Mineral prospectivity analysis of the Wagga-Omeo Belt, NSW

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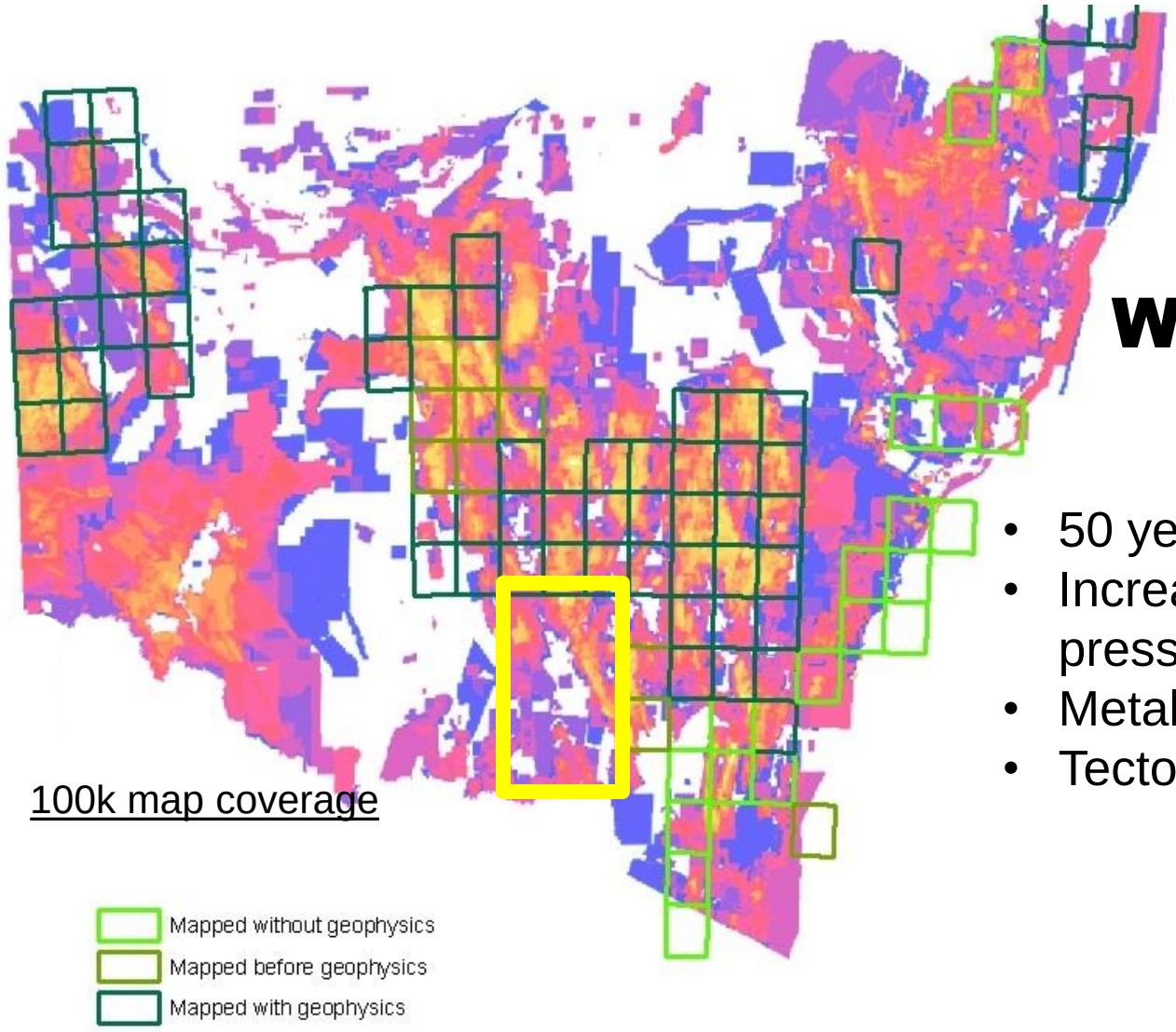
Geological Survey of NSW

Antony Mamuse & Pietro Guj
Centre for Exploration Targeting, Perth

Exploration activity since ~1970

Not much **Lots**



Why Wagga Wagga?

- 50 year old maps
- Increasing Land Use pressure
- Metal potential
- Tectonic questions

Wagga Wagga Mapping

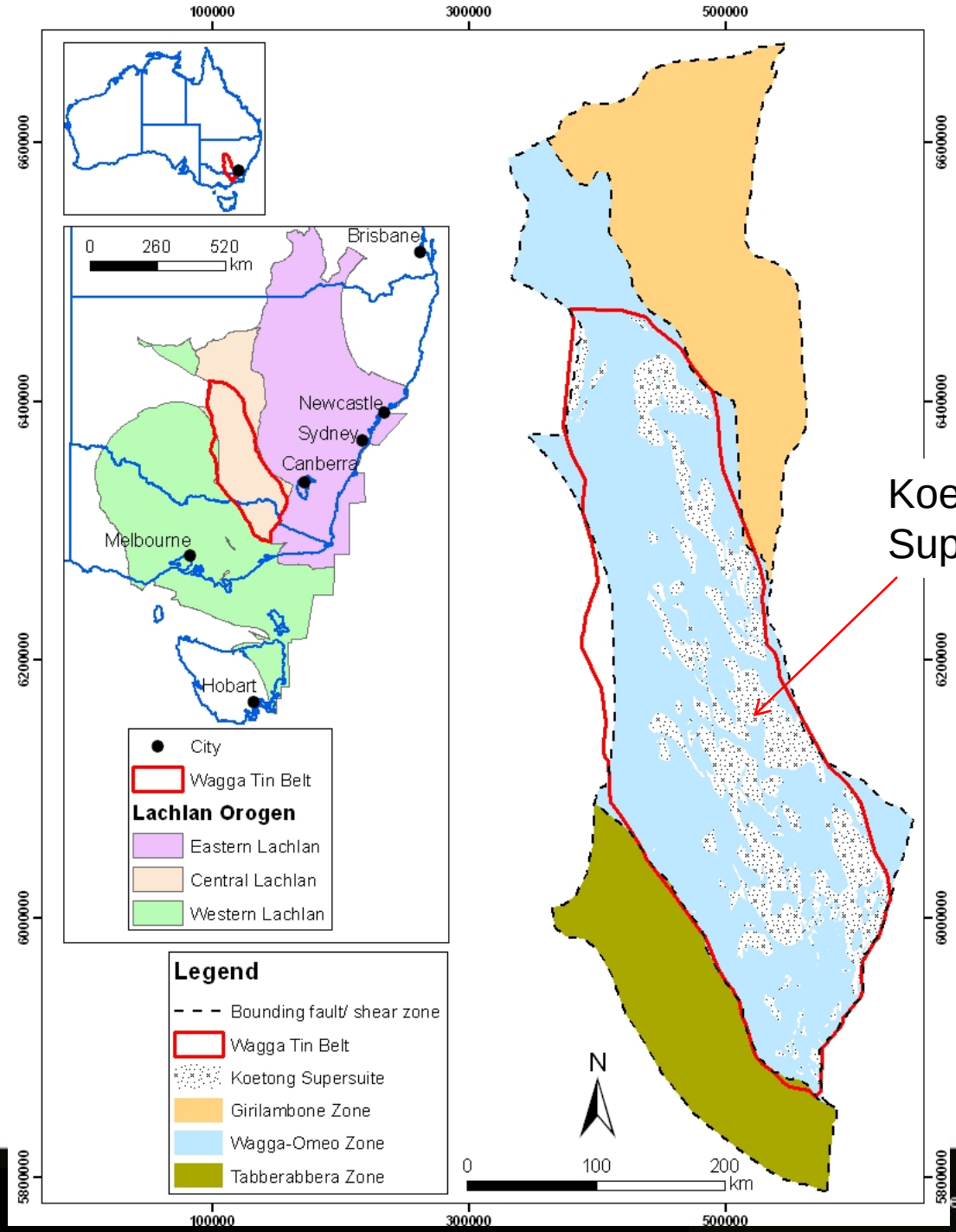
- Tin prospectivity analysis;
- hydrogeochemistry;
- Aster study;
- Radioelement re-processing;
- <2x2 km gravity;

Trade & Investment Resources & Energy

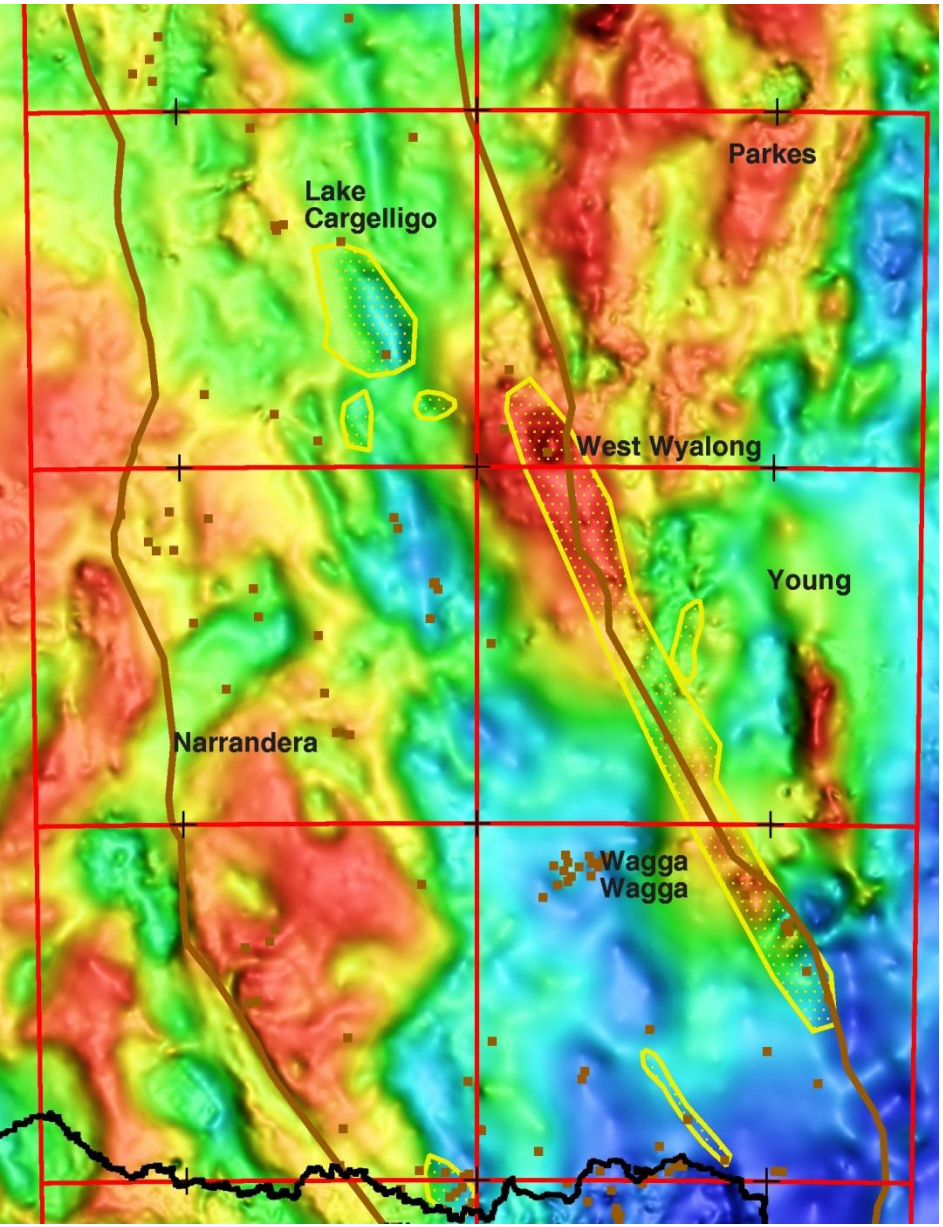
new frontiers new south wales

Location and generalised geology

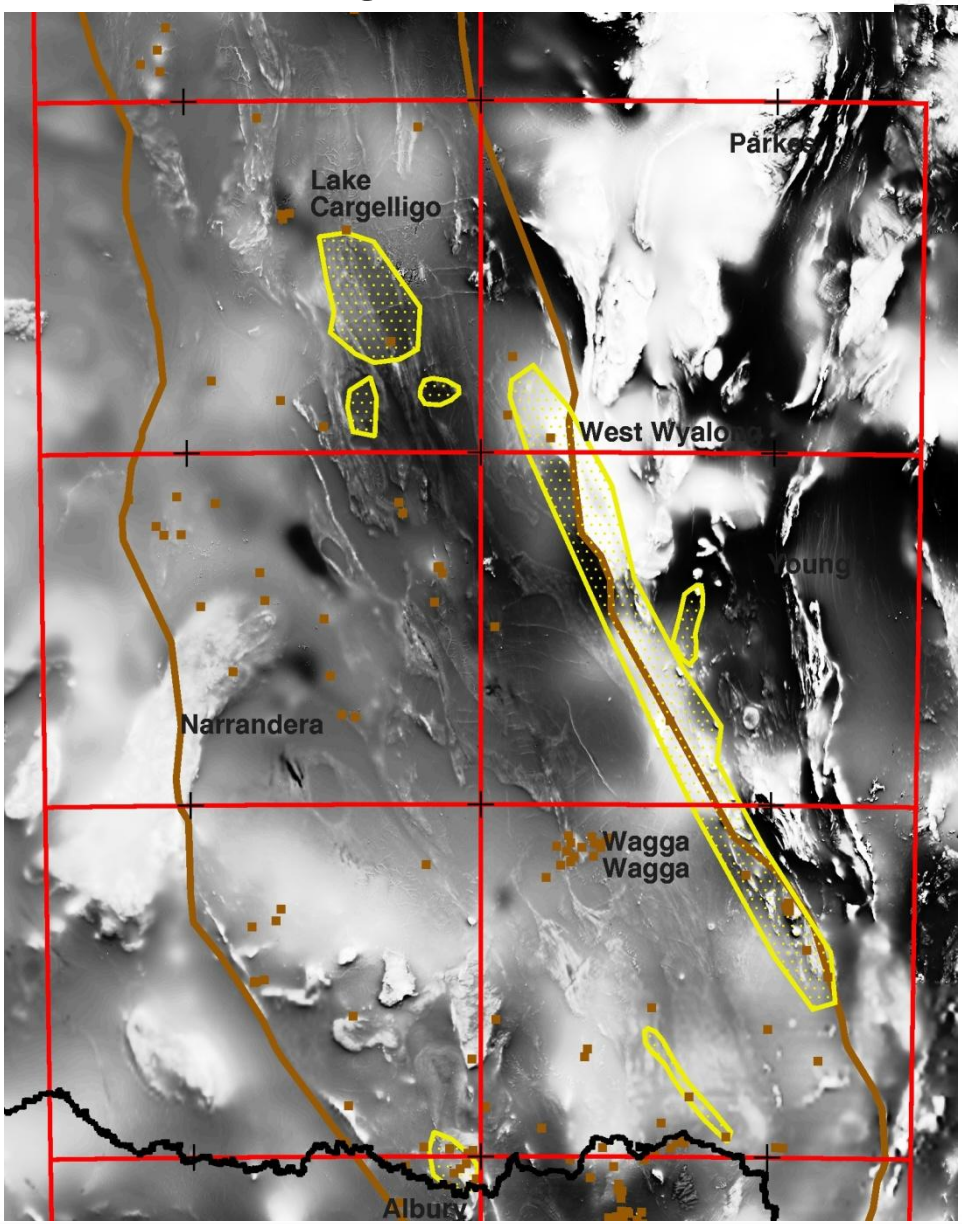
(report available at booth/DIGS GS 2013-0833)

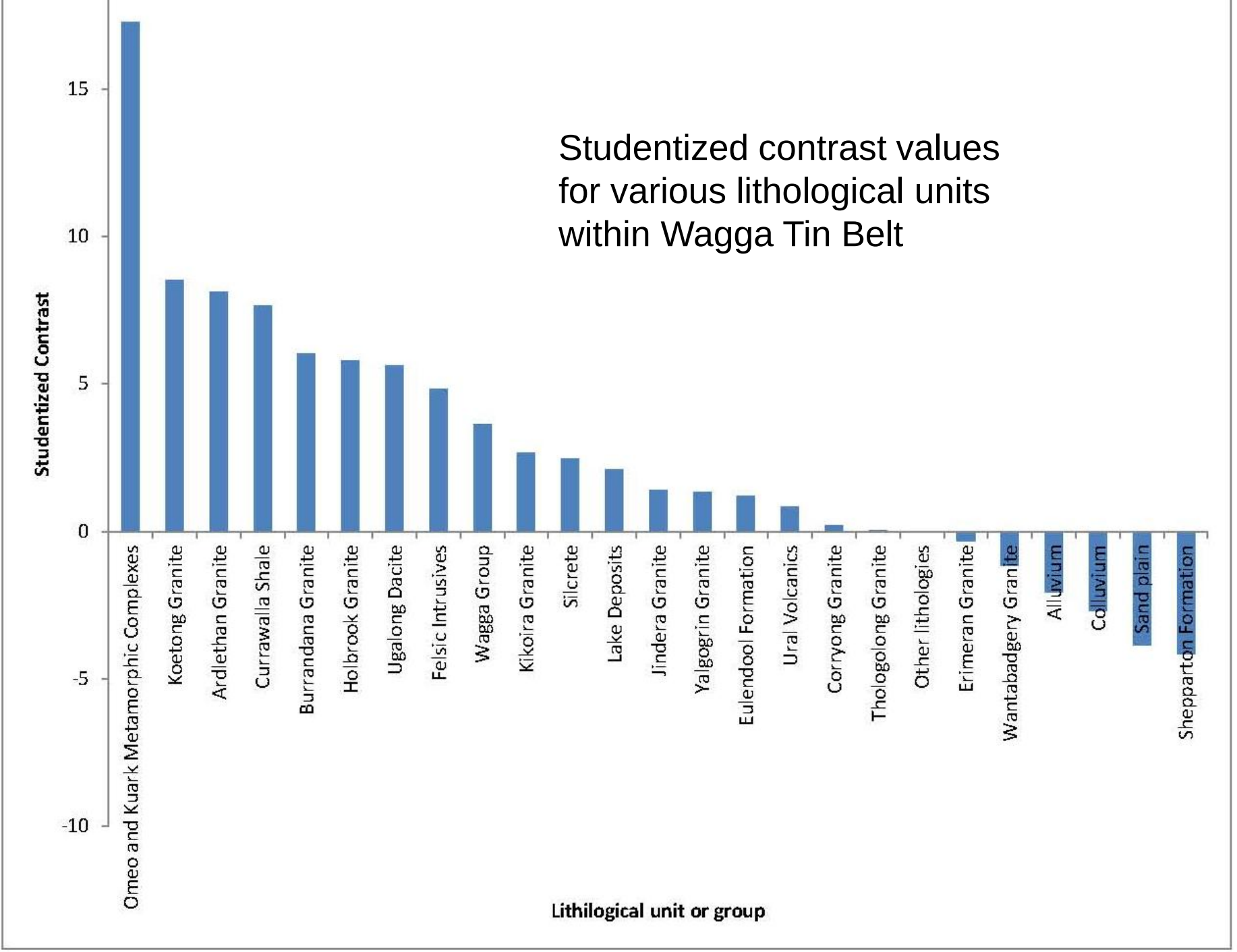


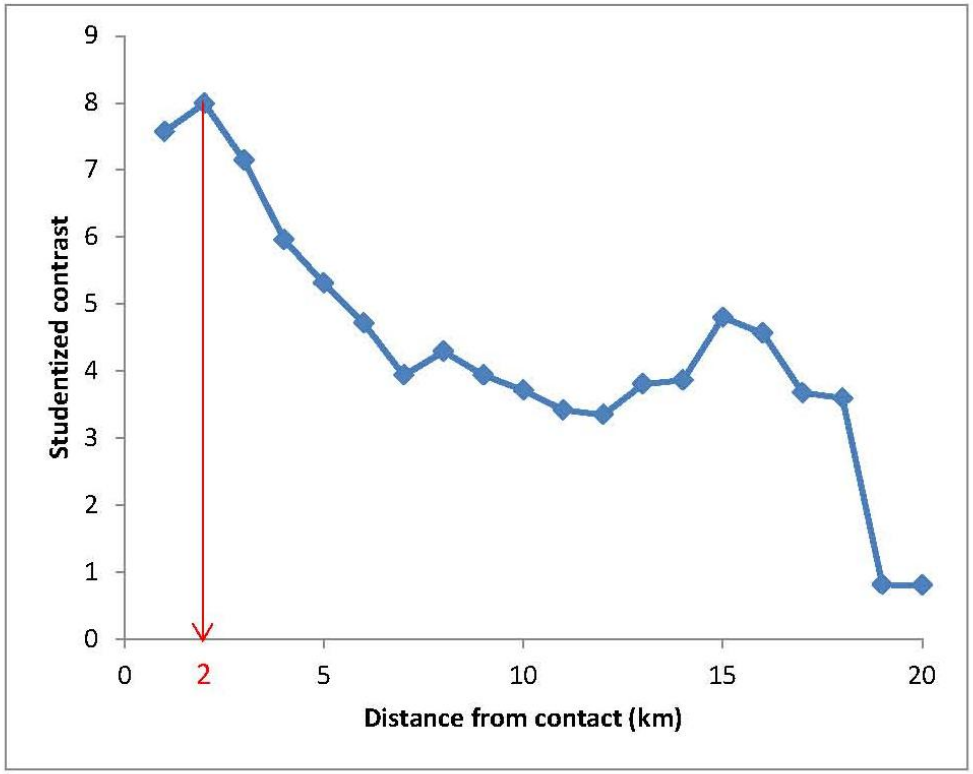
Gravity Data (Pre-2013)

