Transported cover: friend not an enemy

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March 2014

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Minerals Down Under

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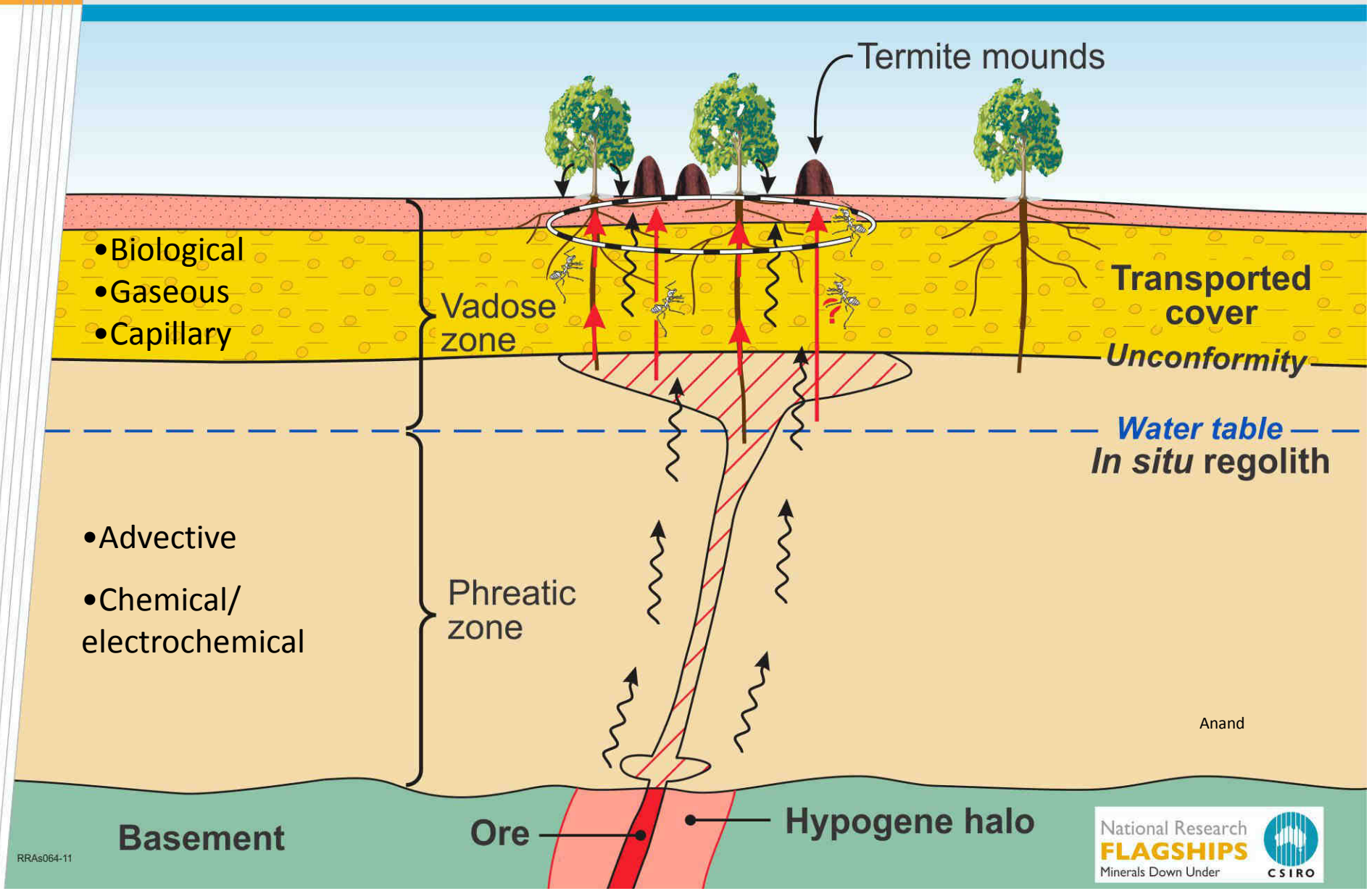
The Challenge - Seeing through transported cover in a cost effective manner

