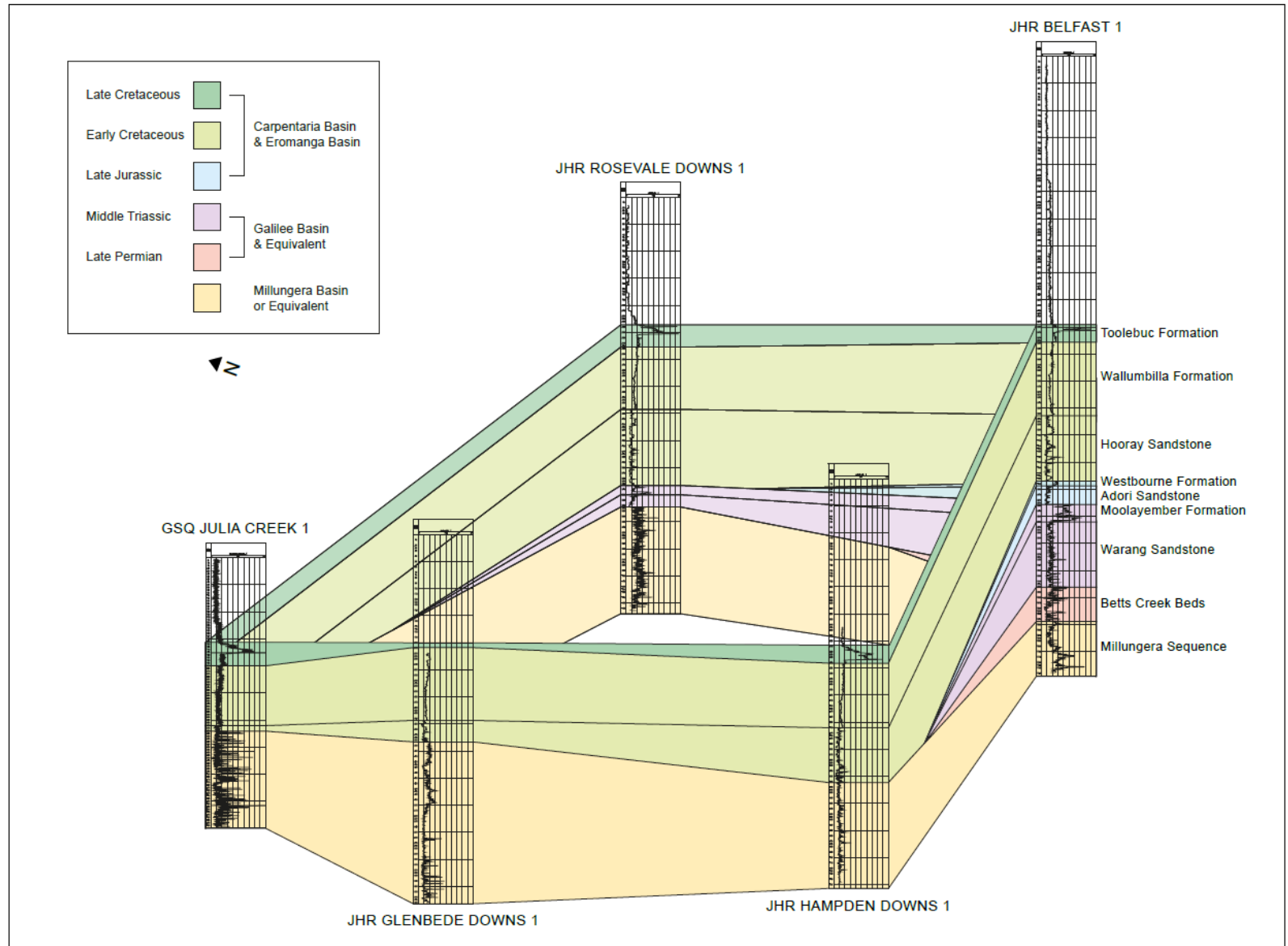
No results: hydrocarbon concentration below detection limit

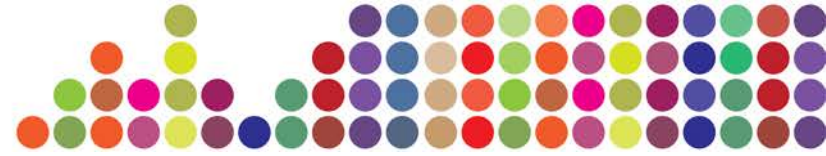
GSQ Dobbryn 2

- Awaiting results from 2x 0.70m core samples from Toolebuc Formation and analysis
 - 1 week gas desorption (Q2)
 - crush 100g (Q3)



Regional Correlation - Box Diagram



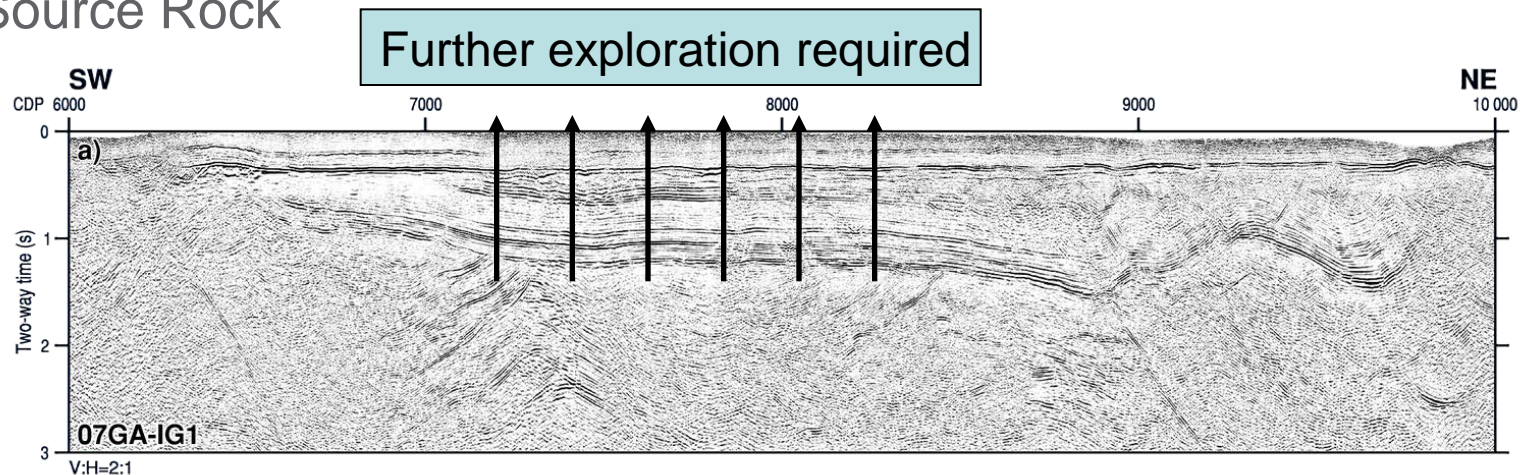


Millungera Basin

- ✓ Sequence 2 = quartzose sandstone with minor siltstone, and clay bands
- ✓ Porosity and permeability over some intervals
- ✓ Potential for suitable reservoir rocks
- ✓ Potential shallow regional shale gas resource
- ✓ Potential geothermal energy resource
- ? Age
- ? Source Rock

Core is available for viewing at Exploration Data Centre, Zillmere

Contact: 07 3863 8710





Thank you



GSQ Dobbyn 2