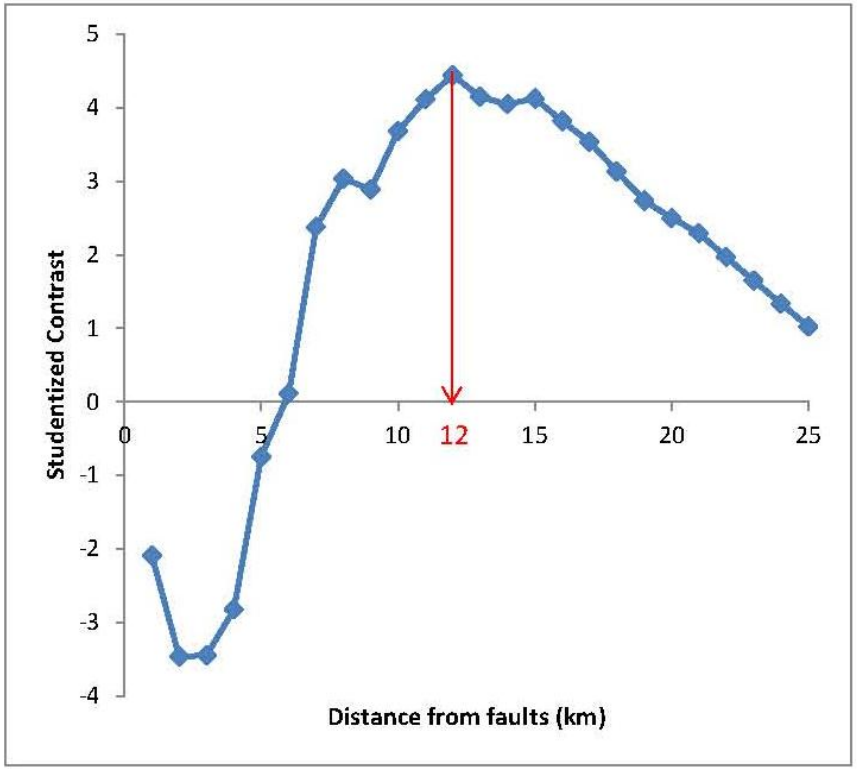


Magnetic Data

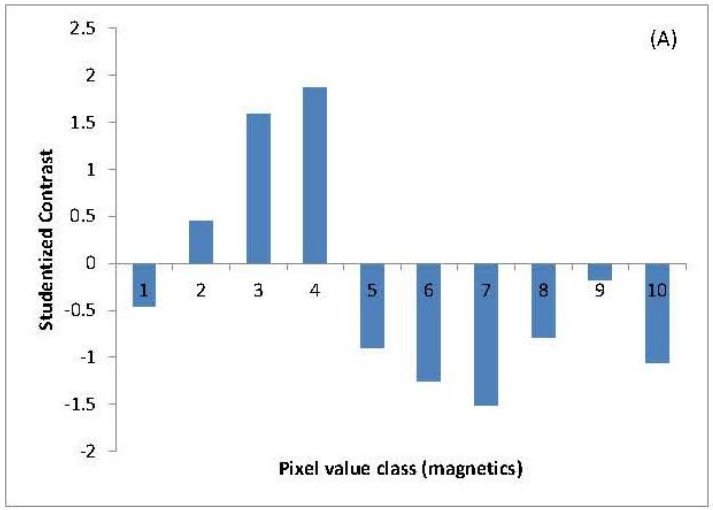


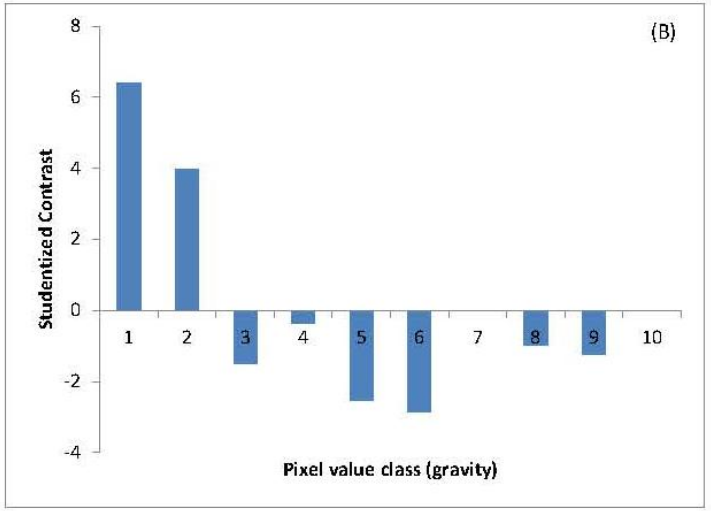

Studentized contrast values for various lithological units within Wagga Tin Belt
Studentized Contrast
15
10
5
0
-5
-10
Omeo and Kuark Metamorphic Complexes
Koetong Granite
Ardlethan Granite
Currawalla Shale
Burrandana Granite
Holbrook Granite
Ugalong Dacite
Felsic Intrusives
Wagga Group
Kikoira Granite
Silcrete
Lake Deposits
Jindera Granite
Yalgogrin Granite
Eulendool Formation
Ural Volcanics
Corryong Granite
Thologolong Granite
Other lithologies
Erimeran Granite
Wantabadgery Granite
Alluvium
Colluvium
Sand plain
Shepparton Formation
Lithilogical unit or group

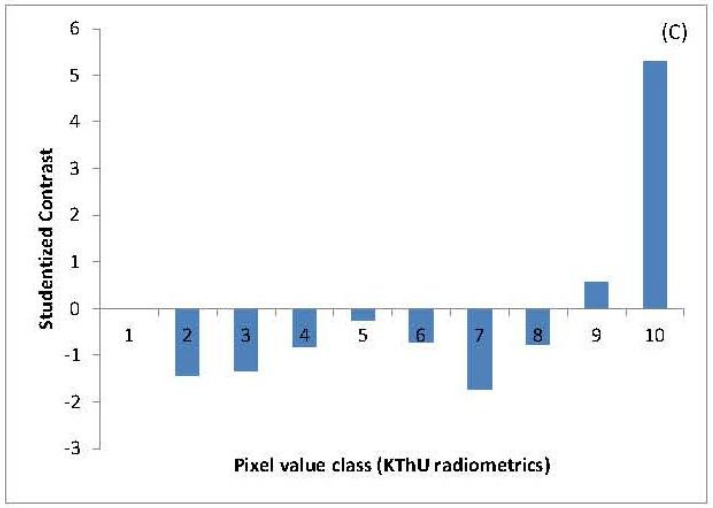

Studentized contrast
Distance from contact (km)
0
2
5
10
15
20

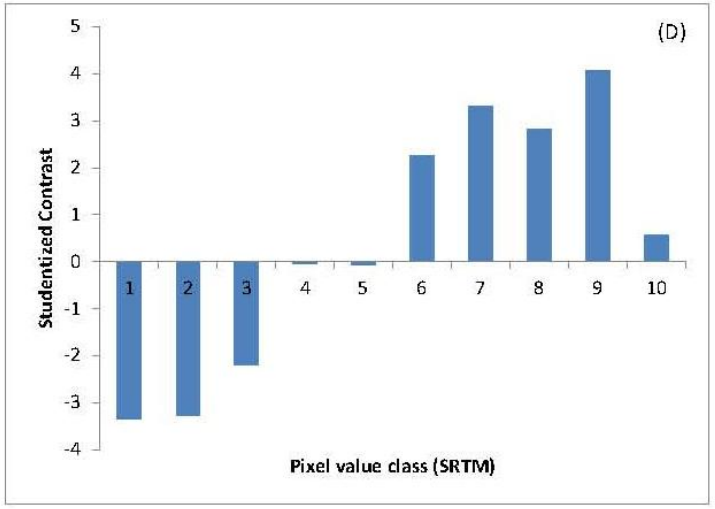

Studentized Contrast
Distance from faults (km)
0
5
10
12
15
20
25

Studentized contrasts values for (A) magnetic, (B) gravity, (C) radiometric and (D) SRTM elevation datasets used in this study