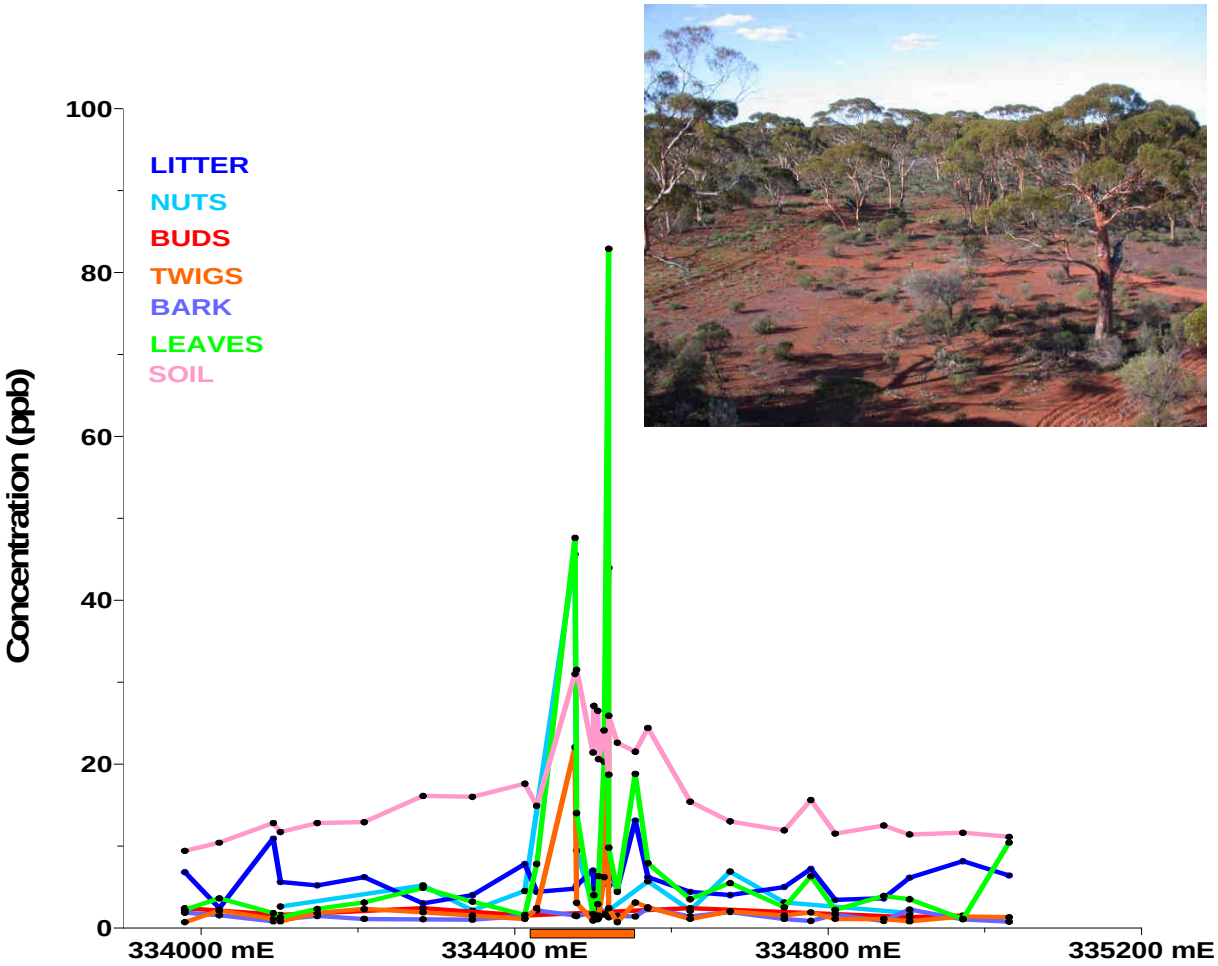
Transported cover

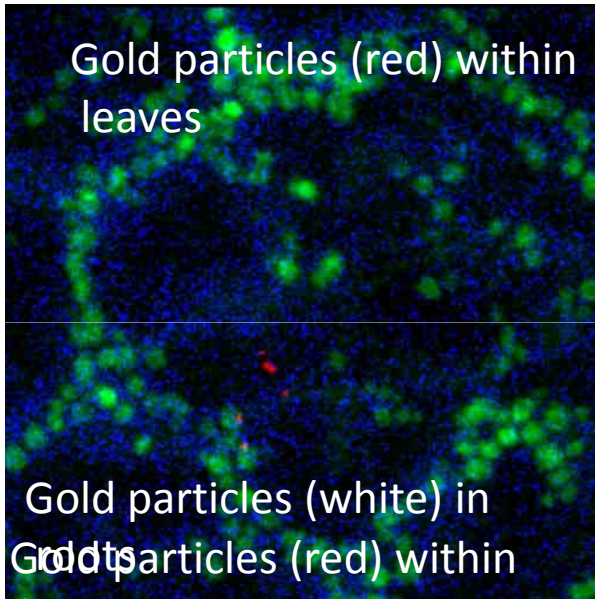
Anand

Mechanisms of metal transport through cover



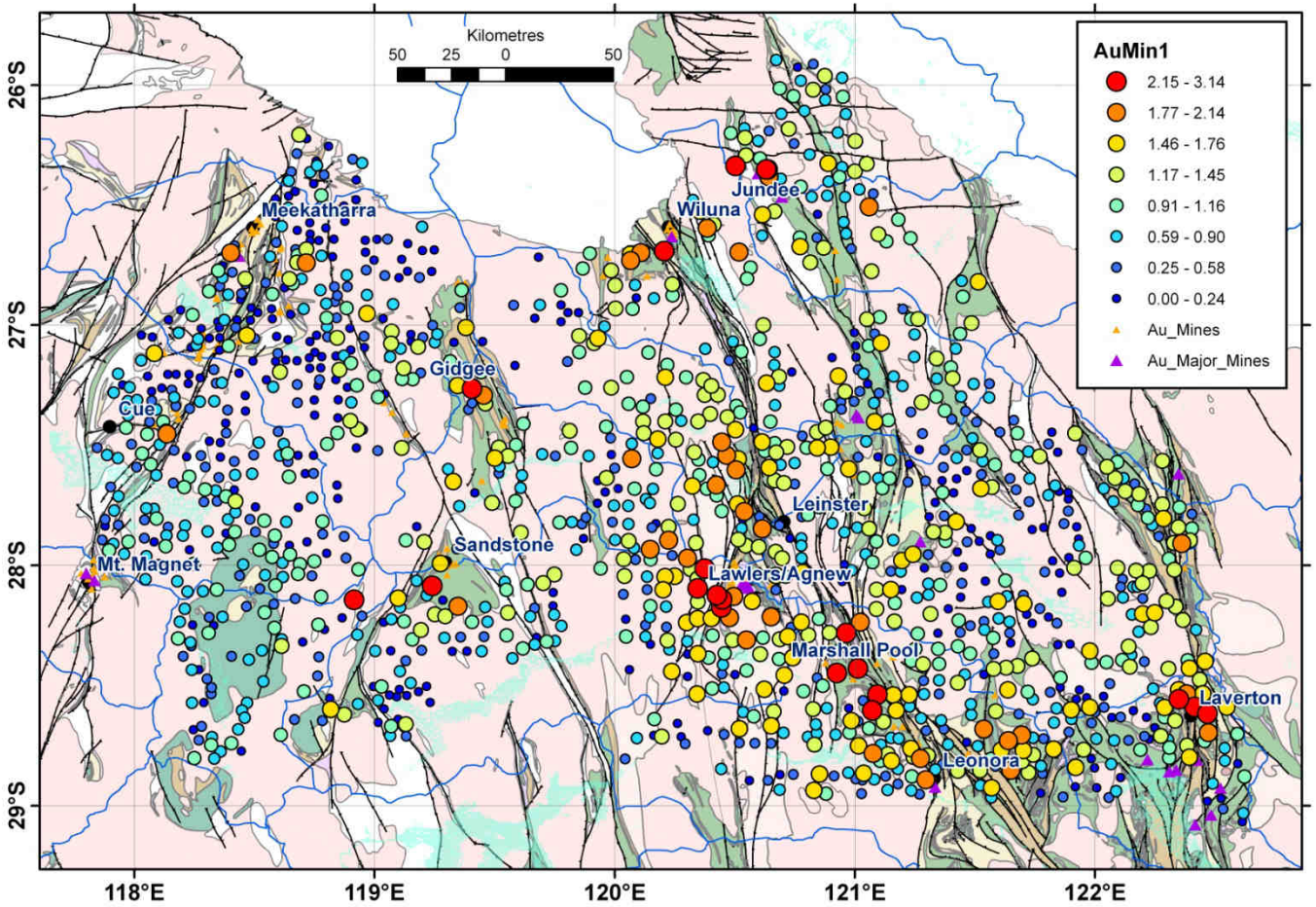
Vegetation as sample media - Mineralisation is below 30m transported cover, Freddo Au deposit