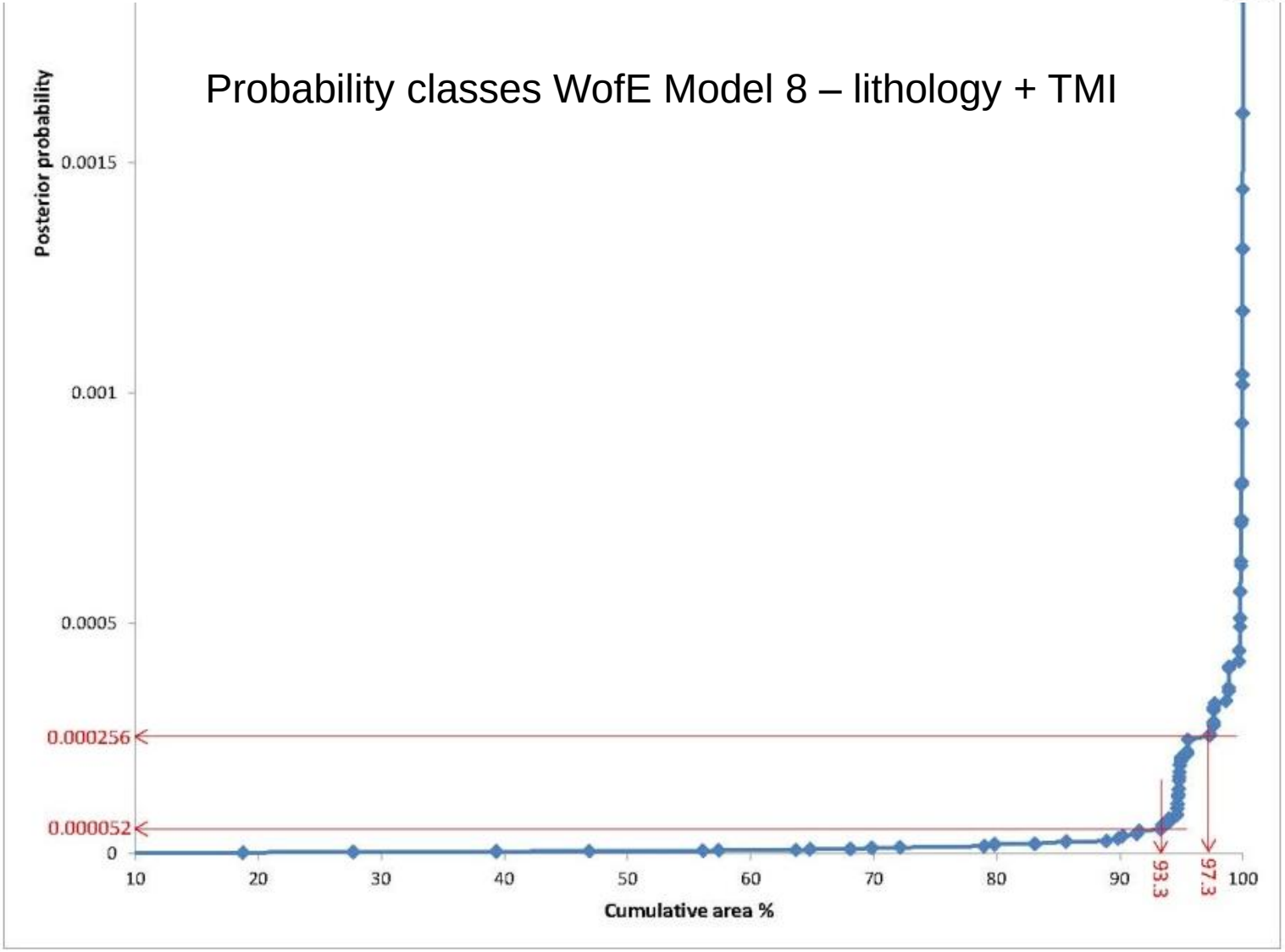


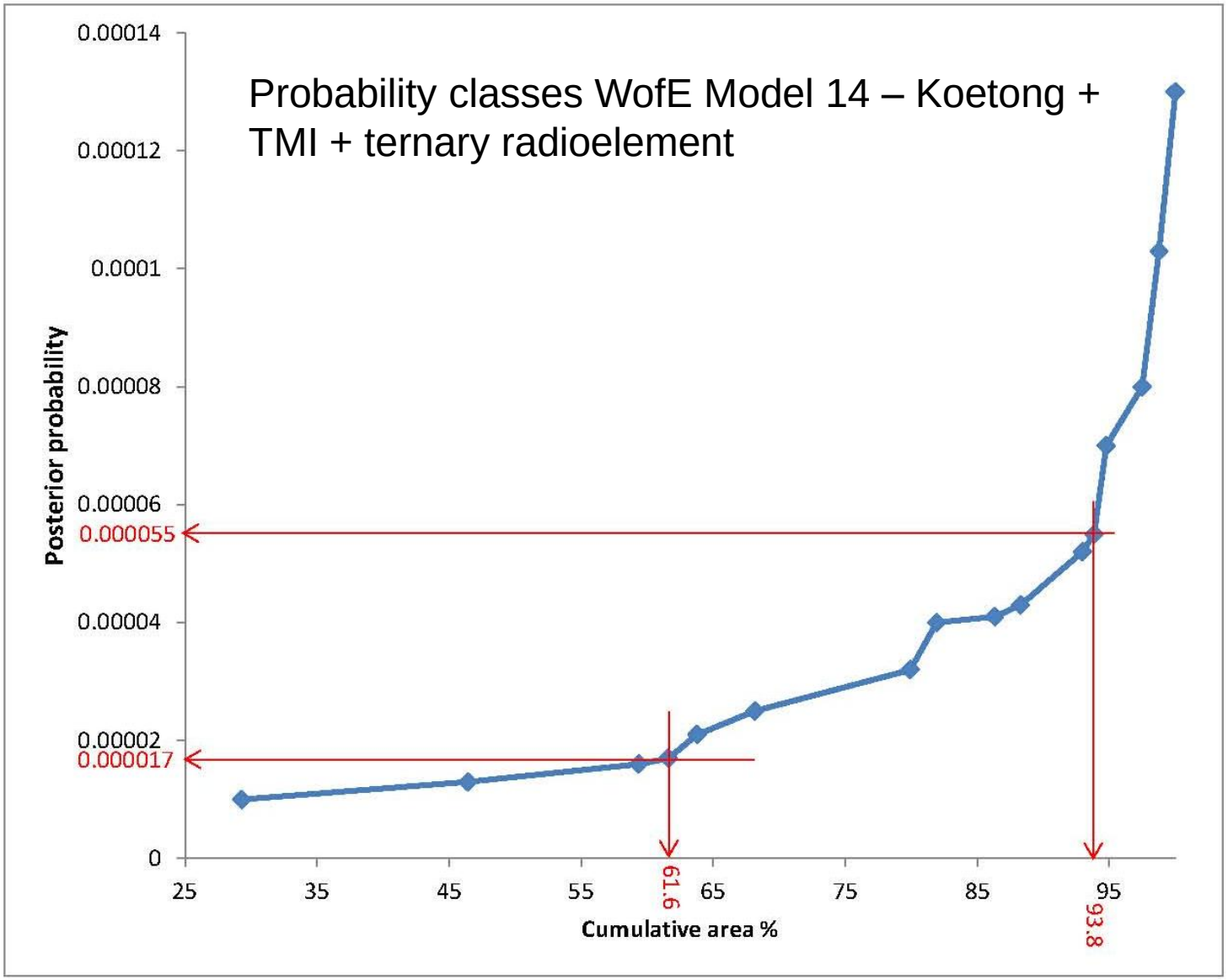


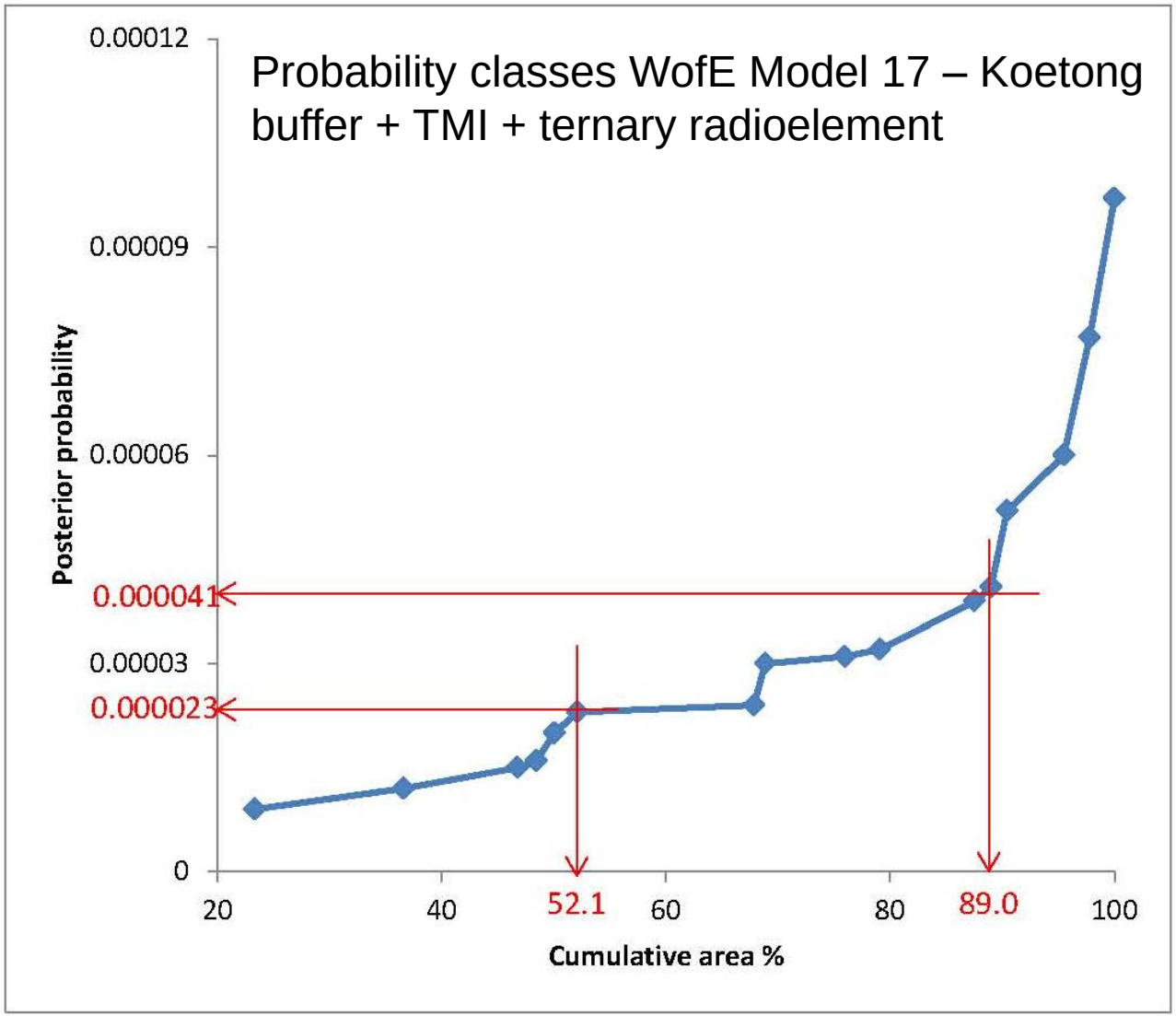


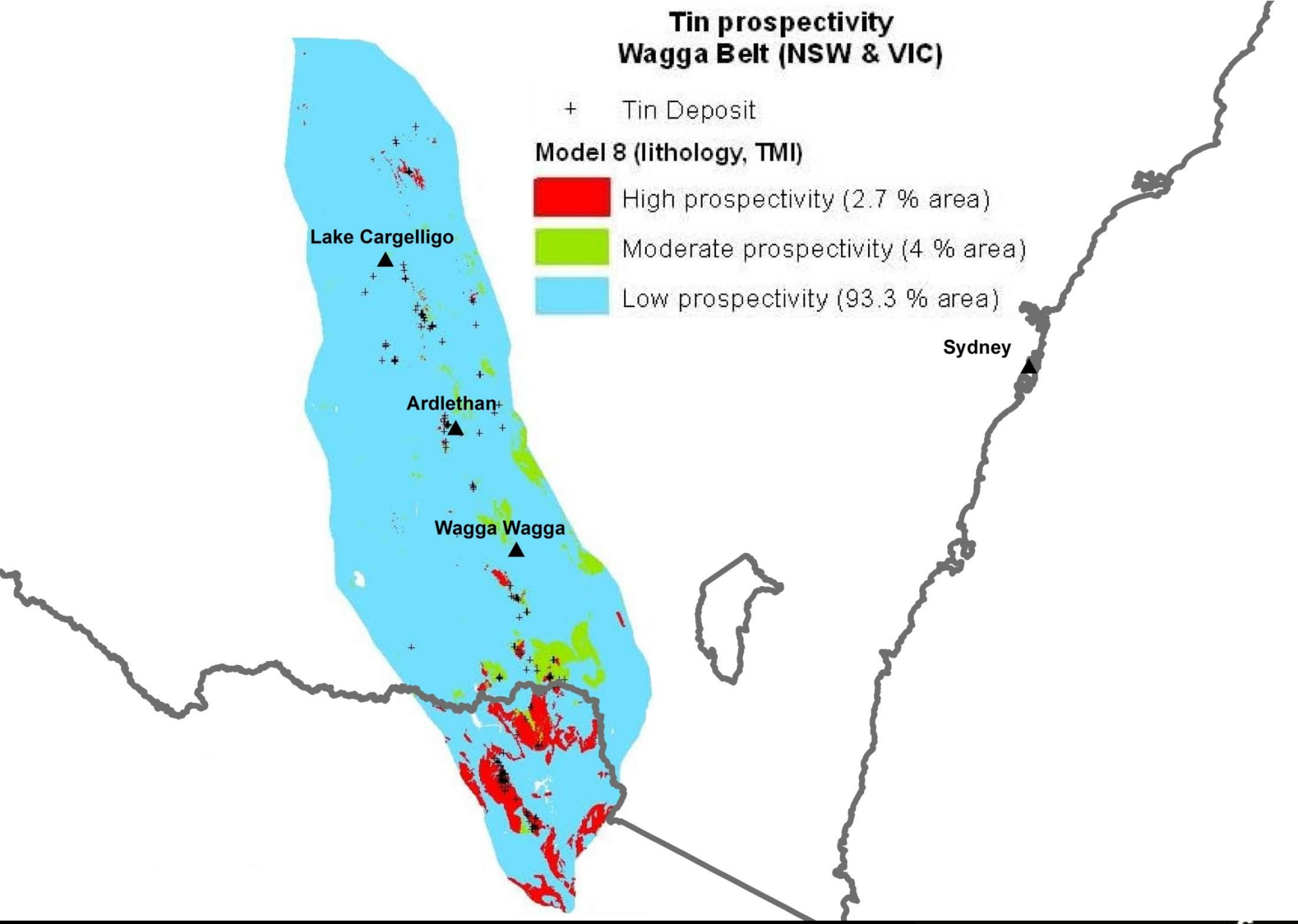
Model	Input themes	CI ratio	Agterberg-Cheng CI (%)	Overall CI (%)
1	Lithology Koetong Faults Magnetics Gravity Radiometric K-Th-U SRTM	0.47	100	0
2	Lithology Koetong Magnetics Gravity SRTM	0.61	100	0
3	Lithology Magnetics Radiometric K-Th-U	0.95	88.7	22.6
4	Lithology Faults Magnetics	0.9	95.6	8.8
5	Lithology Gravity Radiometric K-Th-U	0.84	99.8	0.3
6	Lithology Koetong Magnetics	0.92	95.9	8.2
7	Lithology Radiometric K-Th-U SRTM	0.95	80.2	39.6
8	Lithology Magnetics	1.0	47.0	94.0
9	Lithology Magnetics Gravity	0.88	98.9	2.3
10	Lithology Magnetics Radiometric K-Th-U	0.95	88.7	22.6
11	Magnetics Radiometric K-Th-U SRTM	0.1	100	0
12	Koetong Gravity Radiometric K-Th-U	0.94	81.5	36.9
13	Koetong Magnetics Gravity	0.93	84.5	31.1
14	Koetong contacts Magnetics Radiometric K-Th-U	1.01	40.5	81.1
15	Koetong Magnetics Radiometric K-Th-U	0.98	68.2	63.3
16	Koetong Magnetics SRTM	0.10	100	0
17	Koetong buffer Magnetics Radiometric K-Th-U	1.00	49.3	98.6

Probability classes WofE Model 8 – lithology + TMI

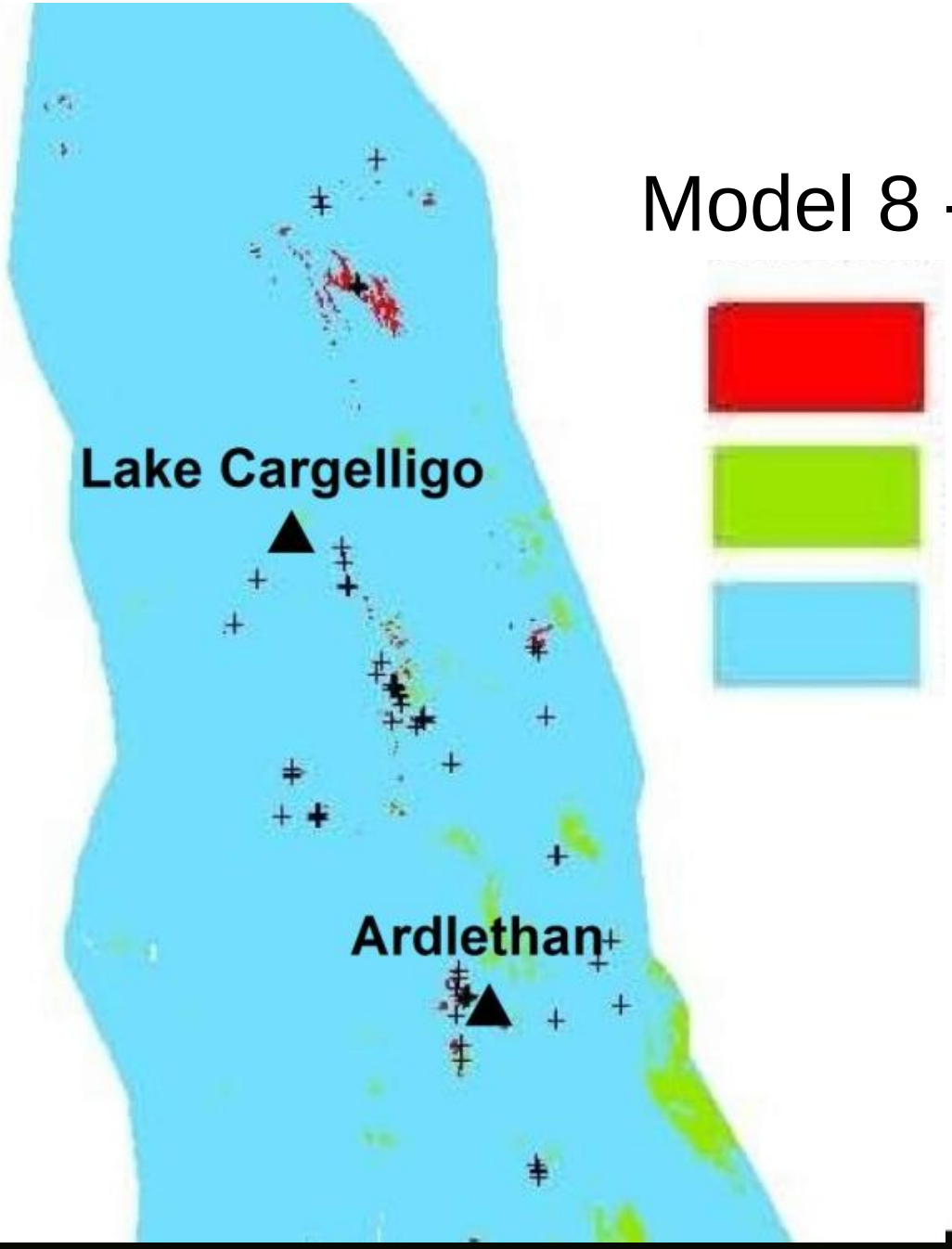



Probability classes WofE Model 14 – Koetong + TMI + ternary radioelement
Posterior probability
0.00014
0.00012
0.0001
0.00008
0.00006
0.000055
0.00004
0.00002
0.000017
0
25
35
45
55
61.6
65
75
85
95
93.8
Cumulative area %


Probability classes WofE Model 17 – Koetong buffer + TMI + ternary radioelement
0.00012
0.00009
0.00006
0.000041
0.00003
0.000023
0
Posterior probability
20
40
52.1
60
80
89.0
100
Cumulative area %


Tin prospectivity
Wagga Belt (NSW & VIC)
+ Tin Deposit
Model 8 (lithology, TMI)
High prospectivity (2.7 % area)
Moderate prospectivity (4 % area)
Low prospectivity (93.3 % area)
Lake Cargelligo
Ardlethan
Wagga Wagga
Sydney

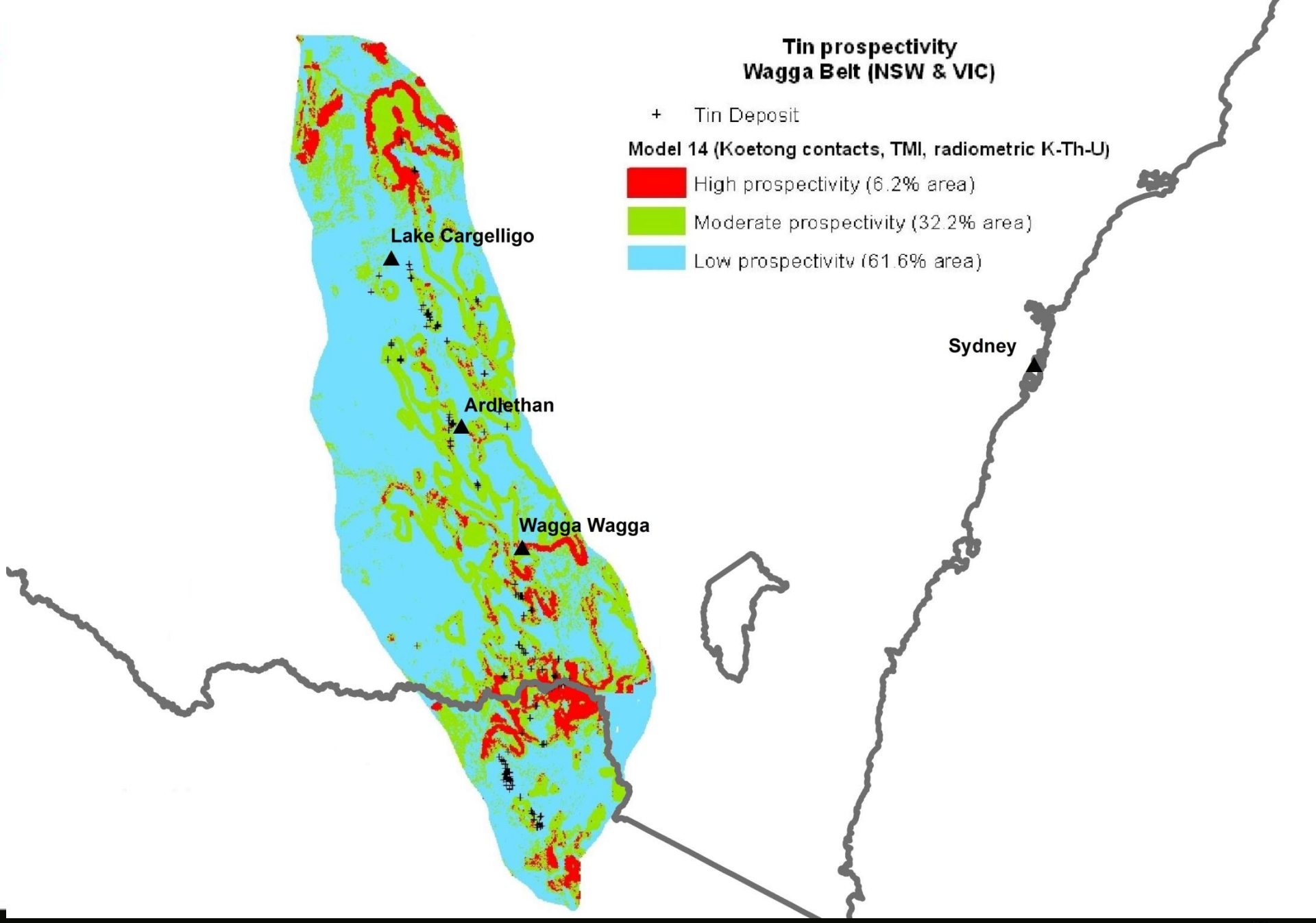
Model 8 - lithology & TMI

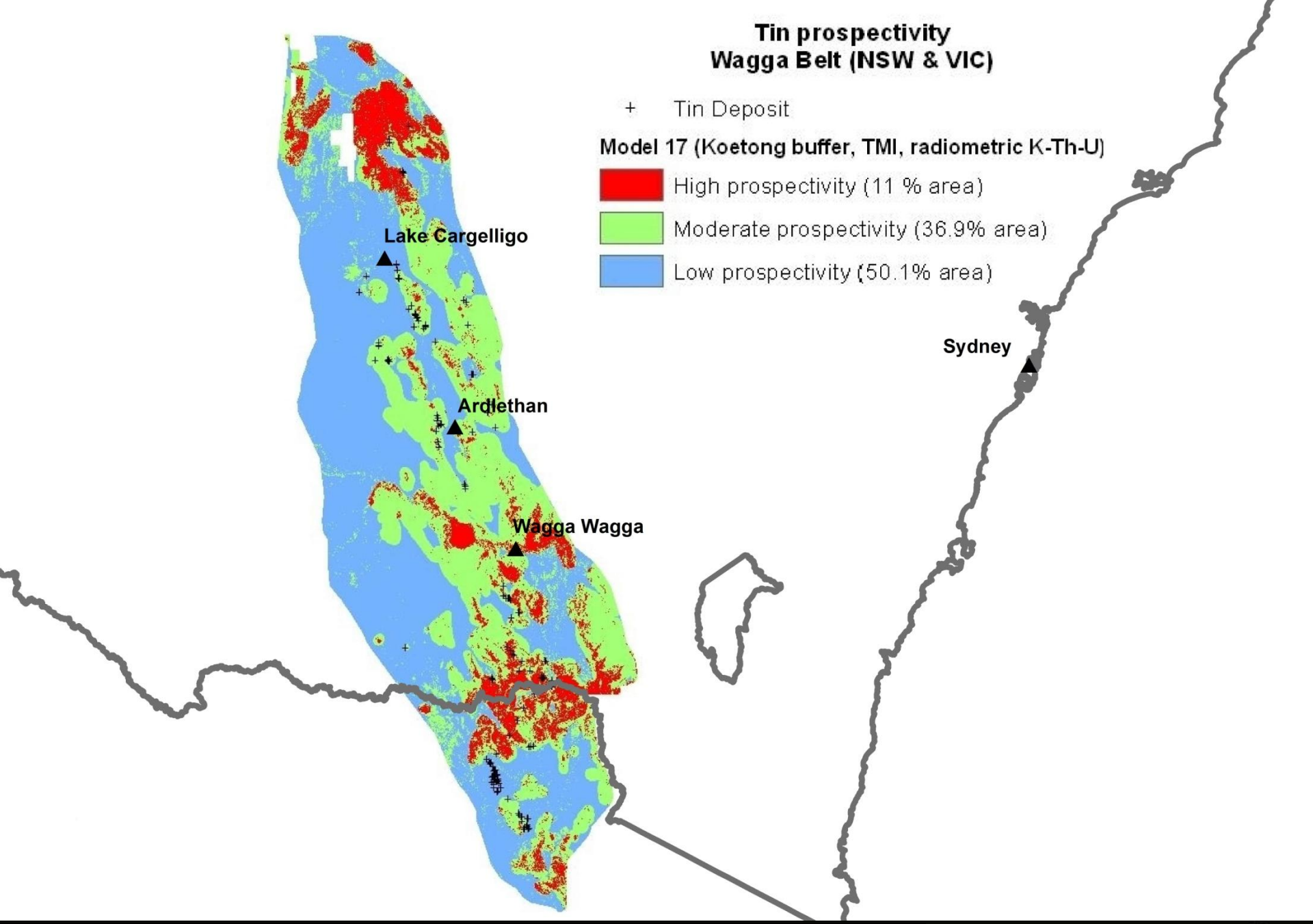


High 2.7% of area

Moderate 4% of area

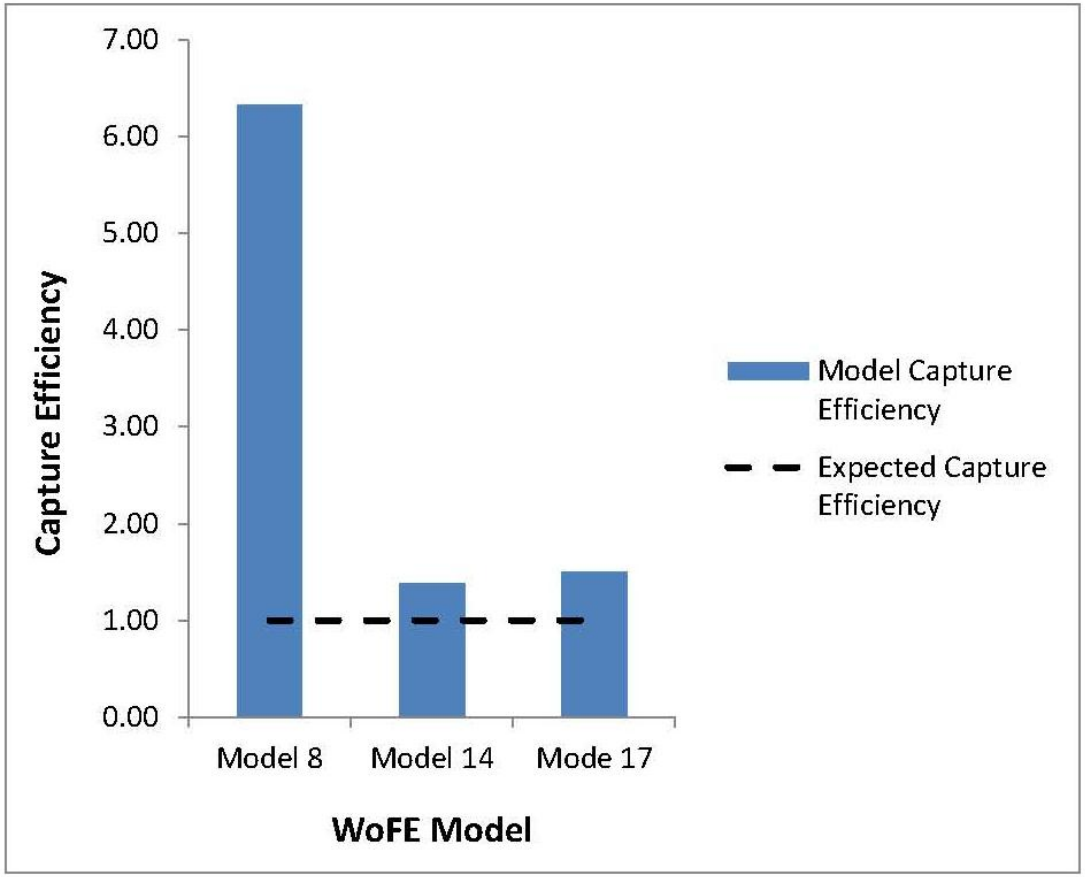
Low 93.3% of area

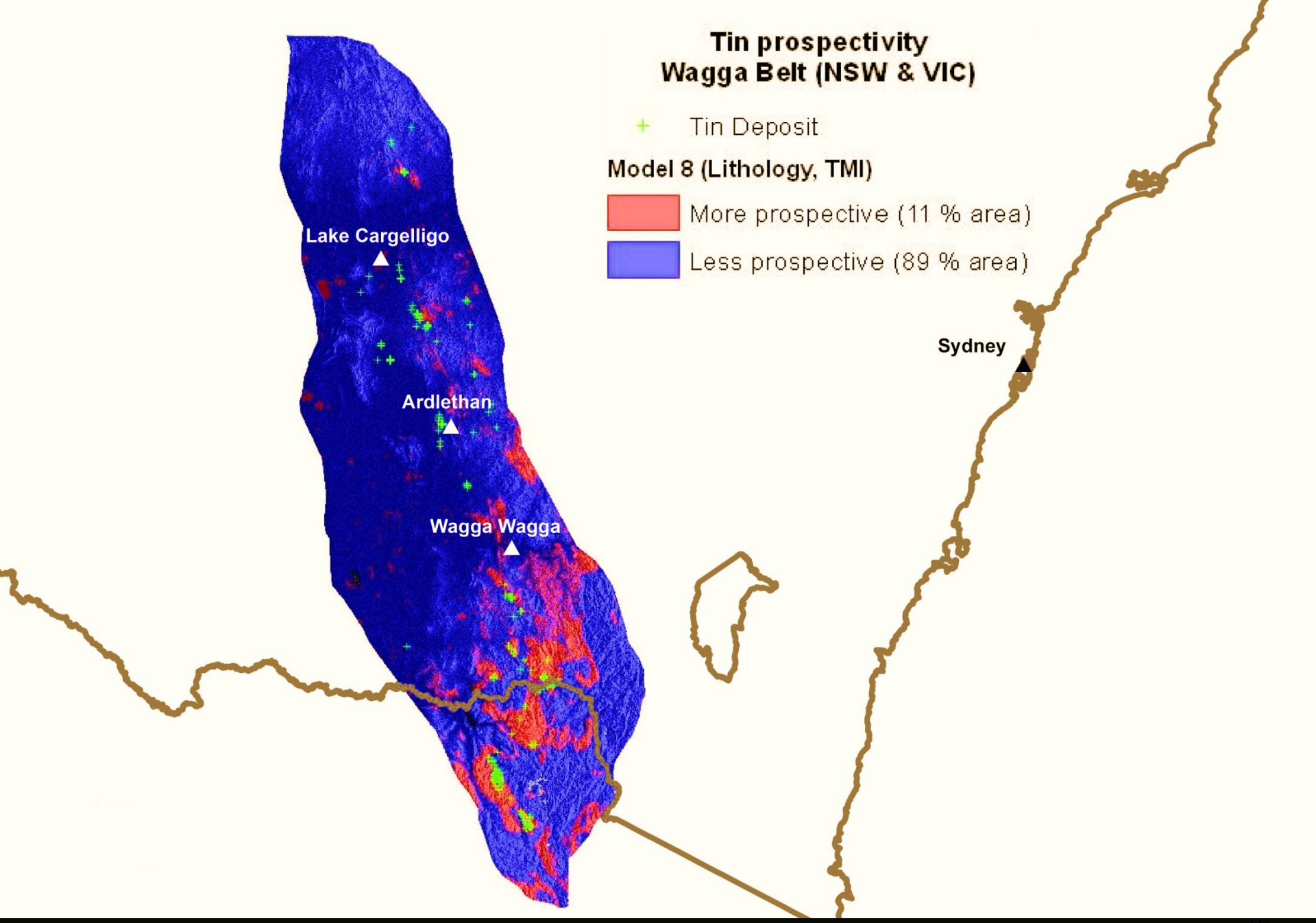

Tin prospectivity
Wagga Belt (NSW & VIC)
+ Tin Deposit
Model 14 (Koetong contacts, TMI, radiometric K-Th-U)
High prospectivity (6.2% area)
Moderate prospectivity (32.2% area)
Low prospectivity (61.6% area)
Lake Cargelligo
Ardlethan
Wagga Wagga
Sydney


Tin prospectivity
Wagga Belt (NSW & VIC)
+ Tin Deposit
Model 17 (Koetong buffer, TMI, radiometric K-Th-U)
High prospectivity (11 % area)
Moderate prospectivity (36.9% area)
Low prospectivity (50.1% area)
Lake Cargelligo
Ardlethan
Wagga Wagga
Sydney

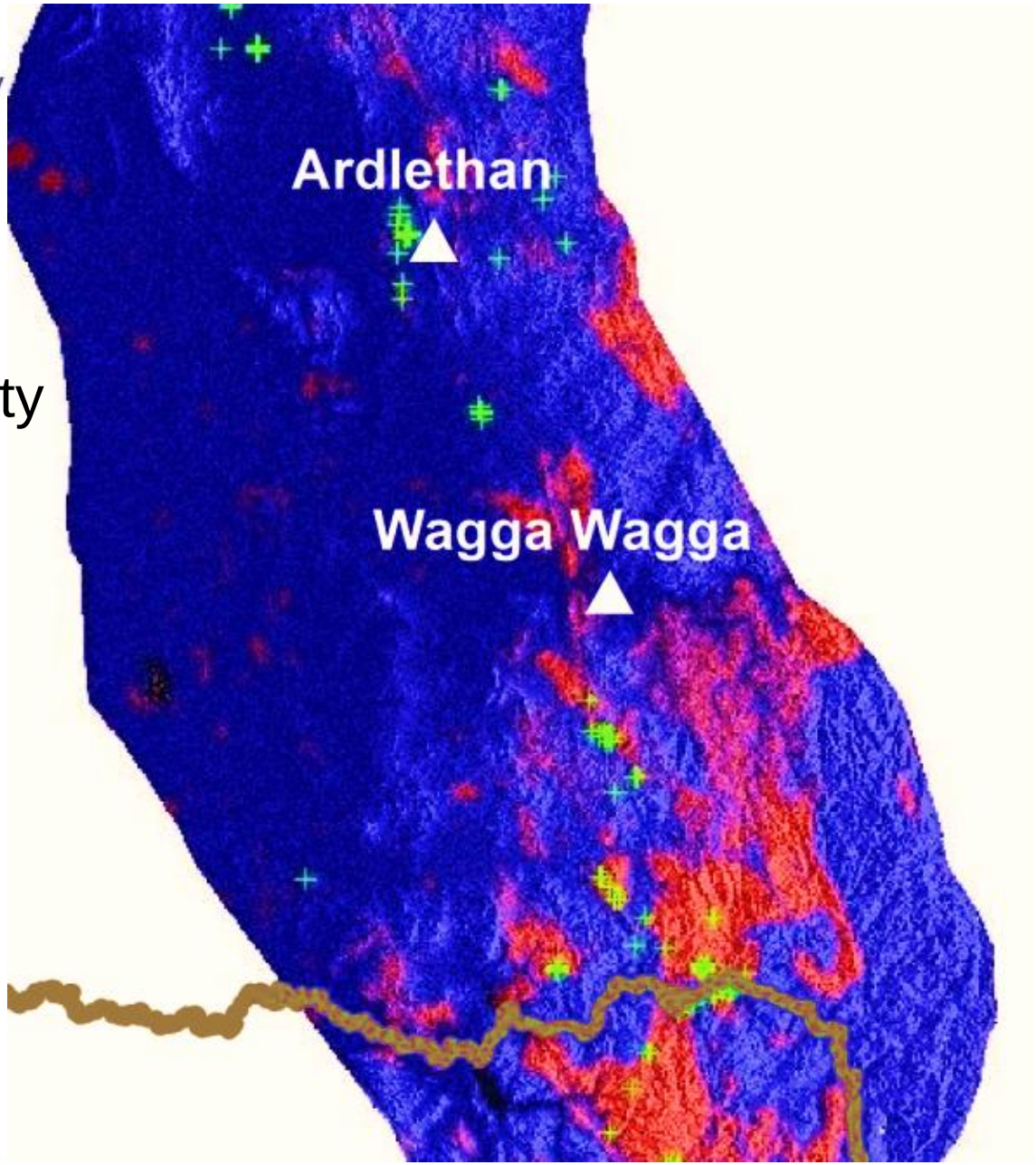
Model	Percentile at which prospective portion first encompasses at least 70% of deposits				Capture Efficiency
	Area percentile		Deposits		
	%	Size (km^2)	Count	%	
8	11.09	8,456	134	70.16	6.33
14	53.56	39,818	141	73.82	1.38
17	47.91	35,620	137	72.73	1.50

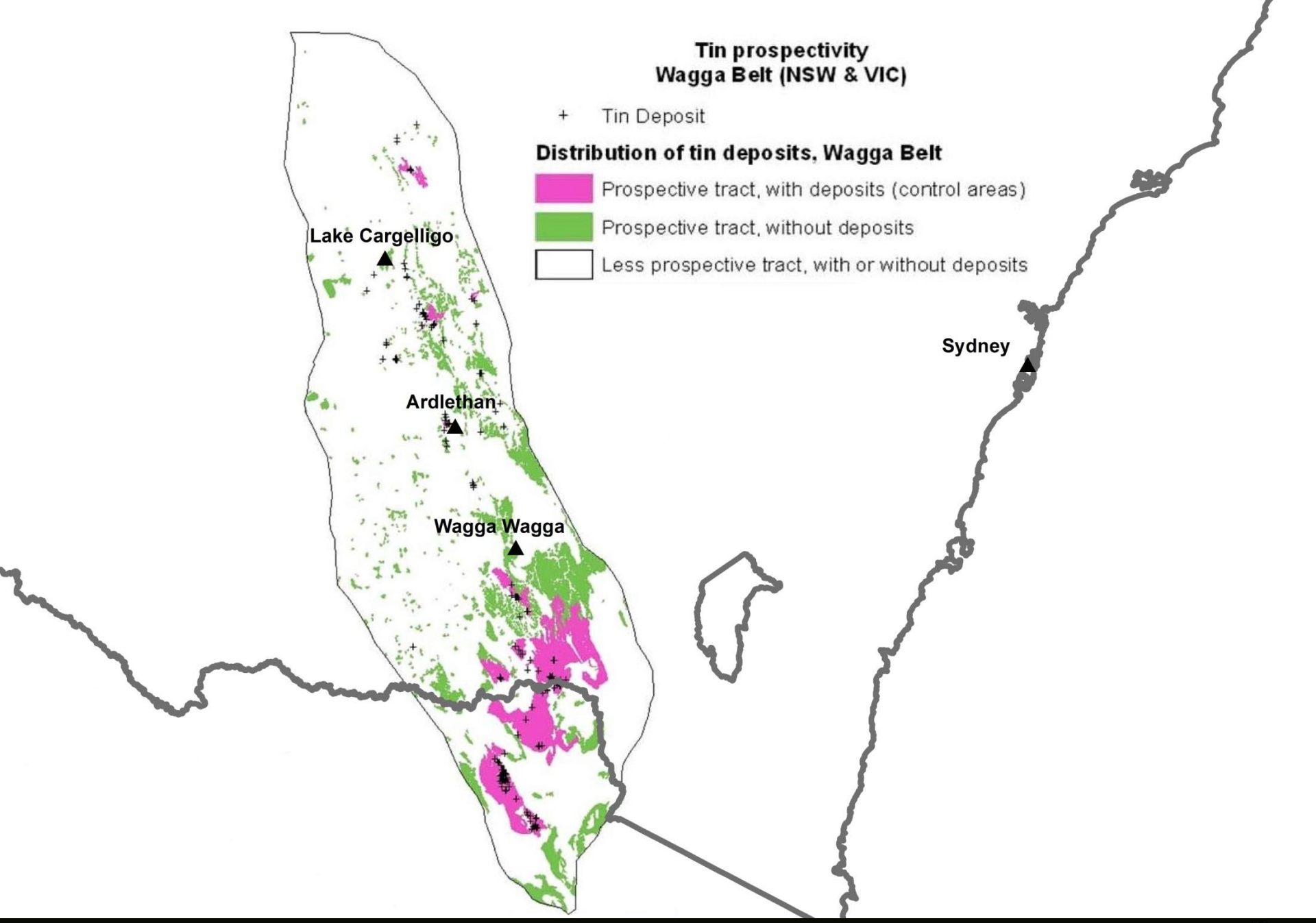
Fitting rate capture efficiency comparisons of WofE models



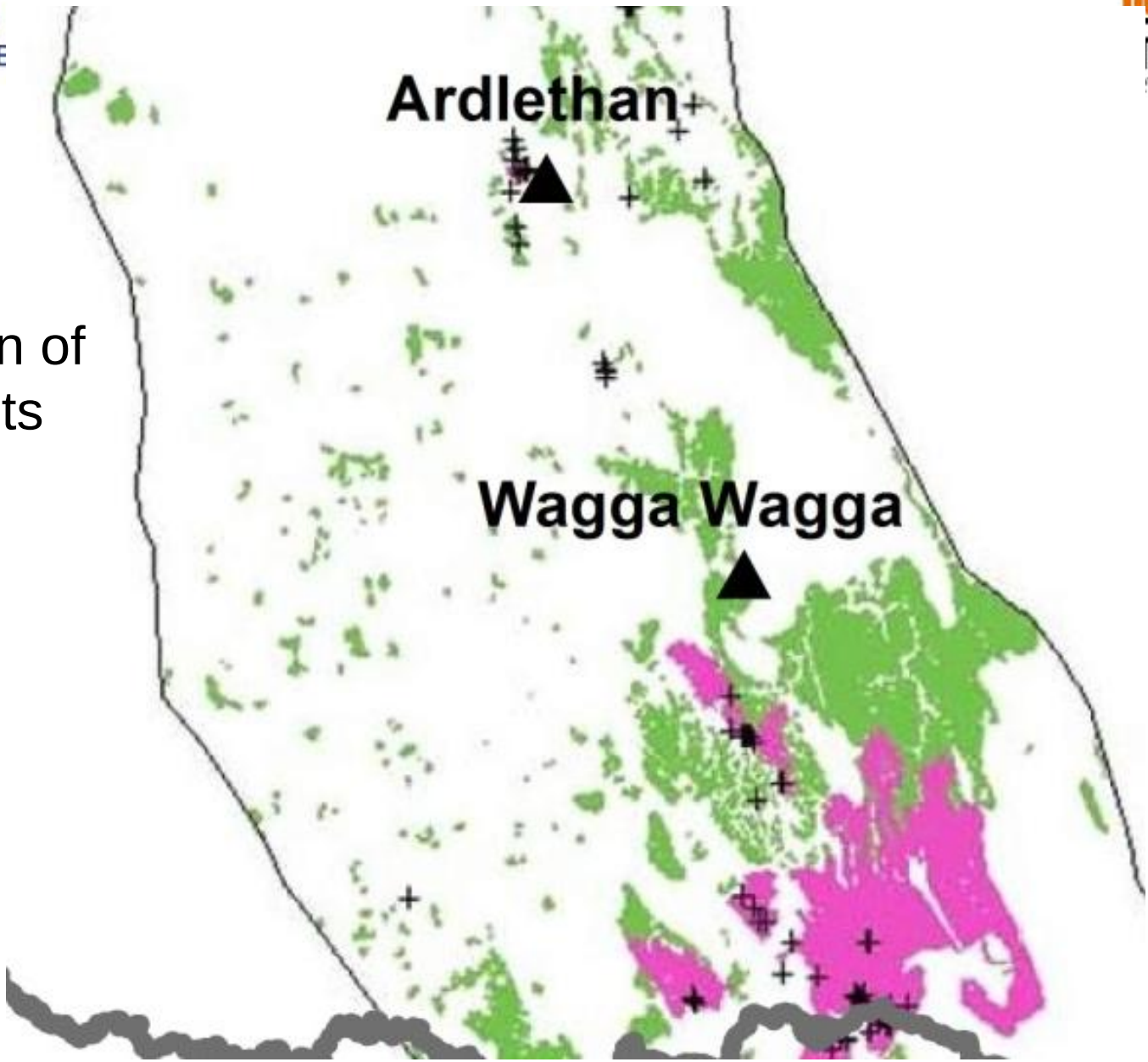

Tin prospectivity
Wagga Belt (NSW & VIC)
Tin Deposit
Model 8 (Lithology, TMI)
More prospective (11 % area)
Less prospective (89 % area)
Lake Cargelligo
Ardlethan
Wagga Wagga
Sydney

Tin prospectivity




Tin prospectivity
Wagga Belt (NSW & VIC)
Tin Deposit
Distribution of tin deposits, Wagga Belt
Prospective tract, with deposits (control areas)
Prospective tract, without deposits
Less prospective tract, with or without deposits
Lake Cargelligo
Ardlethan
Wagga Wagga
Sydney

Distribution of Tin deposits



Summary

- WofE prospectivity mapping;
- Zipf's Law for resource estimation;
- deposit-density regression modelling

191 known deposits + 796 predicted tin deposits = 987 deposits

987 deposits contain > 380,000 tonnes contained tin

82,000 tonnes contained tin already found

300,000 tonnes of contained tin is undiscovered

Zipf's Law estimates largest deposit ~ 25,000 tonnes

Clustering (Conditional Dependance) =
10? deposits ~ 5,000 tonnes Sn
100? deposits ~ 500 tonnes Sn (270,000 t of Sn)

Wagga Region Hydrogeochemistry Study

Analysing bore

- **water pH**
- **salinity (EC)**
- **oxidation state (Eh)**
- **temperature**.