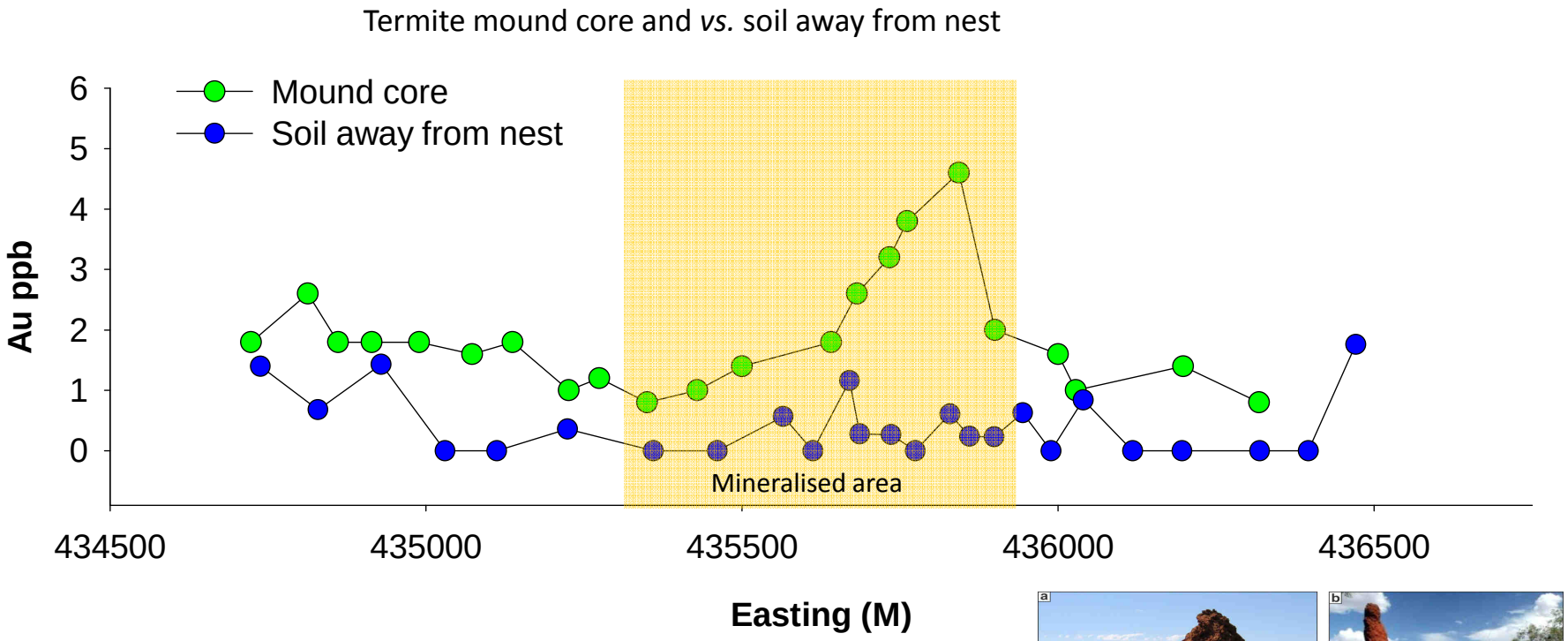
Lintern et al., 2013

Regional geochemistry (Au Min 1: Au+Ag+As) using *Acacia aneura,* Yilgran Craton



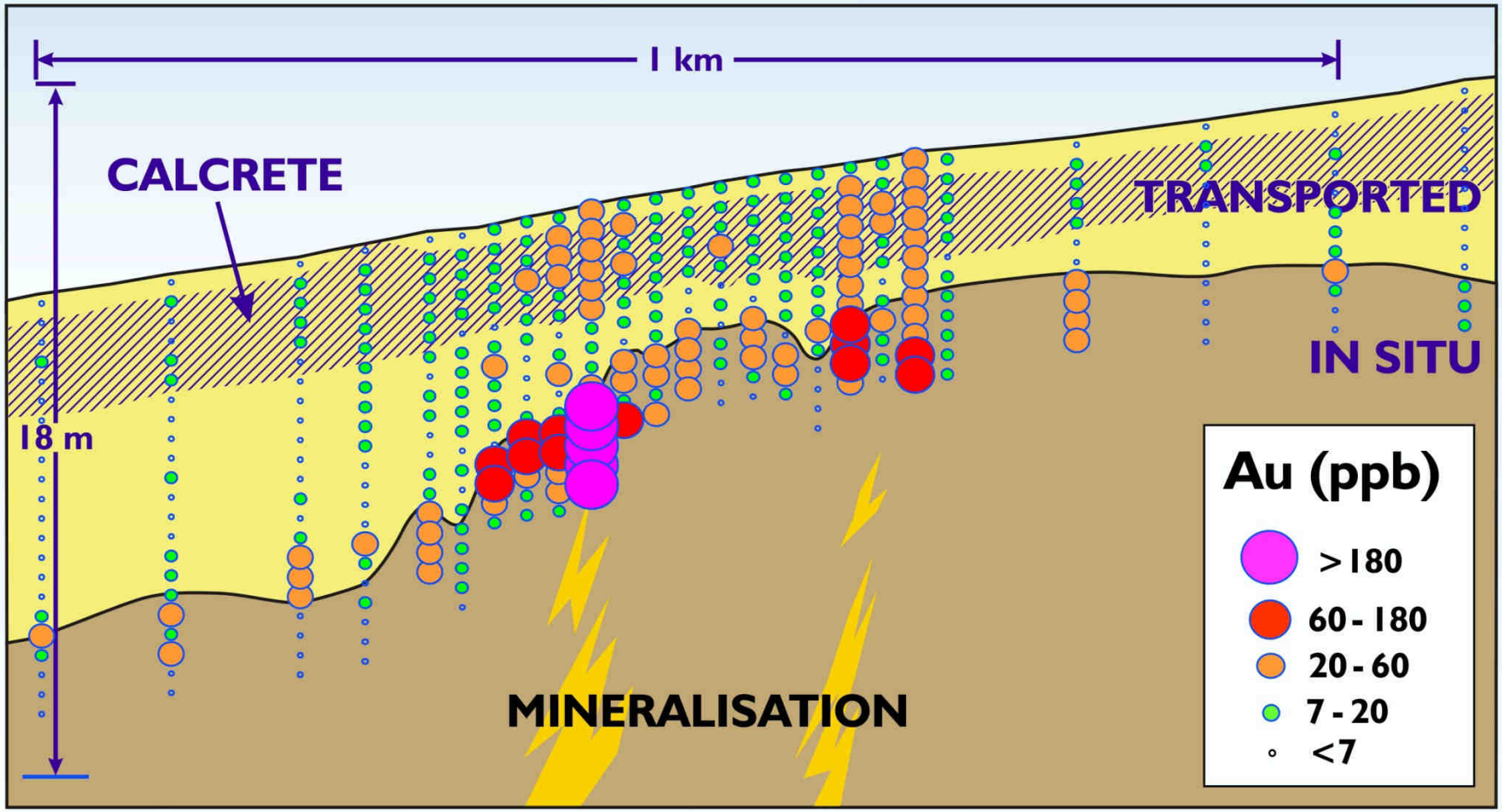
Reid et al 2010

Termite mound as sampling medium, Mineralisation is below 5-15 m of transported cover, Moolart Well Au deposit



Stewart and Anand, 2012

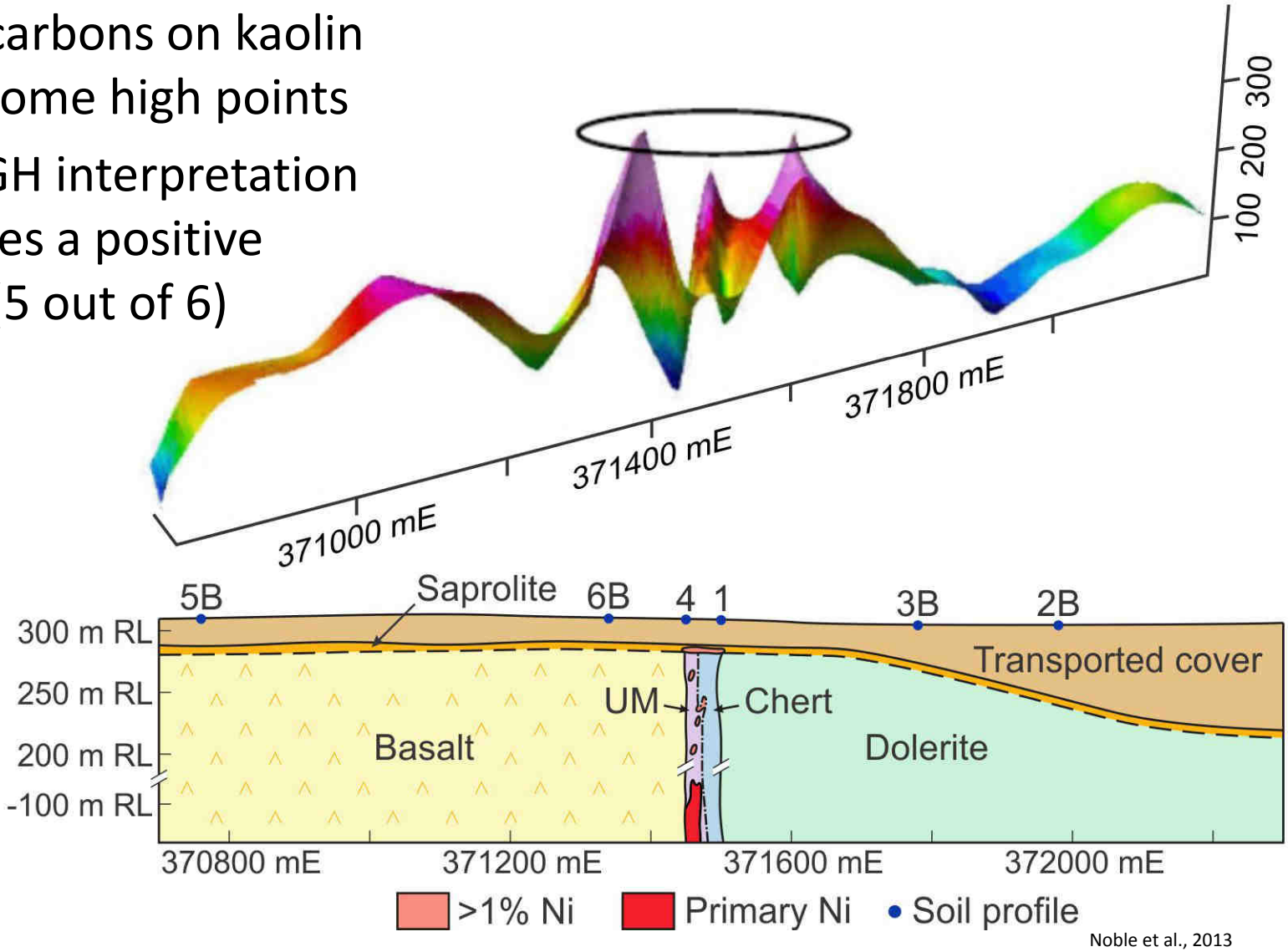
Pedogenic calcrete sampling medium: Safari Au deposit buried beneath 10 m of transported cover



Bristow et al, 2001

Soil Gas Hydrocarbon (SGH) results: Ore Hound Collectors, Miitel North Ni prospect, 10-20 m of transported cover

- Hydrocarbons on kaolin show some high points
- Lab SGH interpretation indicates a positive result (5 out of 6)



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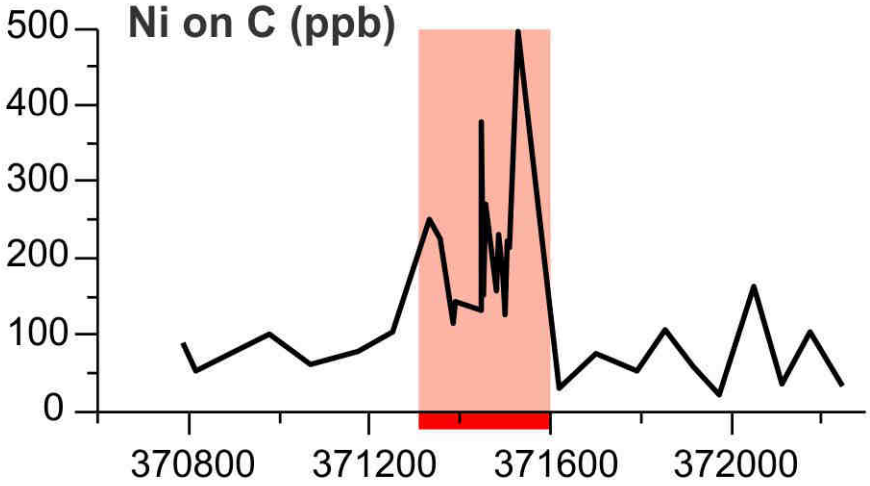
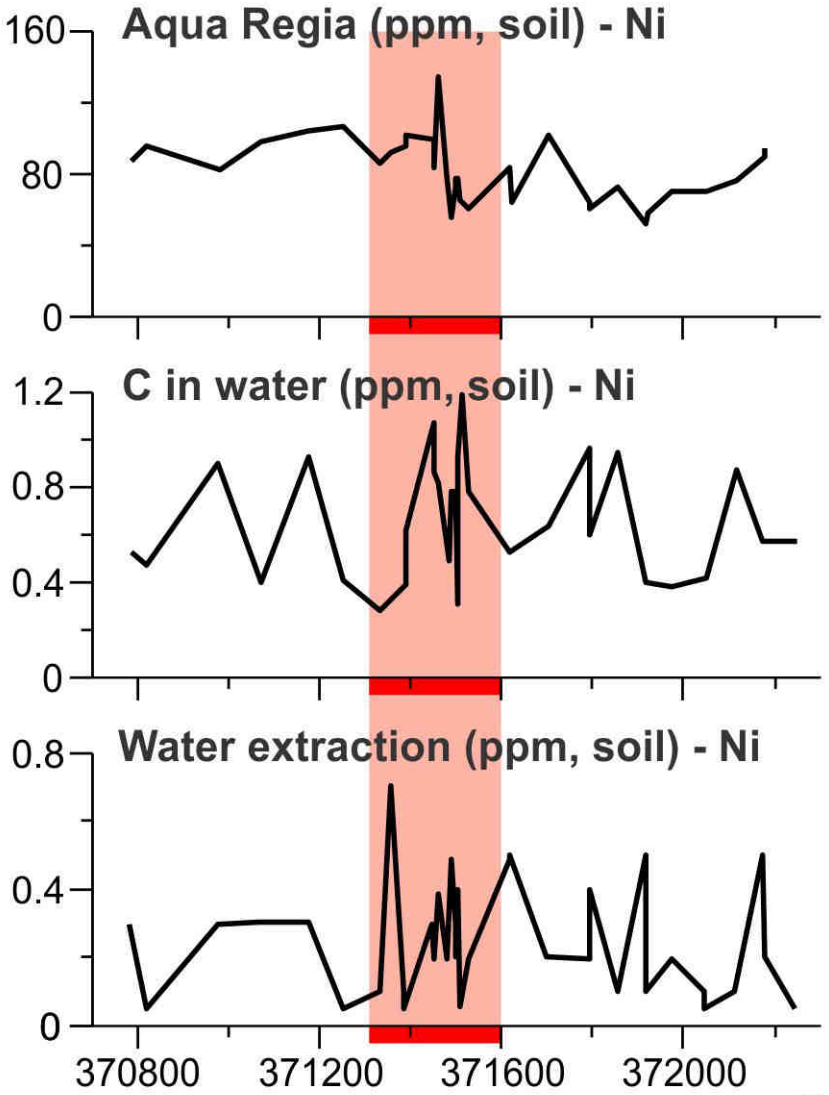
Noble et al., 2013

Ni on carbon collectors but not in soil around collectors, Miitel North Ni prospect



Soils around collectors



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Noble et al. 2013

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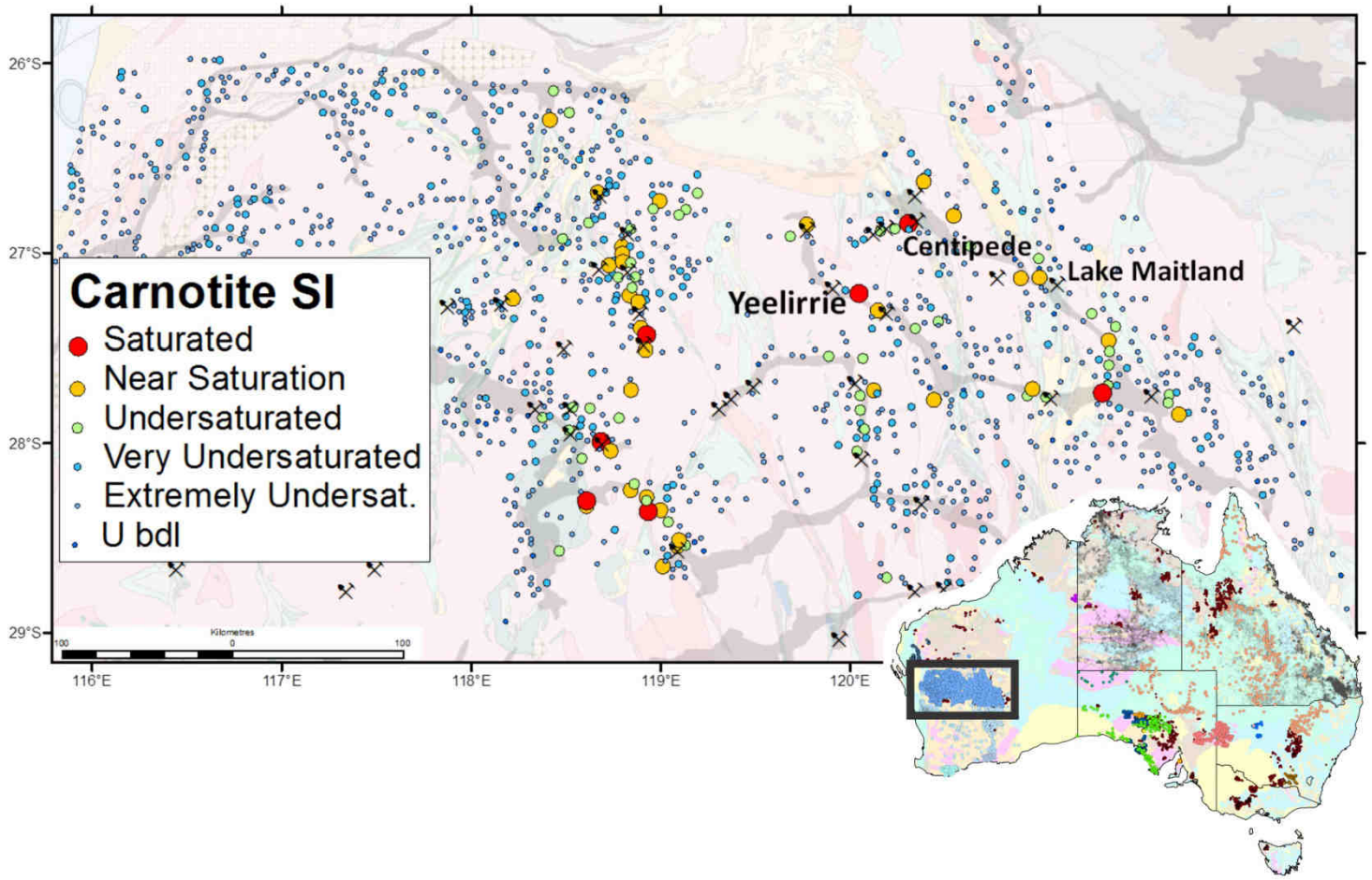
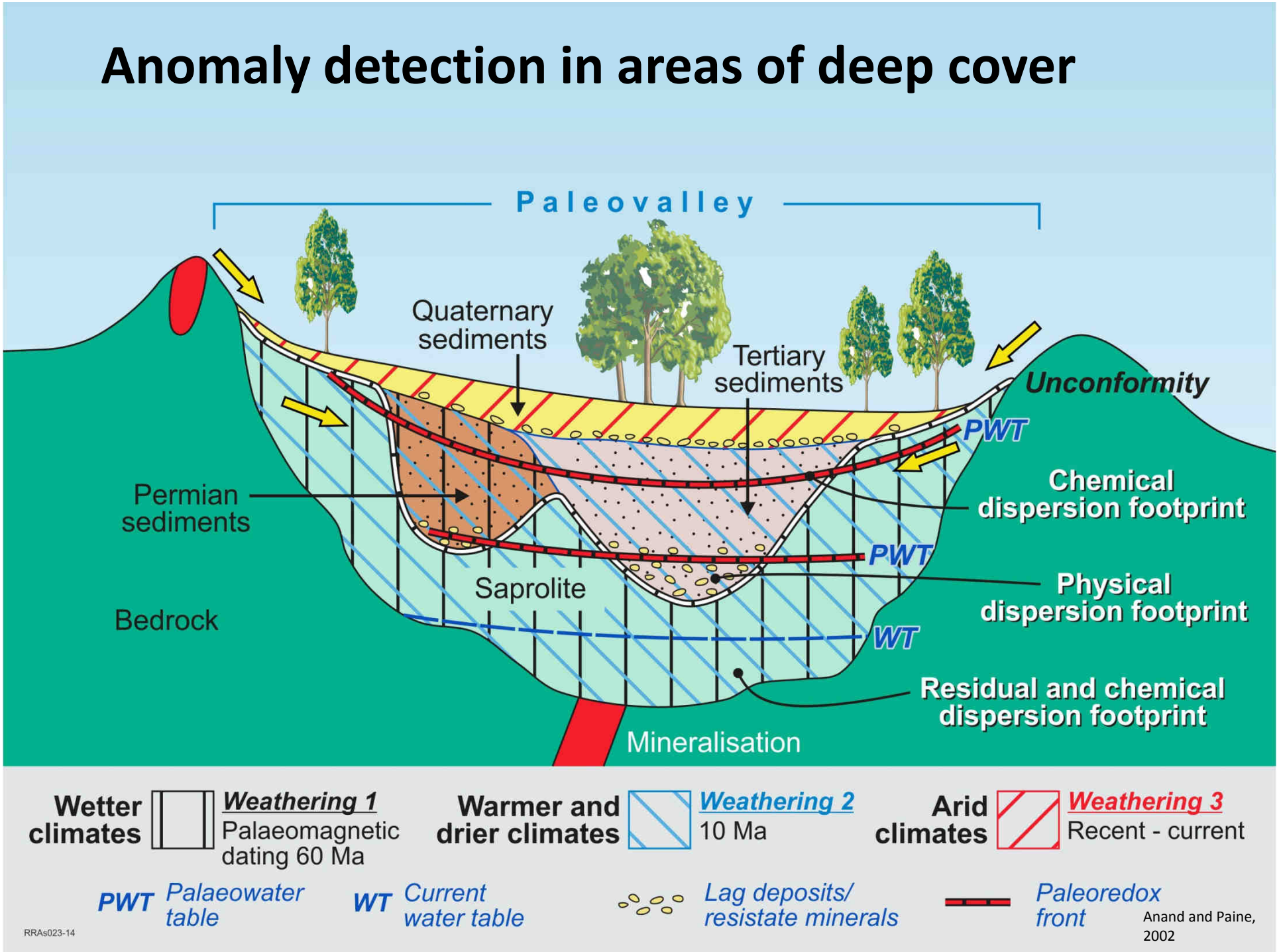
Application of hydrogeochemistry