CSIRO

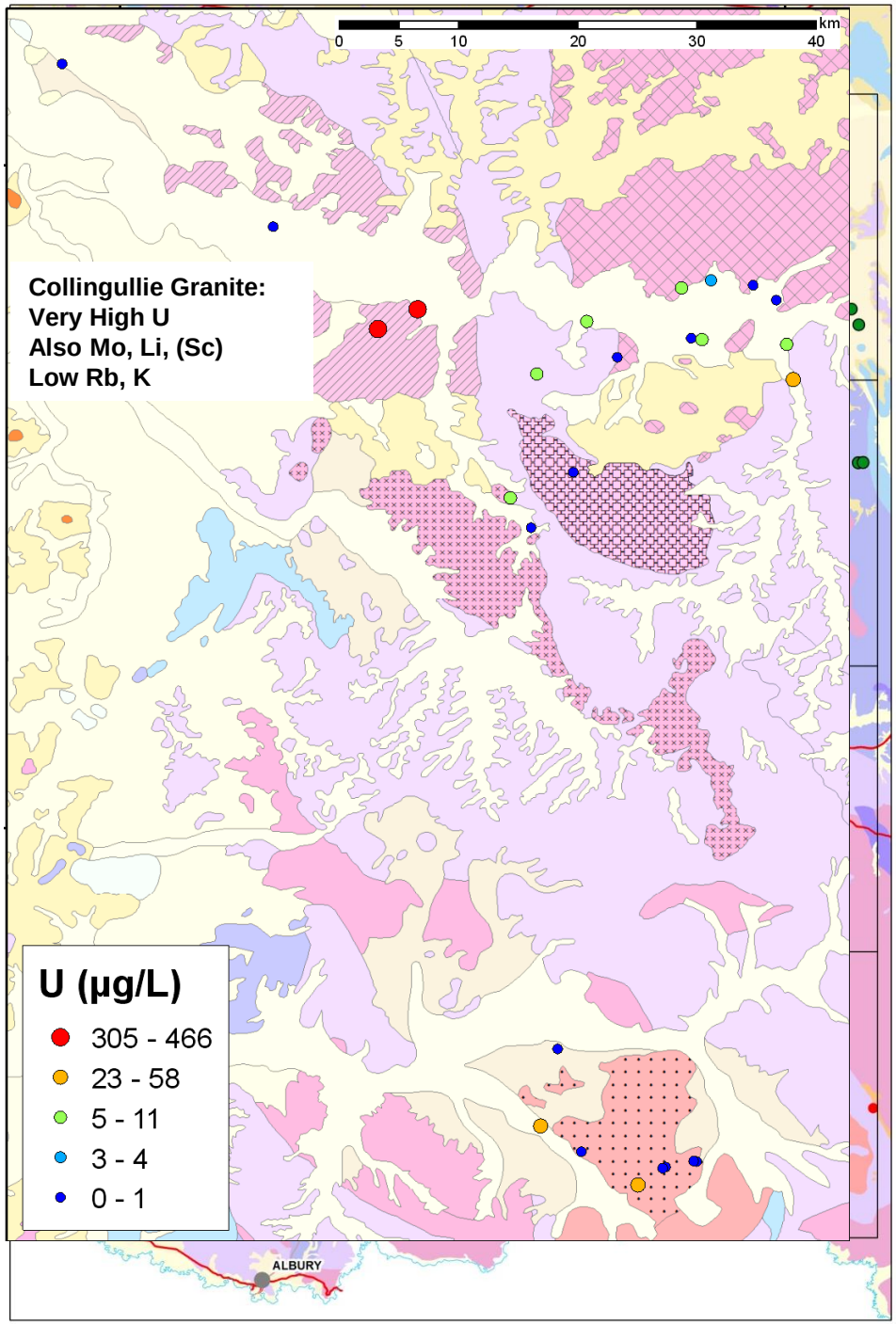
DEEP EXPLORATION TECHNOLOGIES CRC
Uncovering the future

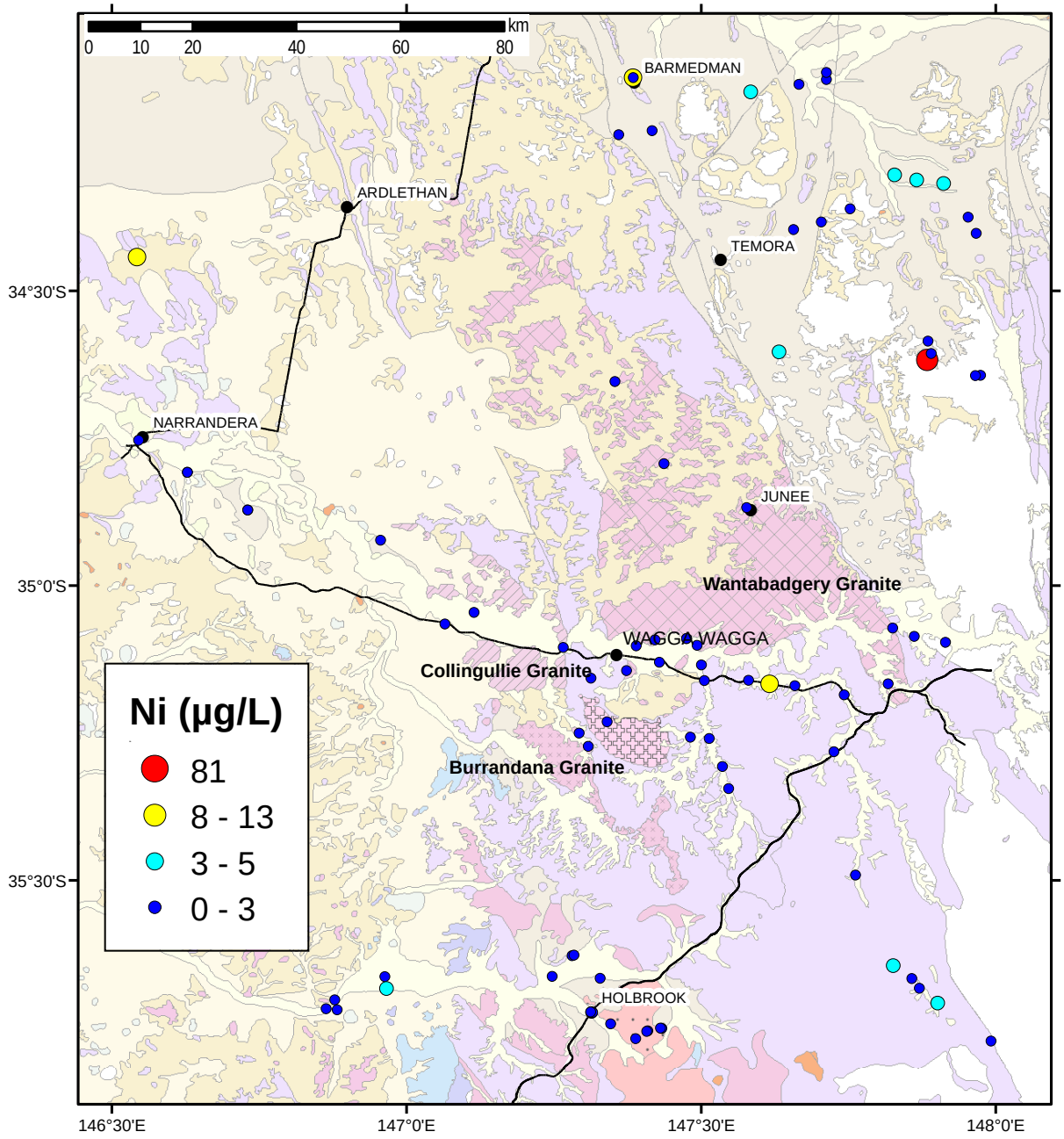
Trade & Investment Resources & Energy

Eastern Riverina Hydrogeochemistry Study

1) 1L (carbon) and 300ml (Alkalinity) bottle filled straight from bore.
2) 300ml of filtered bore water is put in a bottle. (anions)
3) 300ml of filtered bore water is put in another bottle (Acid)
4) While filtering is taking place the pH and Ec are monitored and recorded.

The testing done in CSIRO Perth gives results for approximately 40 different elements and has a sensitivity of parts per trillion.

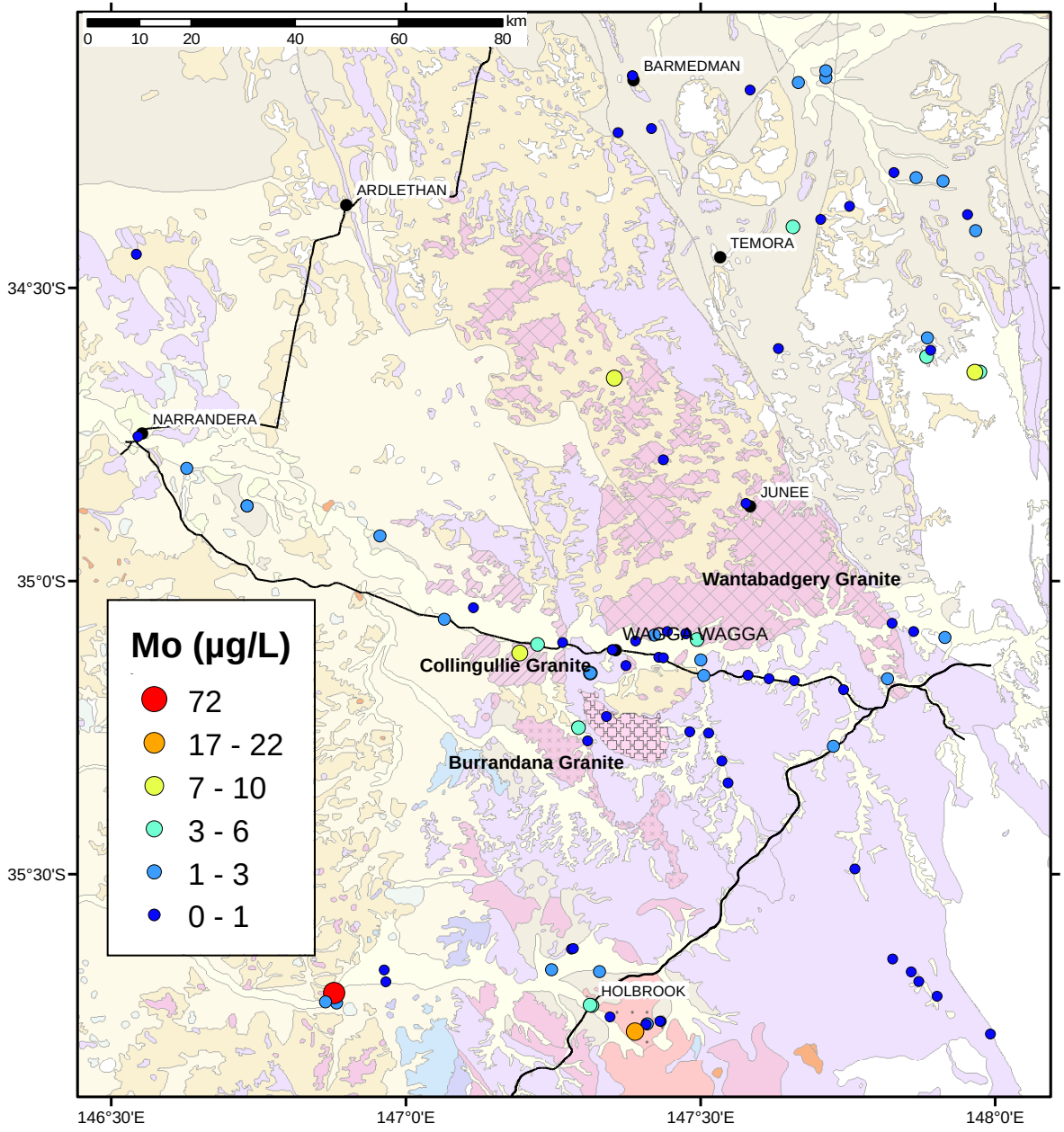




Ni (µg/L)

Nickel

- Red dot is High Ni within the Frampton Volcanics

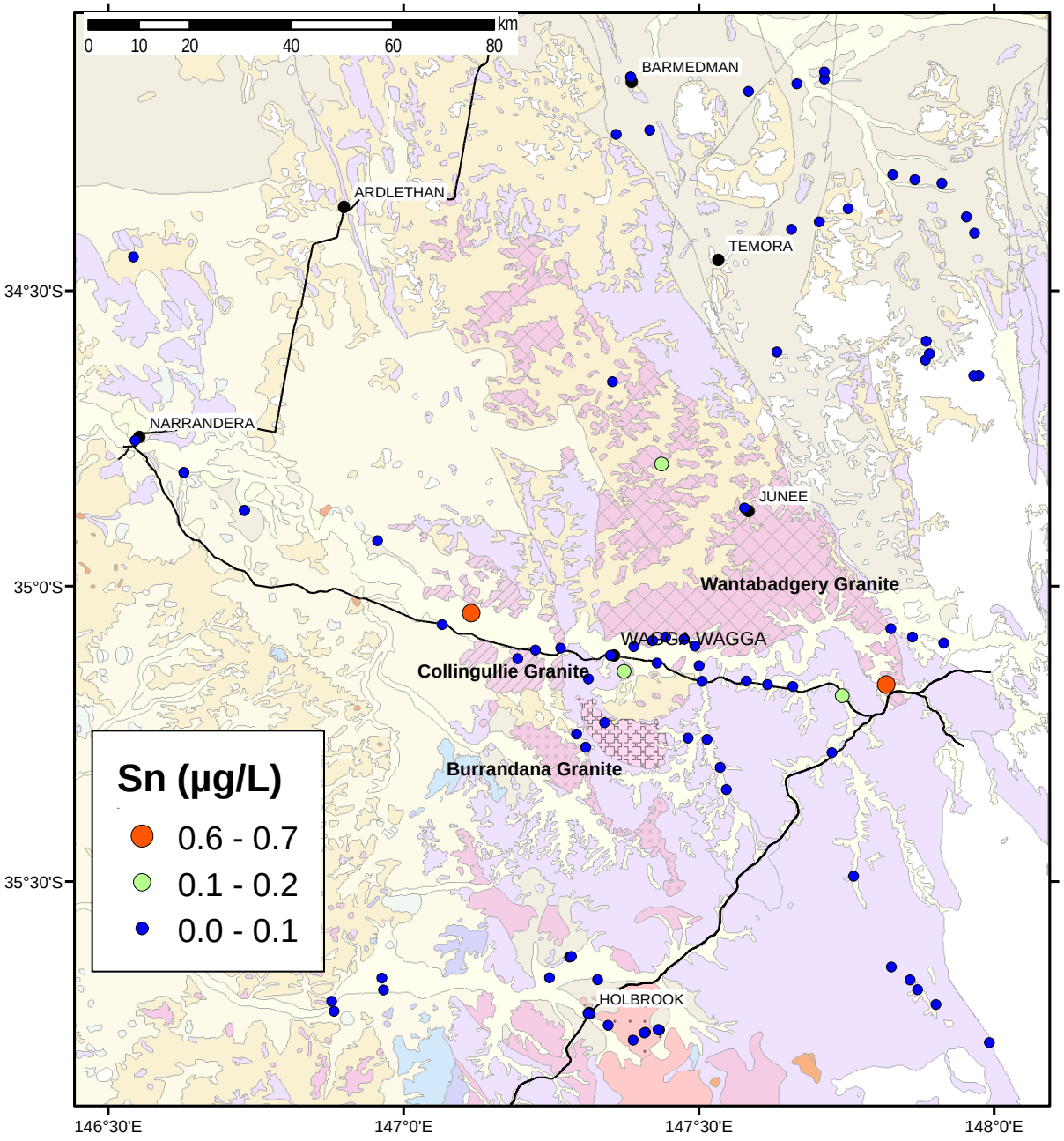


Mo (µg/L)

Molybdenum

Interesting Response

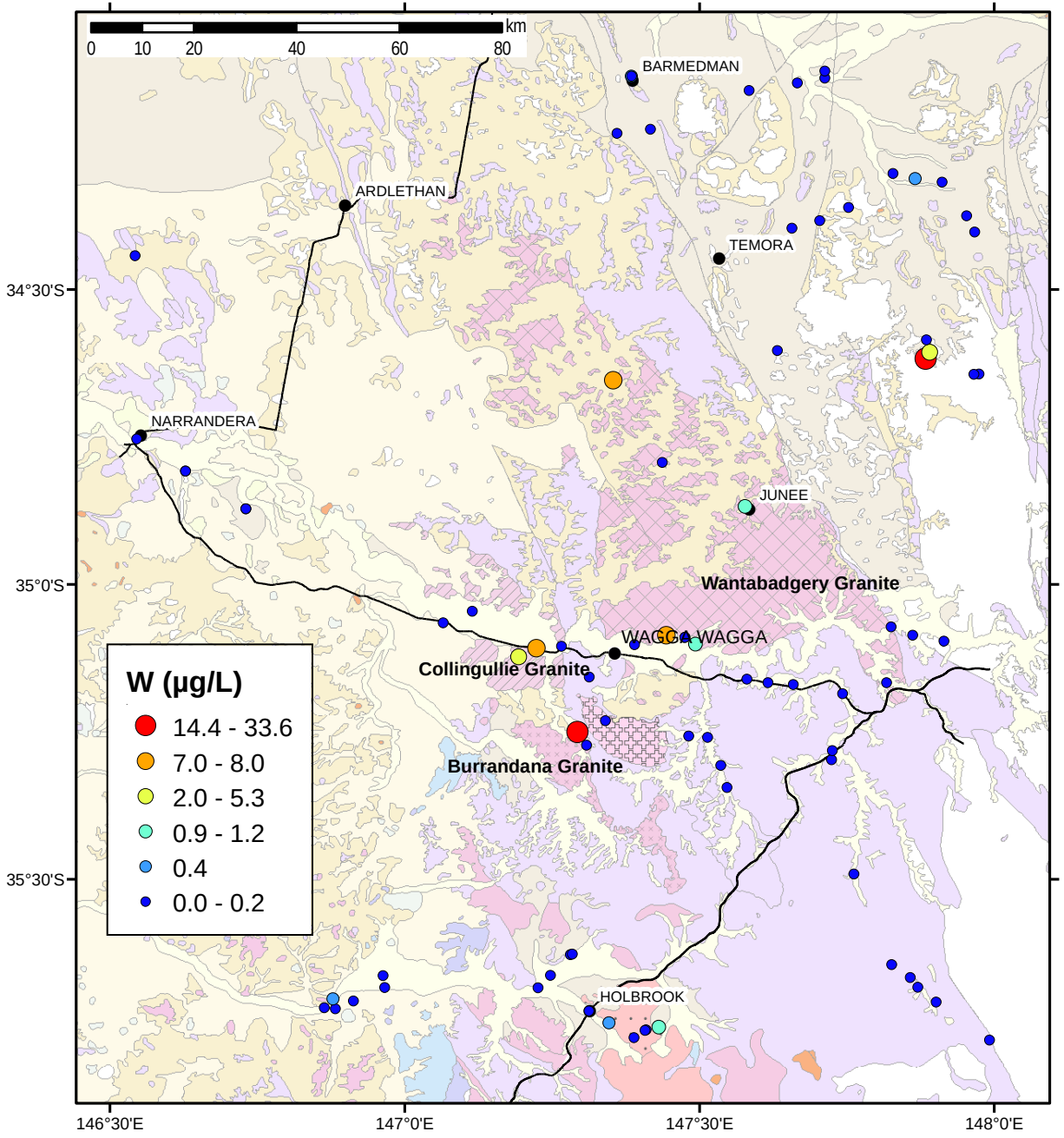
- Jindera Granite
- Holbrook Granite
- Wantabadgery Granite
- Collingullie Granite
- Frampton Volcanics



Sn (µg/L)

Tin

- Subdued response (solubility issues?)
- Wagga Group, Wantabadgery and Collingullie Granite?

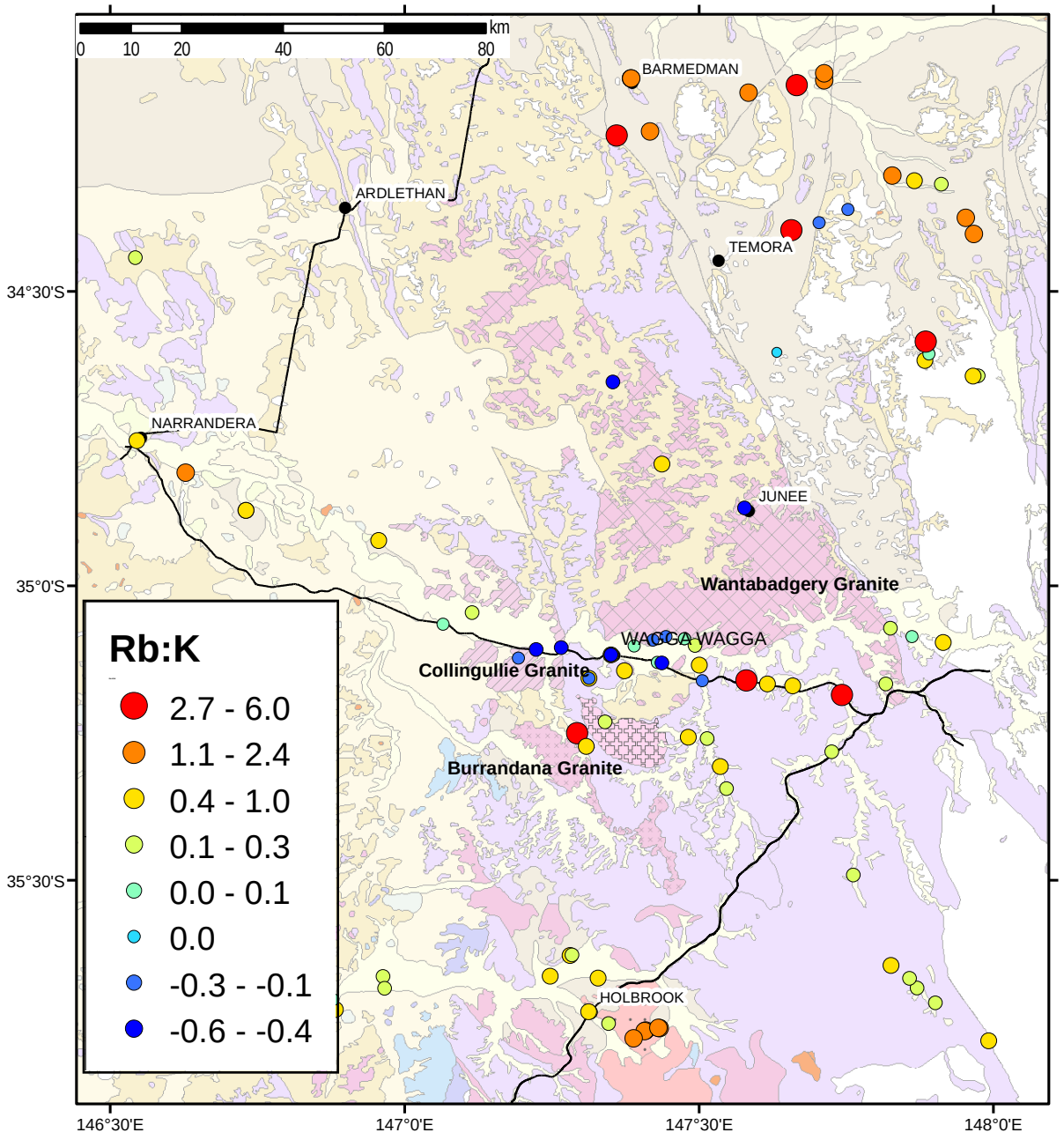


W (µg/L)

Tungsten

Interesting Response

- Collingullie Granite
- Burrandana Granite
- Wantabadgery Granite
- Frampton Volcanics



Rb:K

Rubidium:Potassium

- Differing Granites?

Extracting mineralogical and geomorphological information using new ASTER mineral maps with airborne geophysics

by *R Hewson, D Robson, A Mauger, T Cudahy, M Thomas, S Jones.*

Australia wide maps have recently been generated and released by CSIRO and Geoscience Australia using the 14 band satellite-borne ASTER sensors.

Seventeen map products related to surface composition have been developed, based on spectral absorption features representing either abundance of mineral groups, specific minerals and their chemistry, vegetation cover or regolith related characteristics.

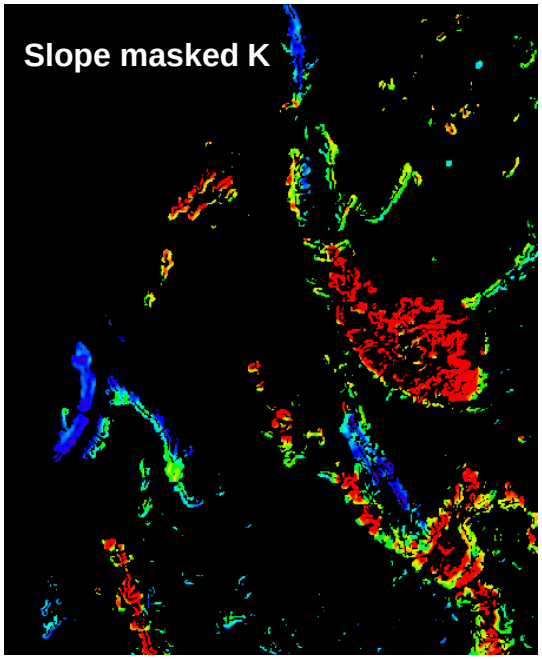
This study aims to test the geoscience mapping capabilities of these products, individually, and integrated with airborne geophysics and DEMs within the agricultural Wagga Wagga region.

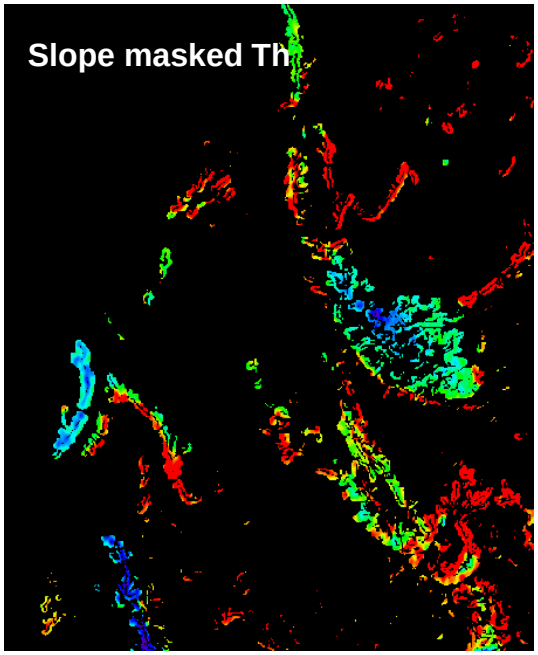
Wagga 100K Mapsheet – masked radiometrics

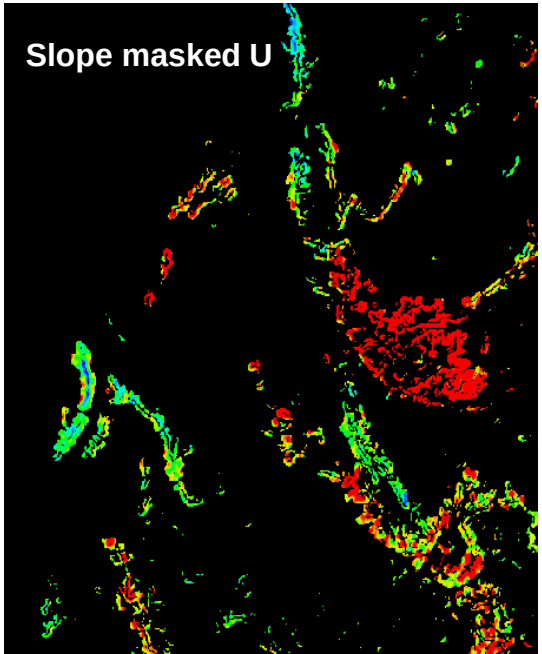
Radiometrics : 10%+ Slope masked

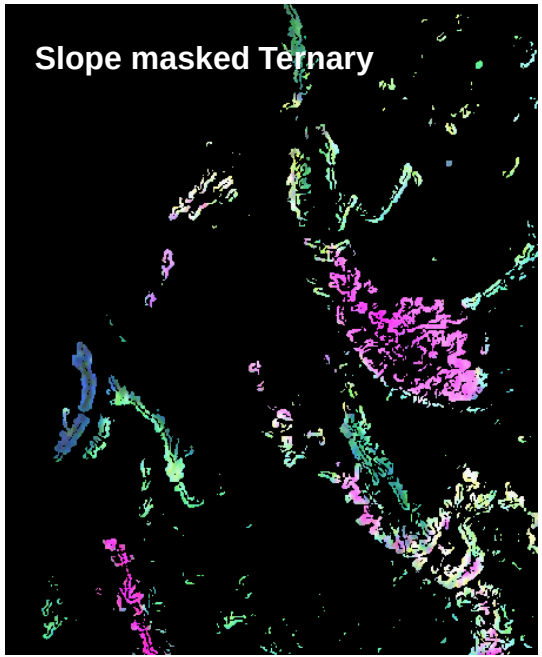
Significant differences in S-granite/adamellite chemistry - different feldspar (orthoclase?) types?

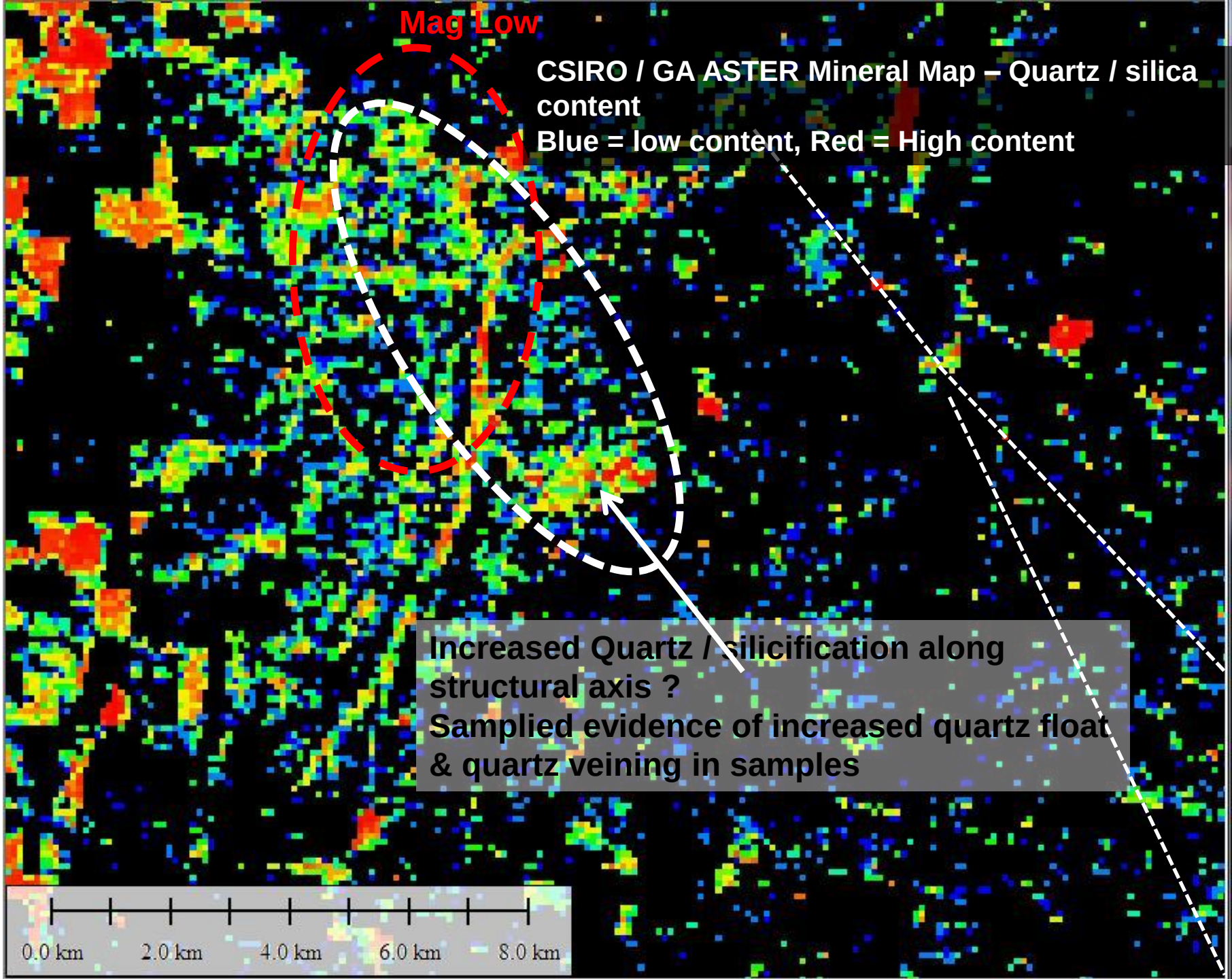
Masking result appears to reflect major changes in geological units rather than affected by floodplain and parna/aeolian blanket cover.