Gray et al 2013

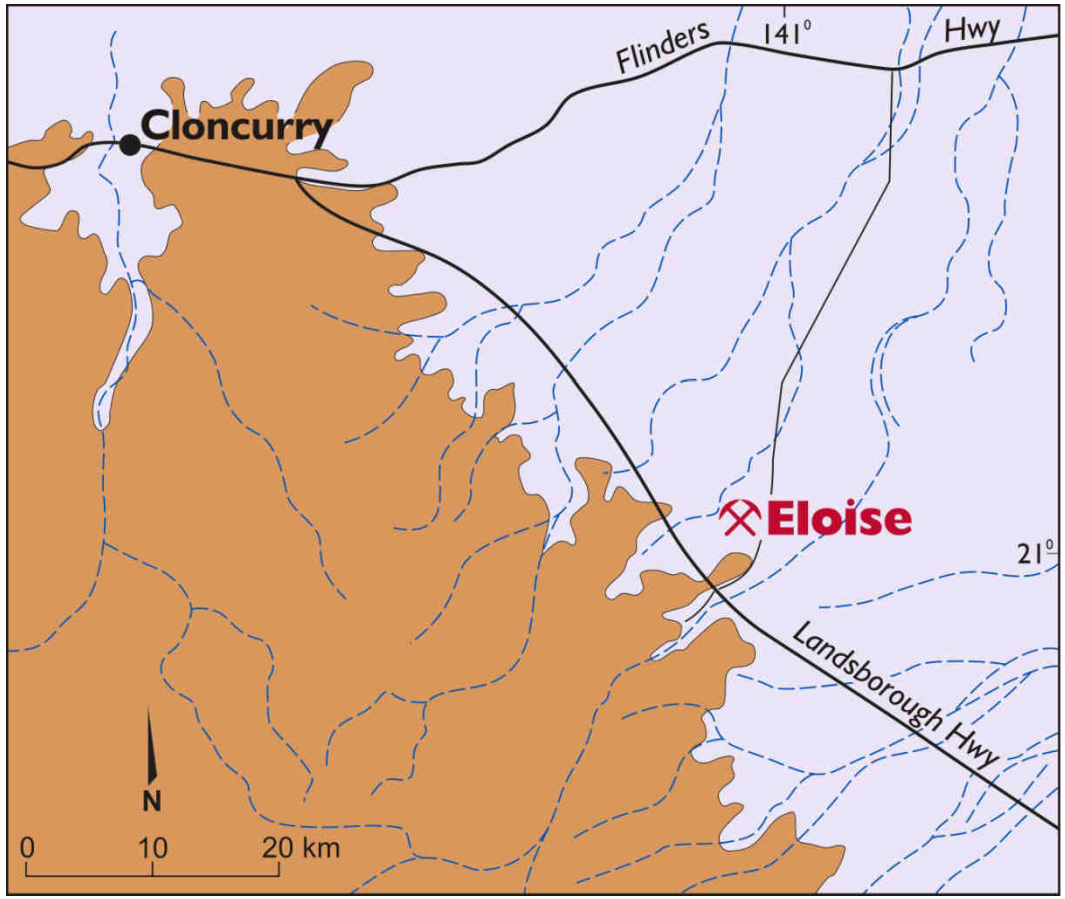
Anomaly detection in areas of deep cover