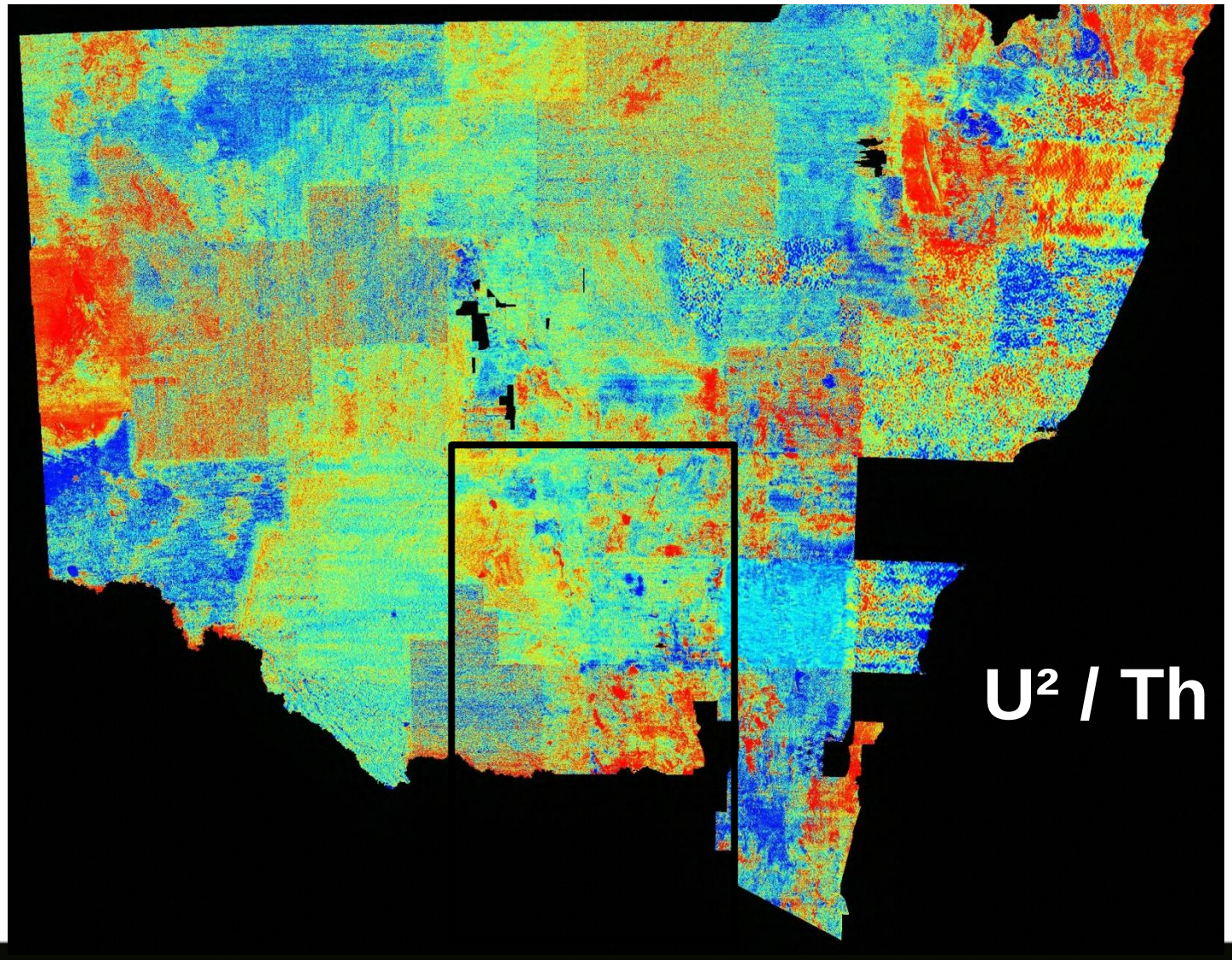


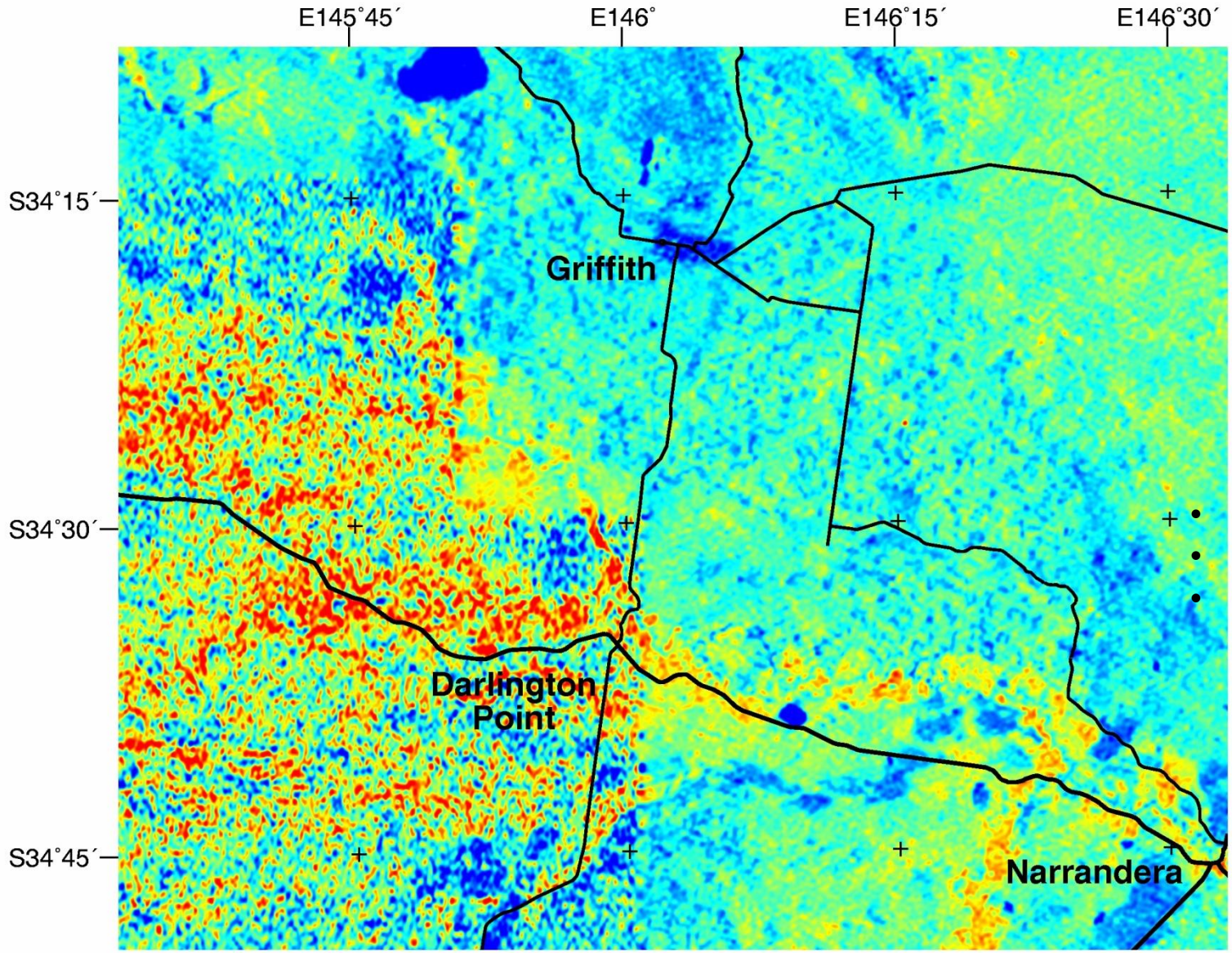



Mag Low
CSIRO / GA ASTER Mineral Map – Quartz / silica content
Blue = low content, Red = High content
Increased Quartz / silicification along structural axis ?
Samplied evidence of increased quartz float & quartz veining in samples
0.0 km
2.0 km
4.0 km
6.0 km
8.0 km

Uranium

The newest frontier in NSW





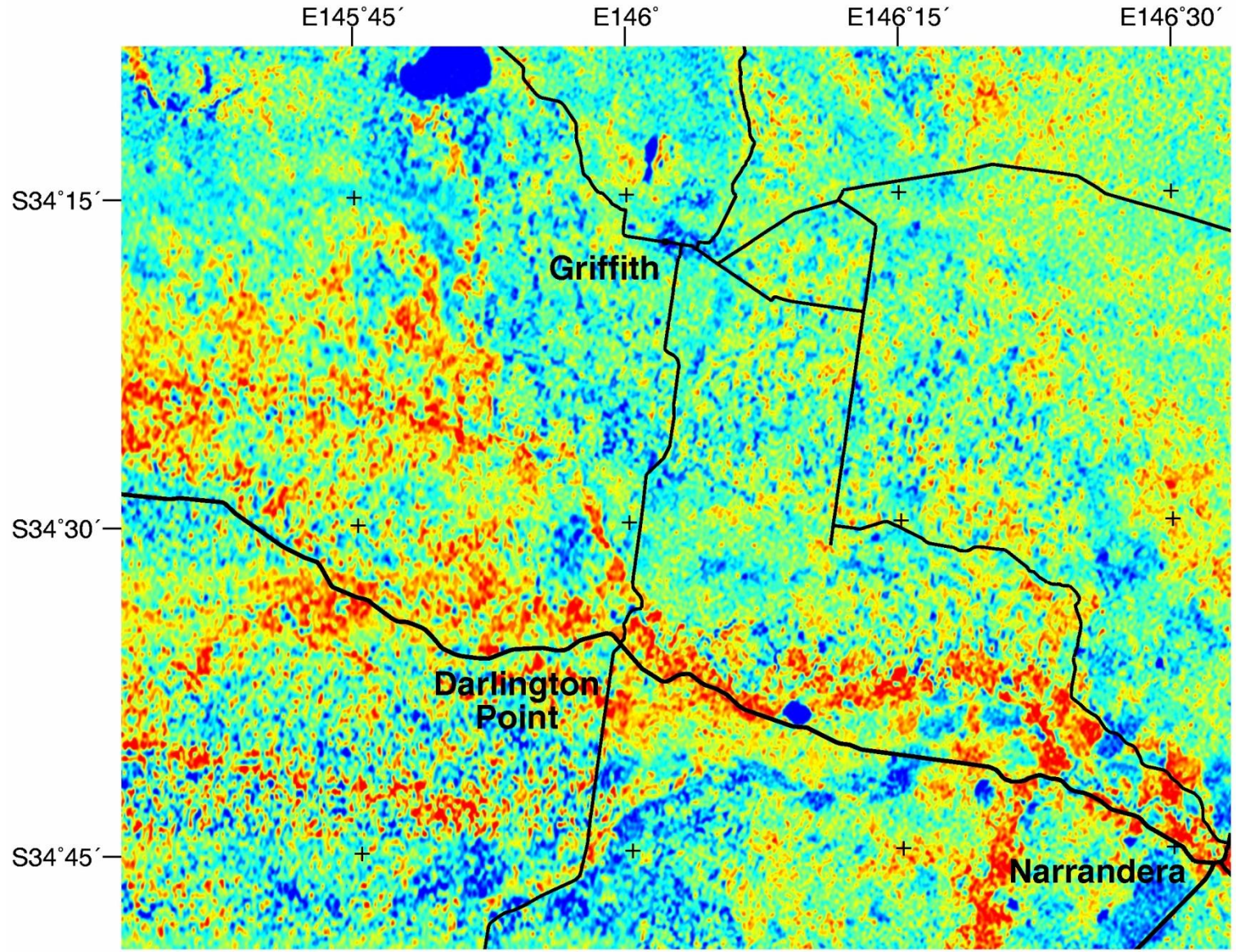
U

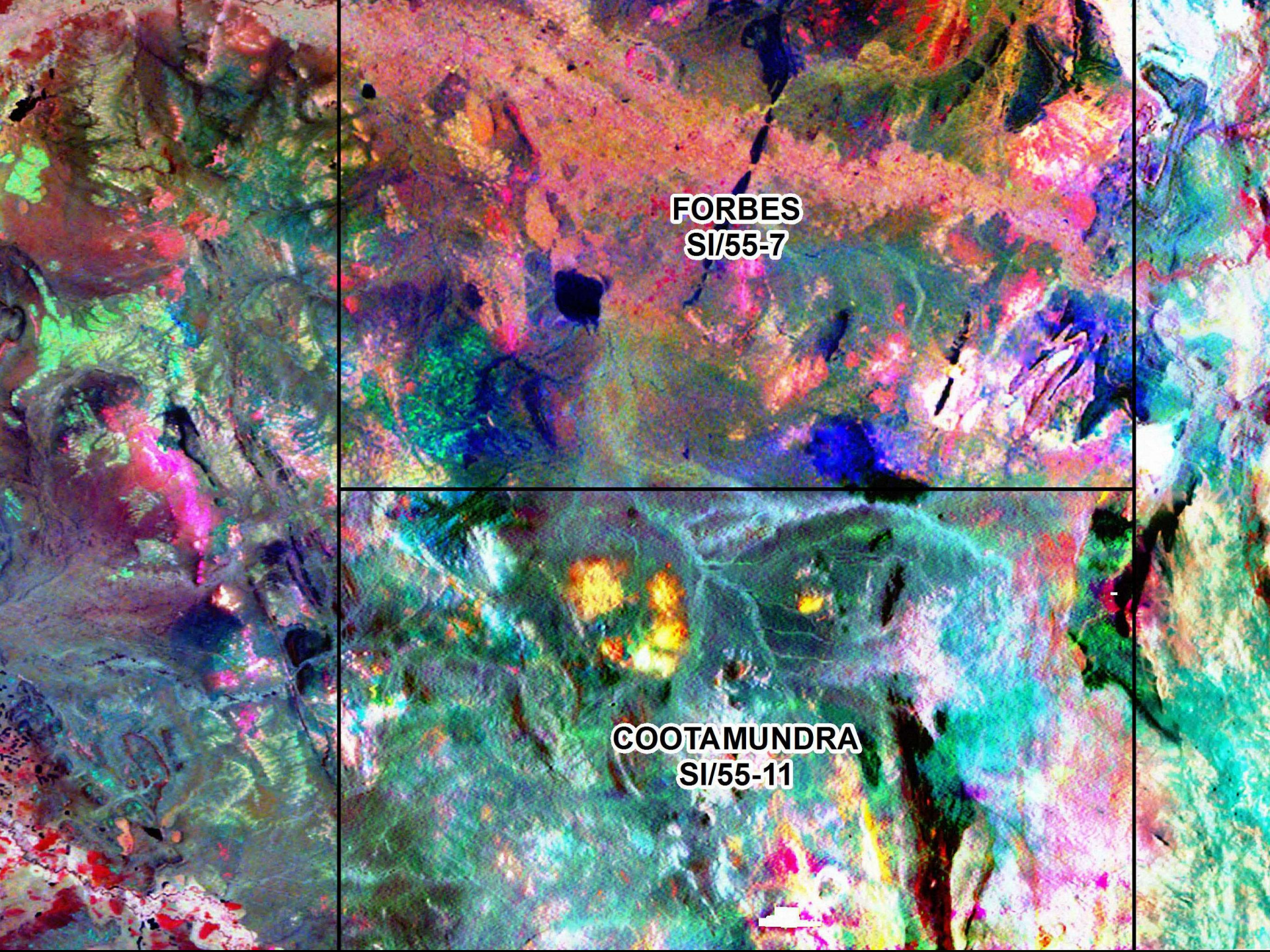
Before NASVD

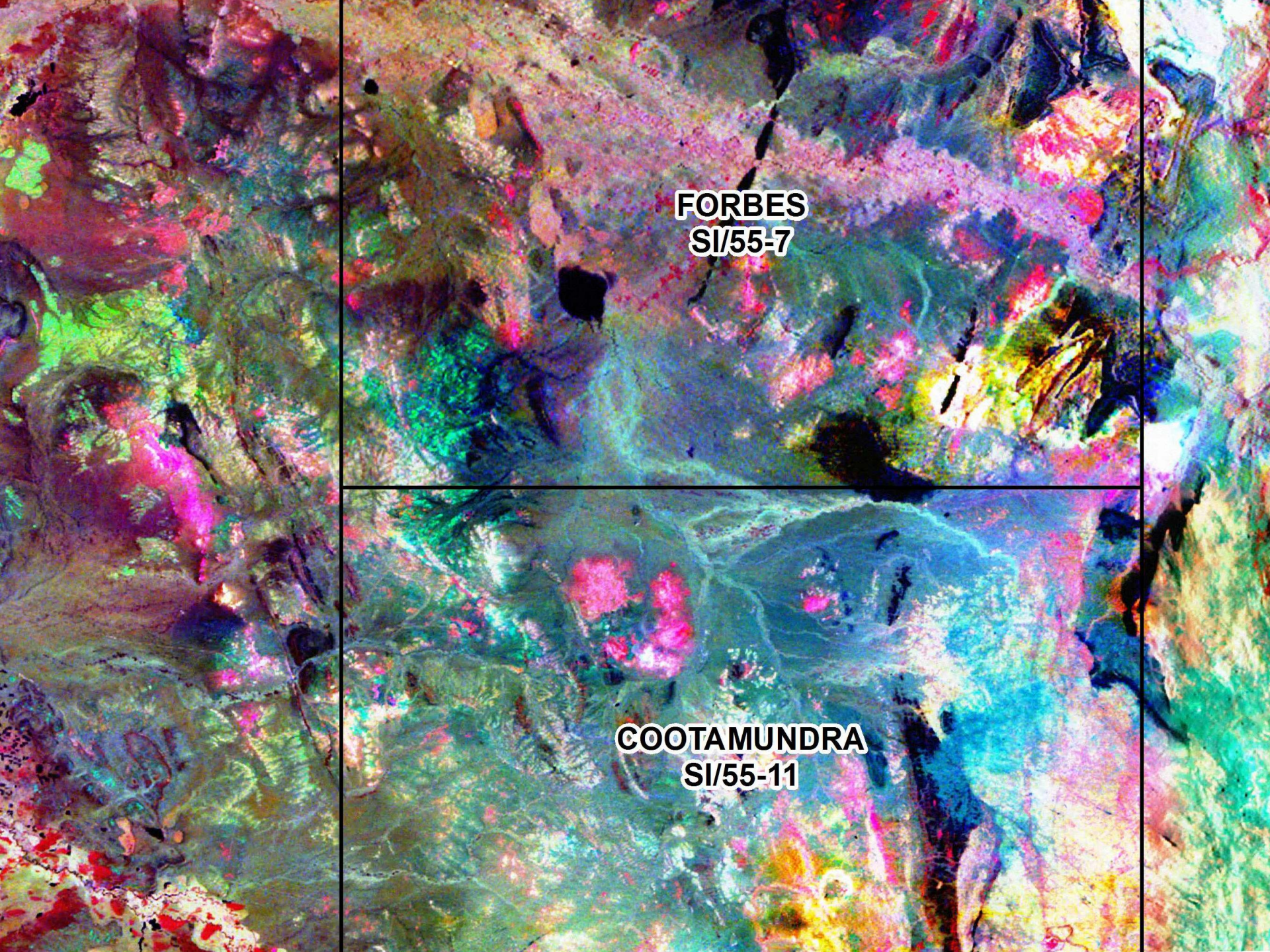
- Flown 1996-2000
- mixed U-Th ‘noise’
- Reprocessed 2013

Brian Minty

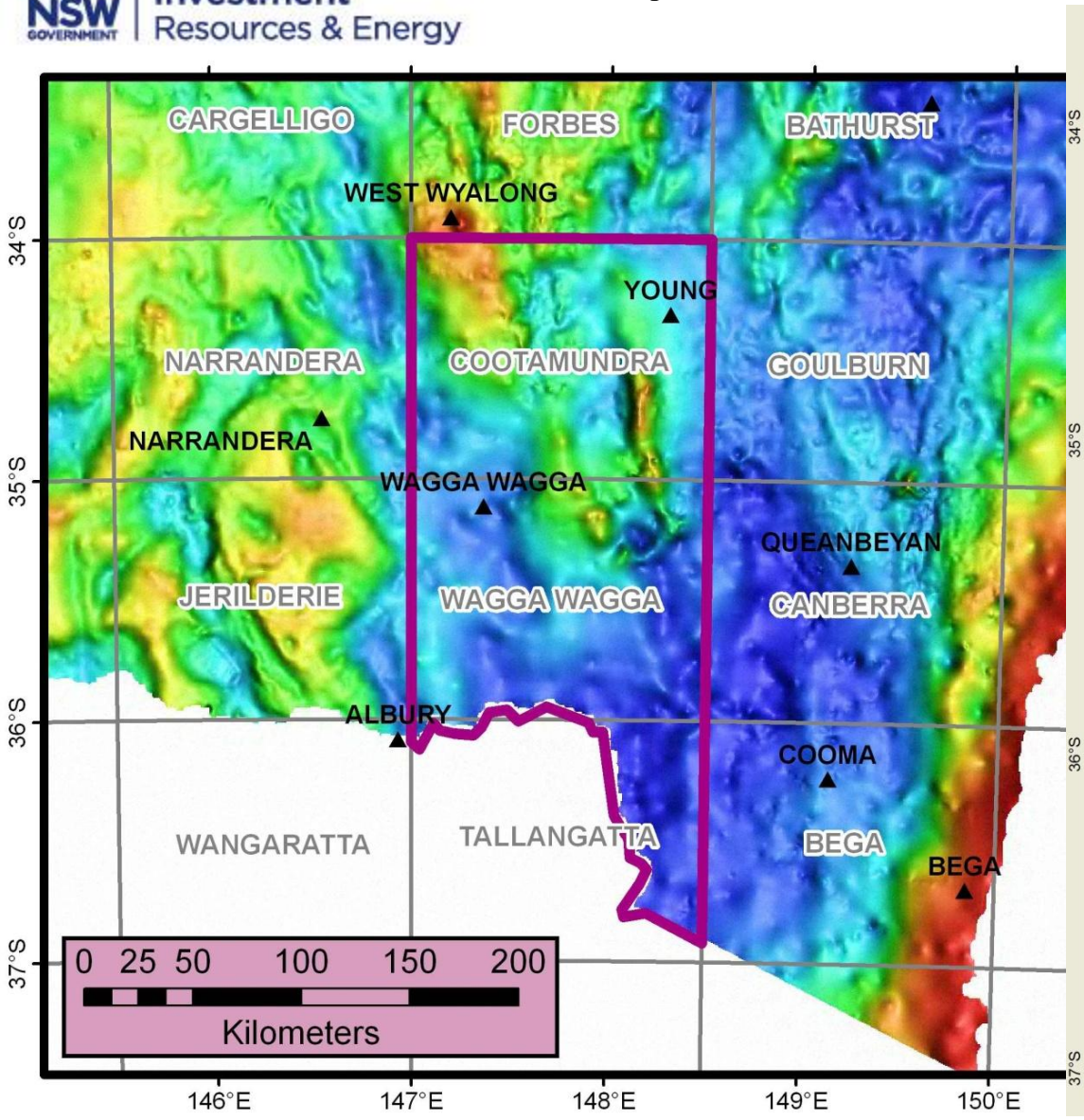
U
After NASVD

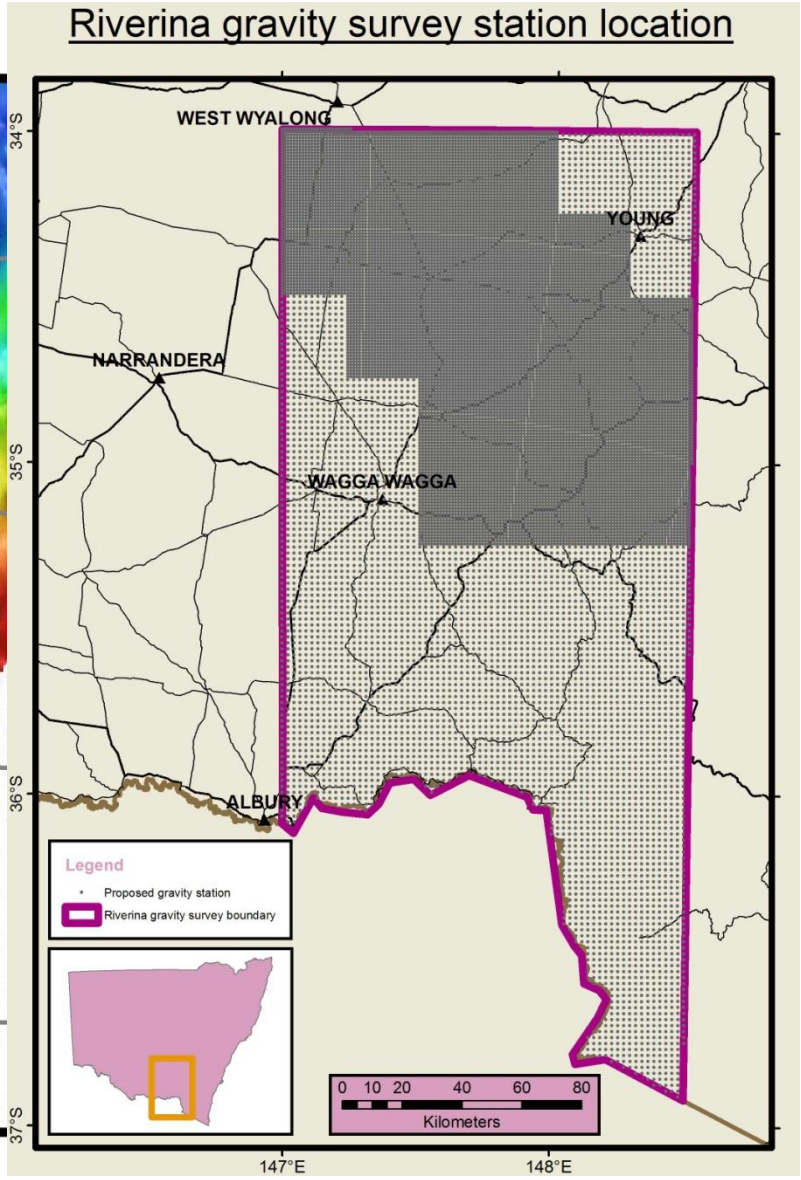



FORBES
SI/55-7
COOTAMUNDRA
SI/55-11


FORBES
SI/55-7
COOTAMUNDRA
SI/55-11

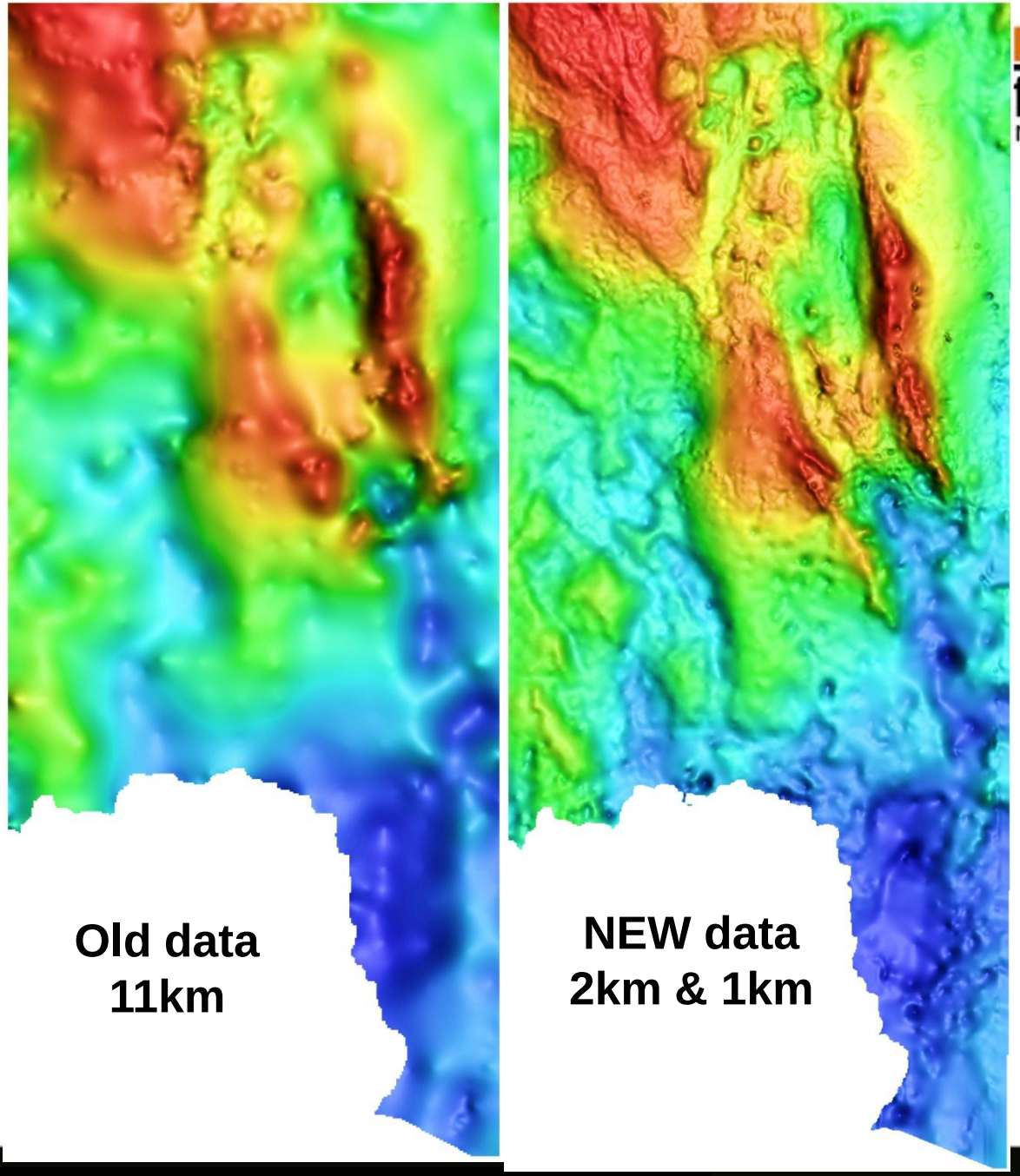
Gravity 2km x 2km & 1km x 1km (11,000 stations)

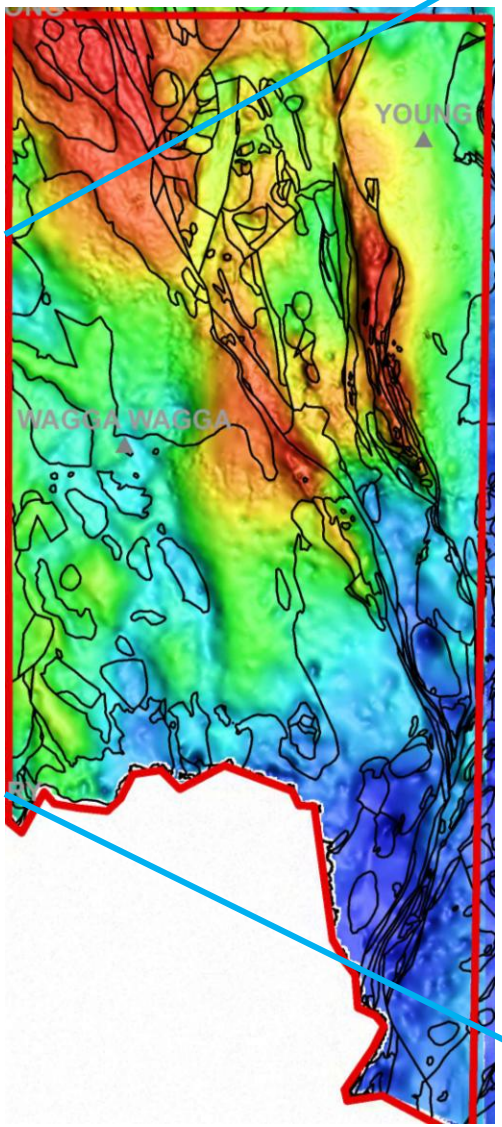


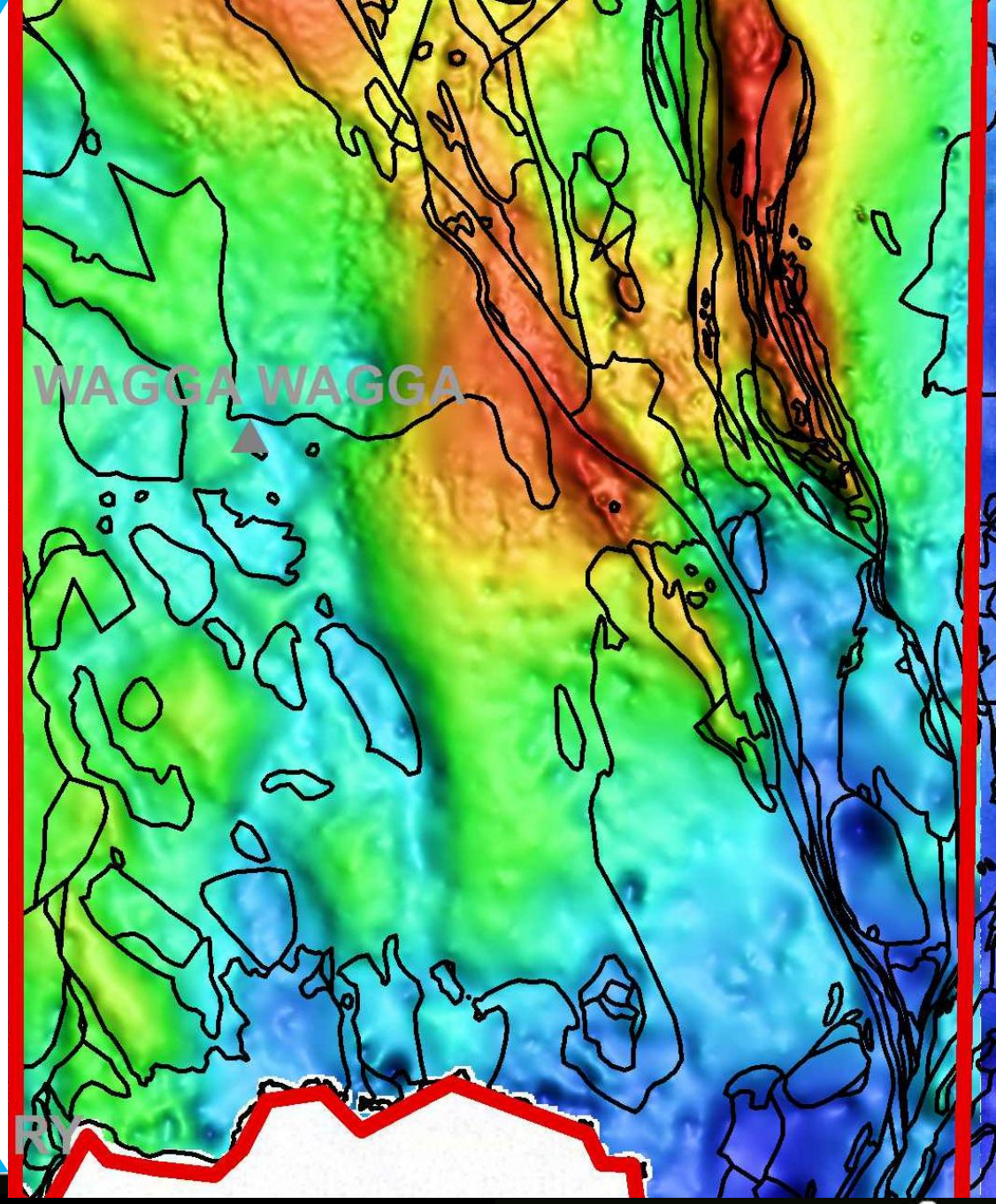


GRAVITY

Cootamundra / Wagga Wagga / Tallangatta
1:250,000 sheets




YOUNG
WAGGA WAGGA


WAGGA WAGGA

Wagga – Omeo Belt

– applying NEW technology to an under-explored area

– the NEW place to be

– the RIGHT place to explore!!!

Thanks

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new frontiers new south wales

NSW Statewide Geology & Geophysics for Phones

- Available for Android smart phones and Apple iPhones
- Entire map is downloaded to your phone – so no mobile reception is required in the field
- Your current location is marked – indicating the geology under your feet
- Geology map is the most popular – 20,000 downloads
- 1:1 500 000 Surface Geology, Total Magnetic Intensity, Radiometrics, TMI 1VD
- To download the maps, google 'geoscientific data warehouse' to find our site .. **http://dwh.minerals.nsw.gov.au**

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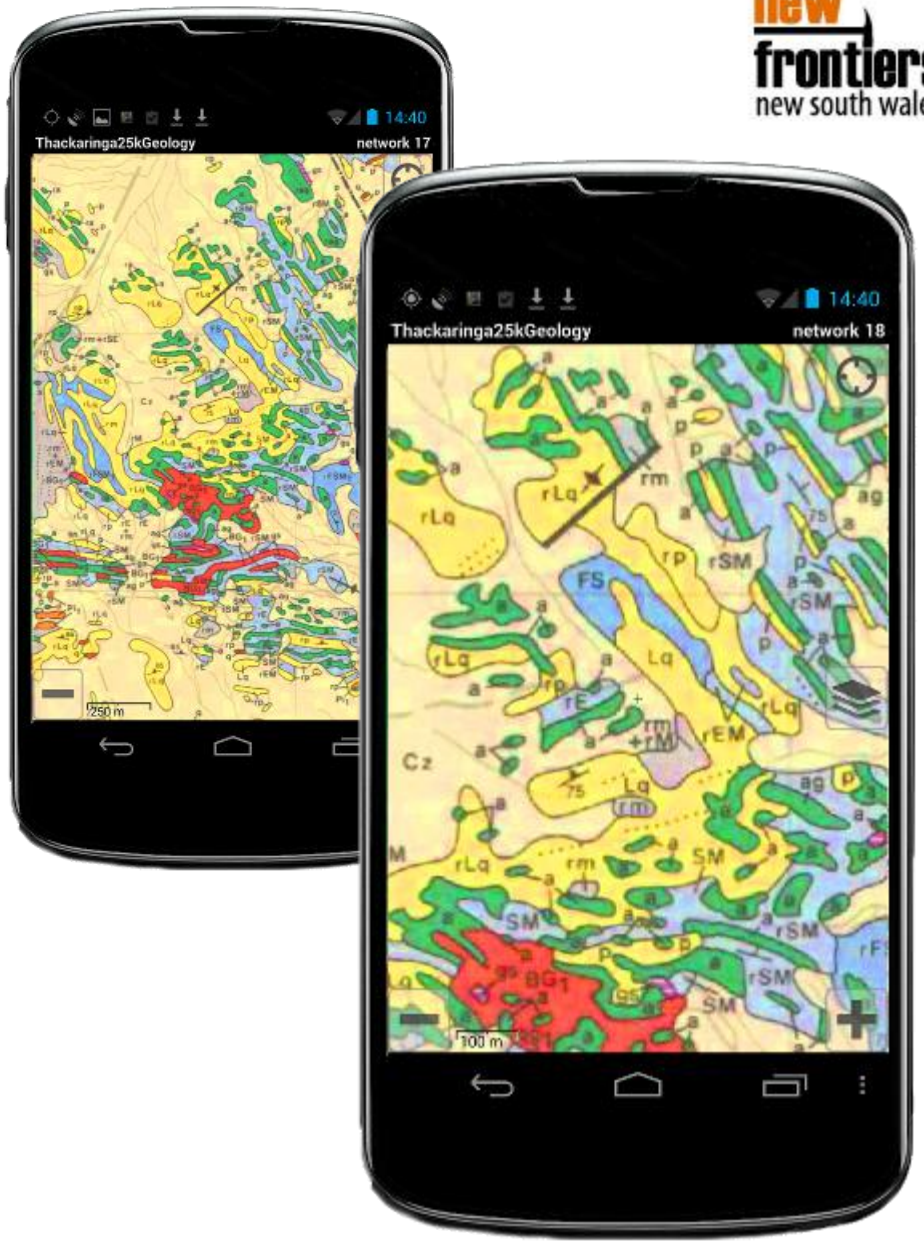
NSW Detailed Geology Maps for Phones

- Available for Android smart phones and Apple iPhones
- Entire map is downloaded to your phone – so no mobile reception is required in the field
- 246 maps are available – 1:250 000, 1:100 000, 1:50 000 & 1:25 000
- List the Geology maps that cover your area of interest – then choose which to download
- To download the maps, google 'geoscientific data warehouse' to find our site .. **http://dwh.minerals.nsw.gov.au**



Thanks