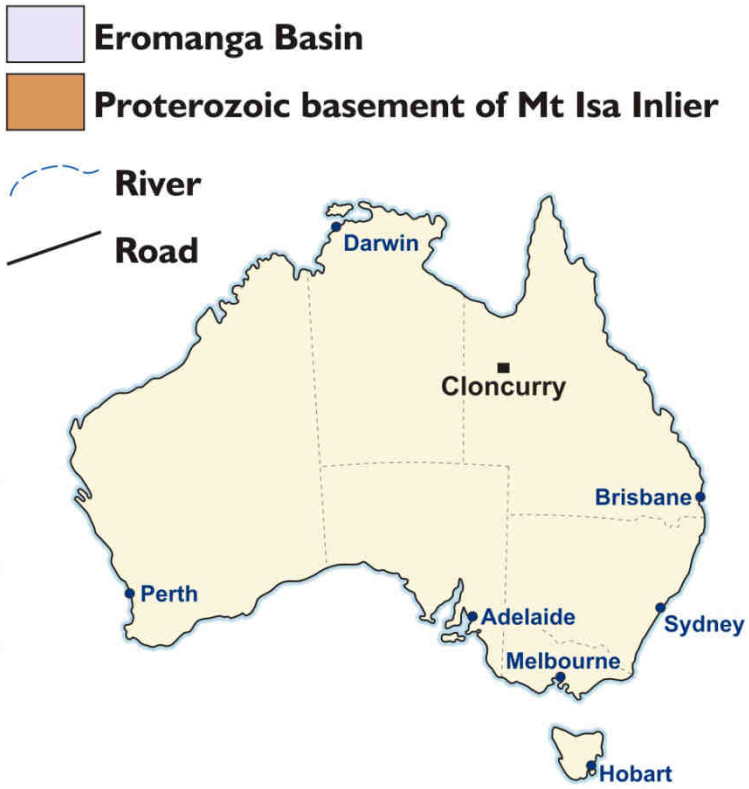


Anand and Paine, 2002

Areas of deep cover: Eloise (Cu-Au) deposit

Example of fresh cover overlying fresh basement

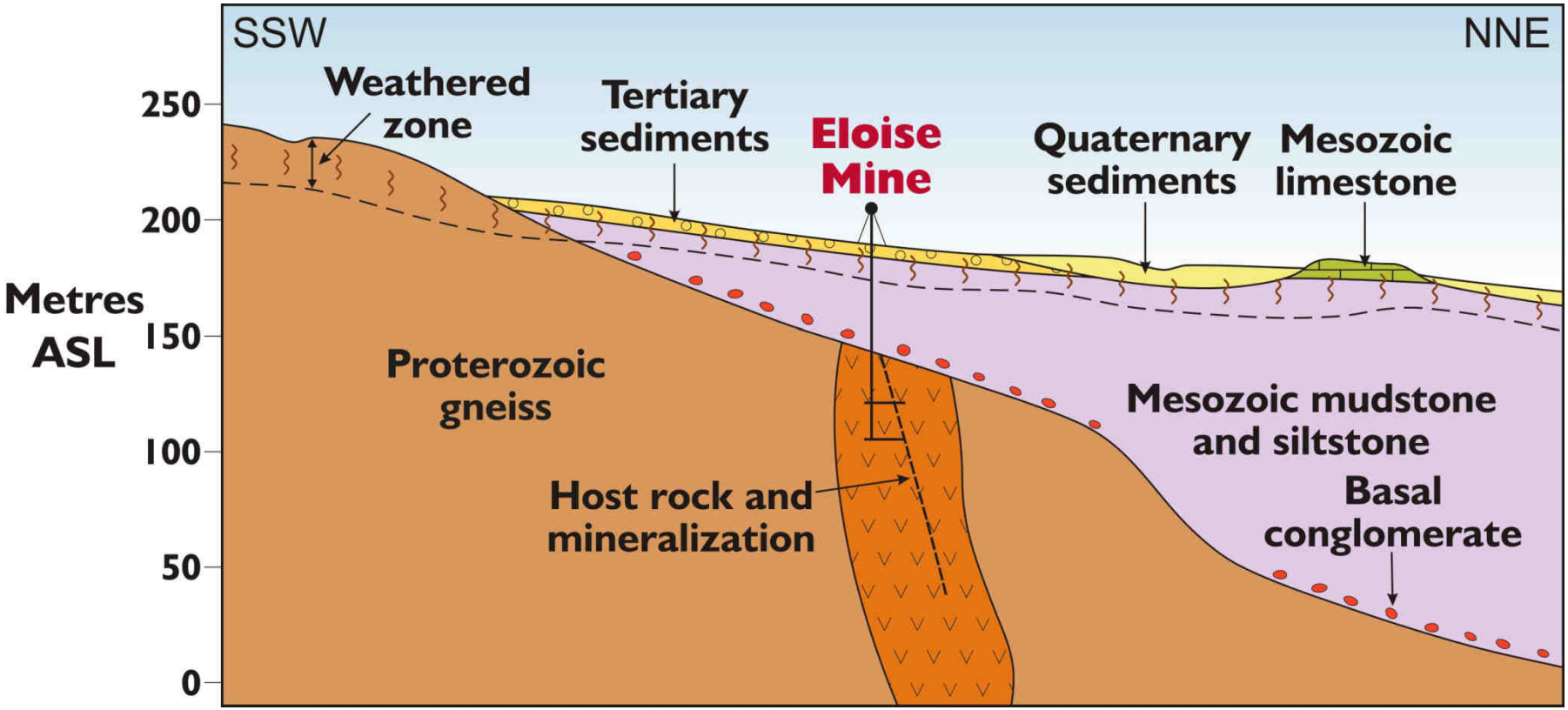




Robertson, 2009

Anand and Robertson, 2012

Eloise deposit buried beneath 70 m transported cover

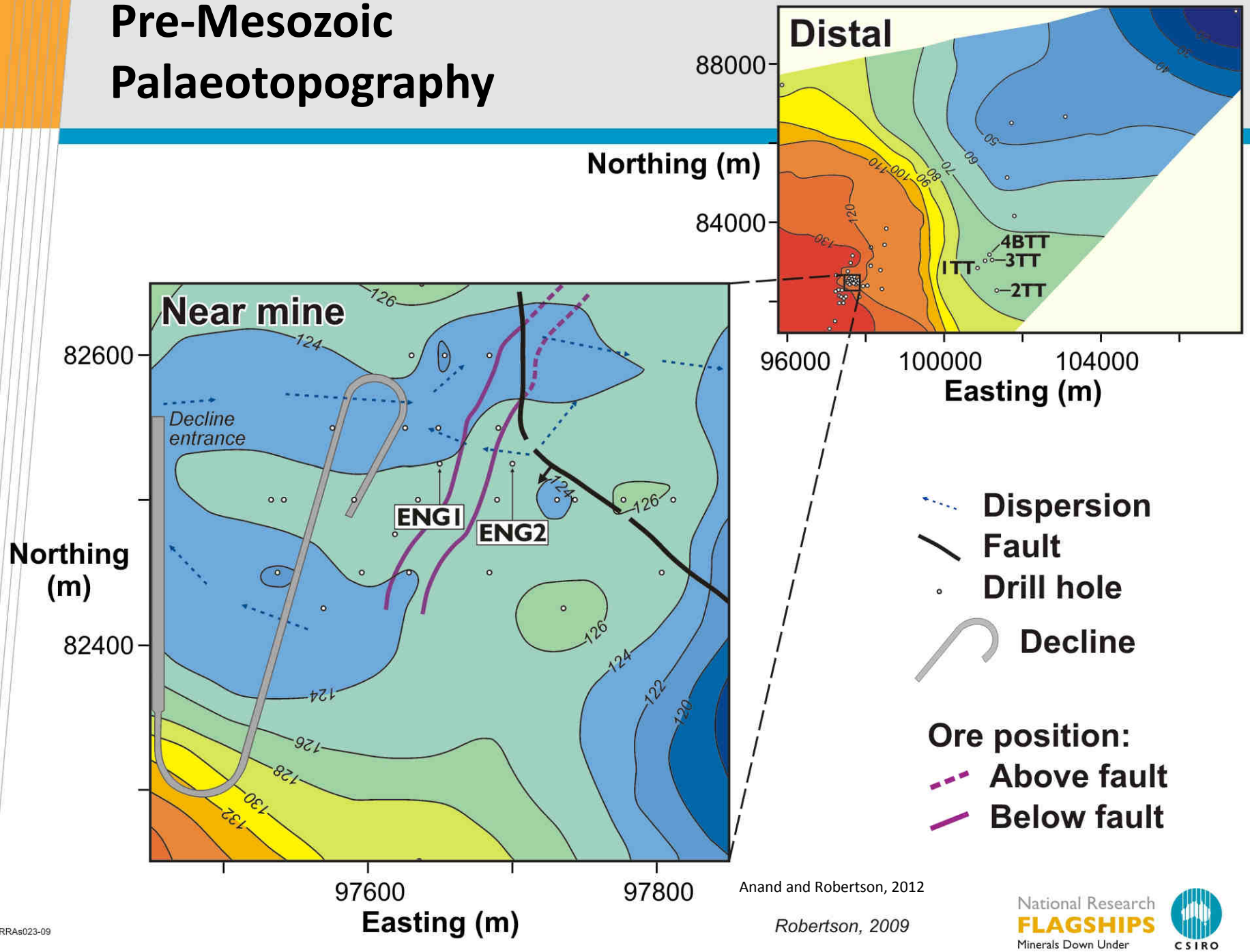


Unweathered cover

Unweathered basement

Anand and Robertson, 2012

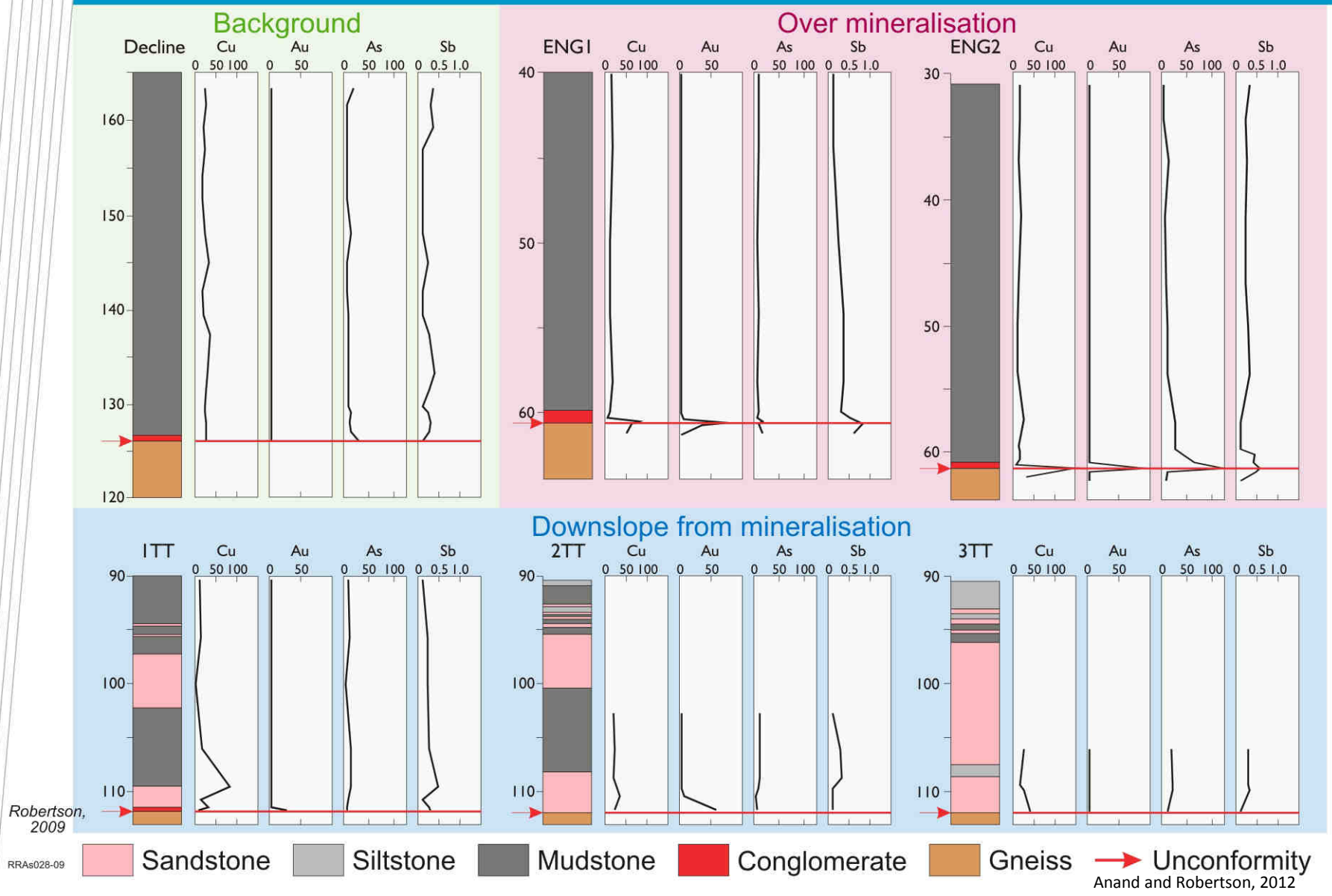
Pre-Mesozoic Palaeotopography



Anand and Robertson, 2012

Robertson, 2009

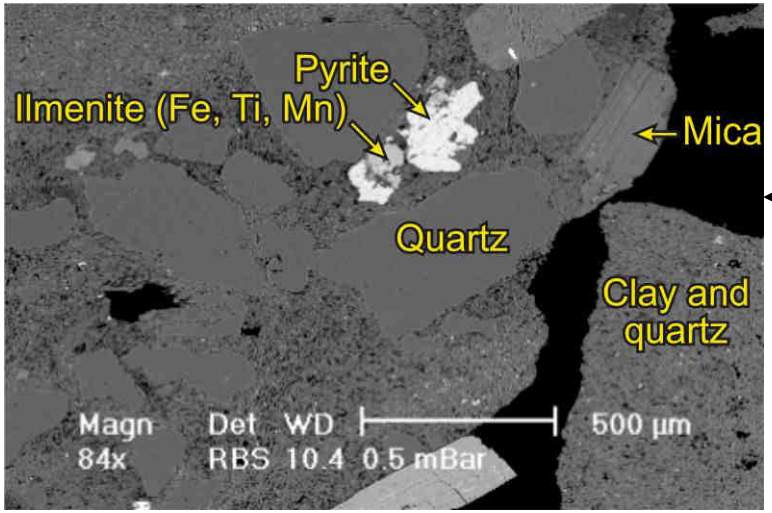
Geochemical dispersion at physical interface, Eloise deposi

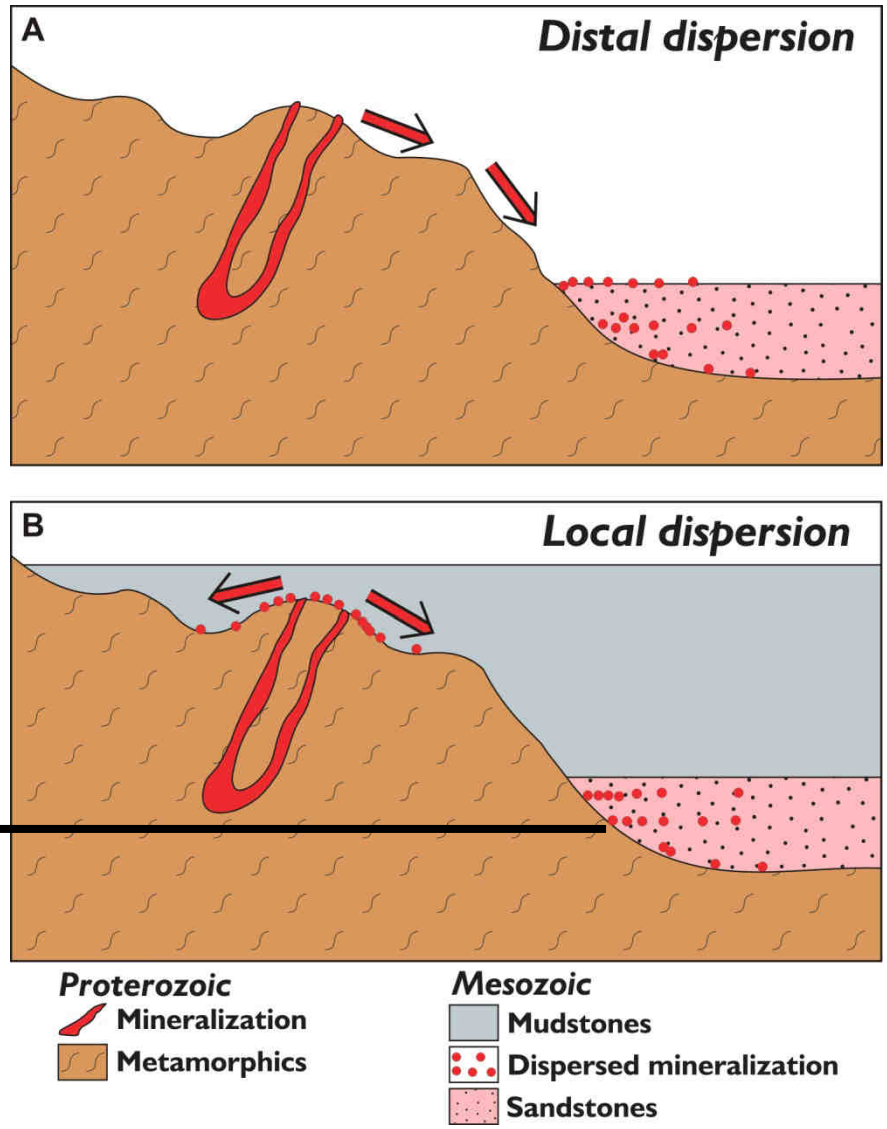


Anand and Robertson, 2012

Formation of anomaly at physical interface by mechanical processes, Eloise Cu-Au deposit

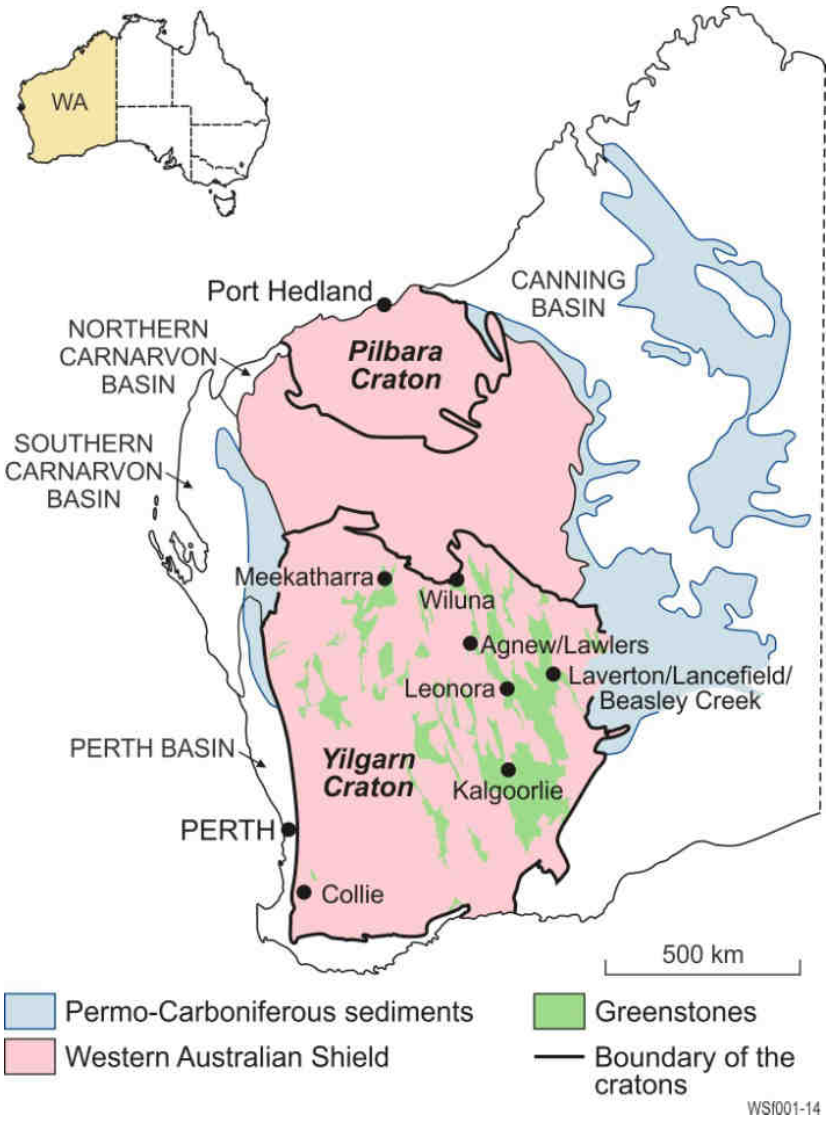
- Dispersion both local and distal (up to 3 km) by mechanical processes restricted to 5-10 m of basal sediments



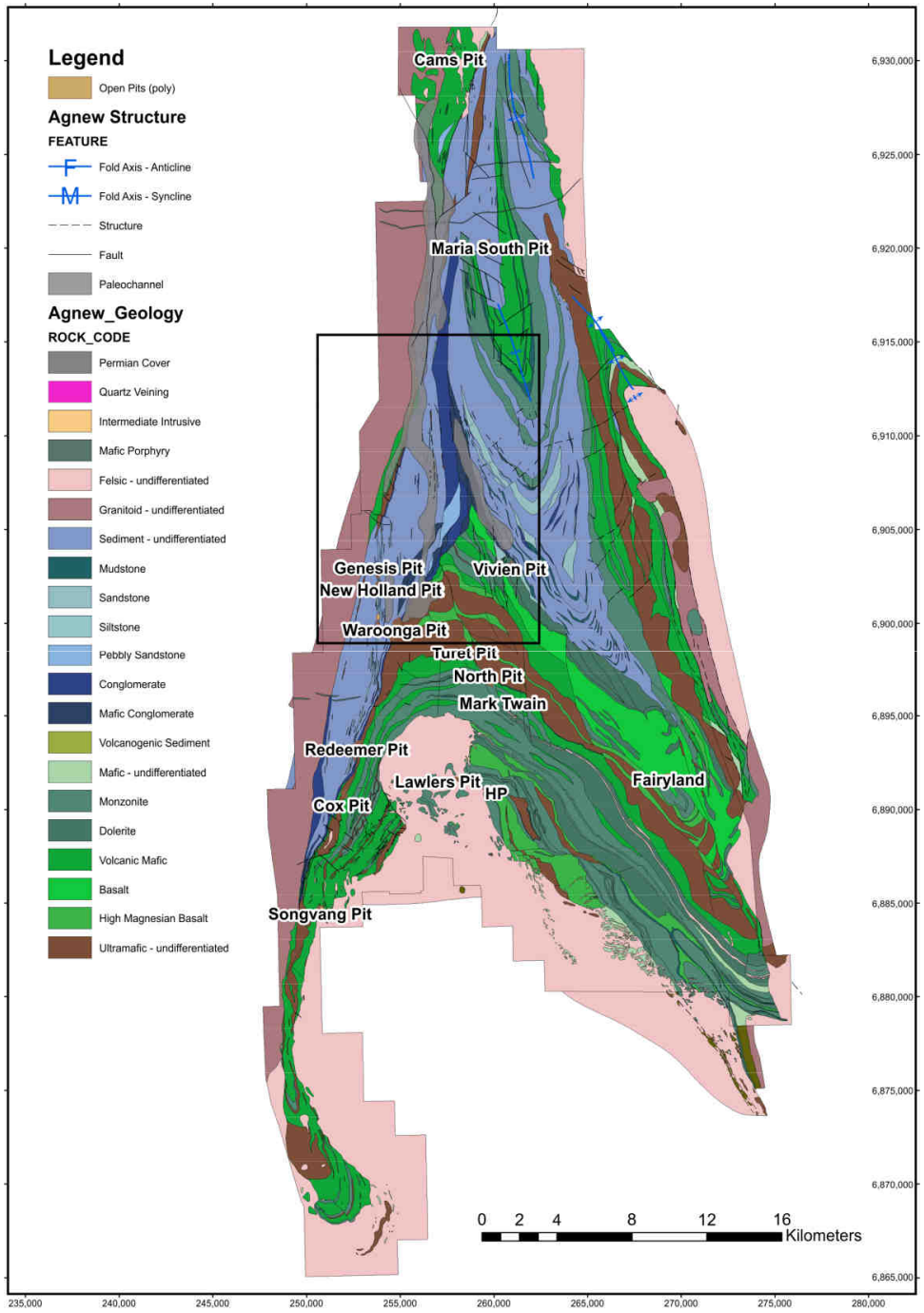


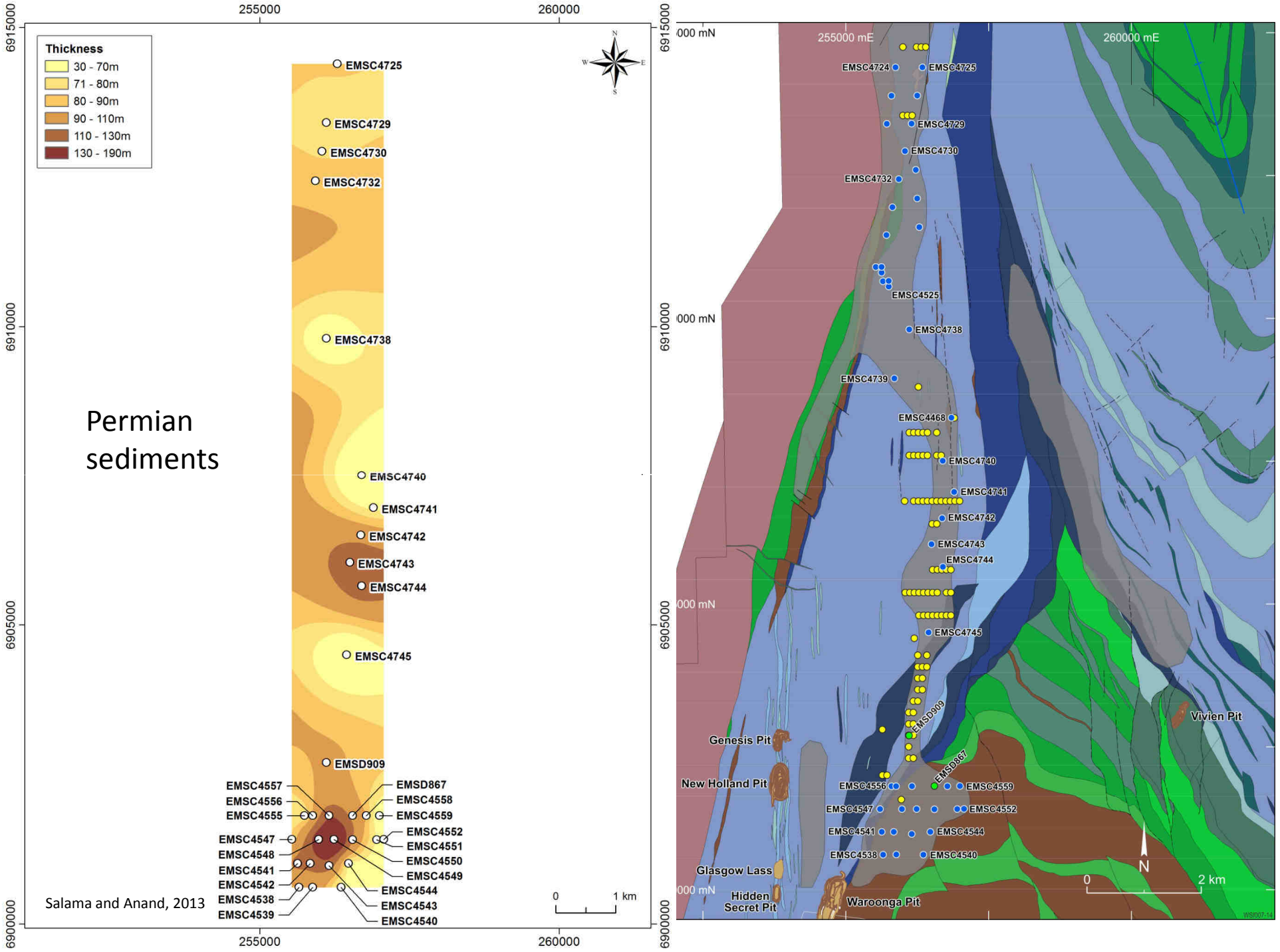
Anand and Robertson, 2012

Agnew Au camp: Example of fresh and weathered Permian sediments



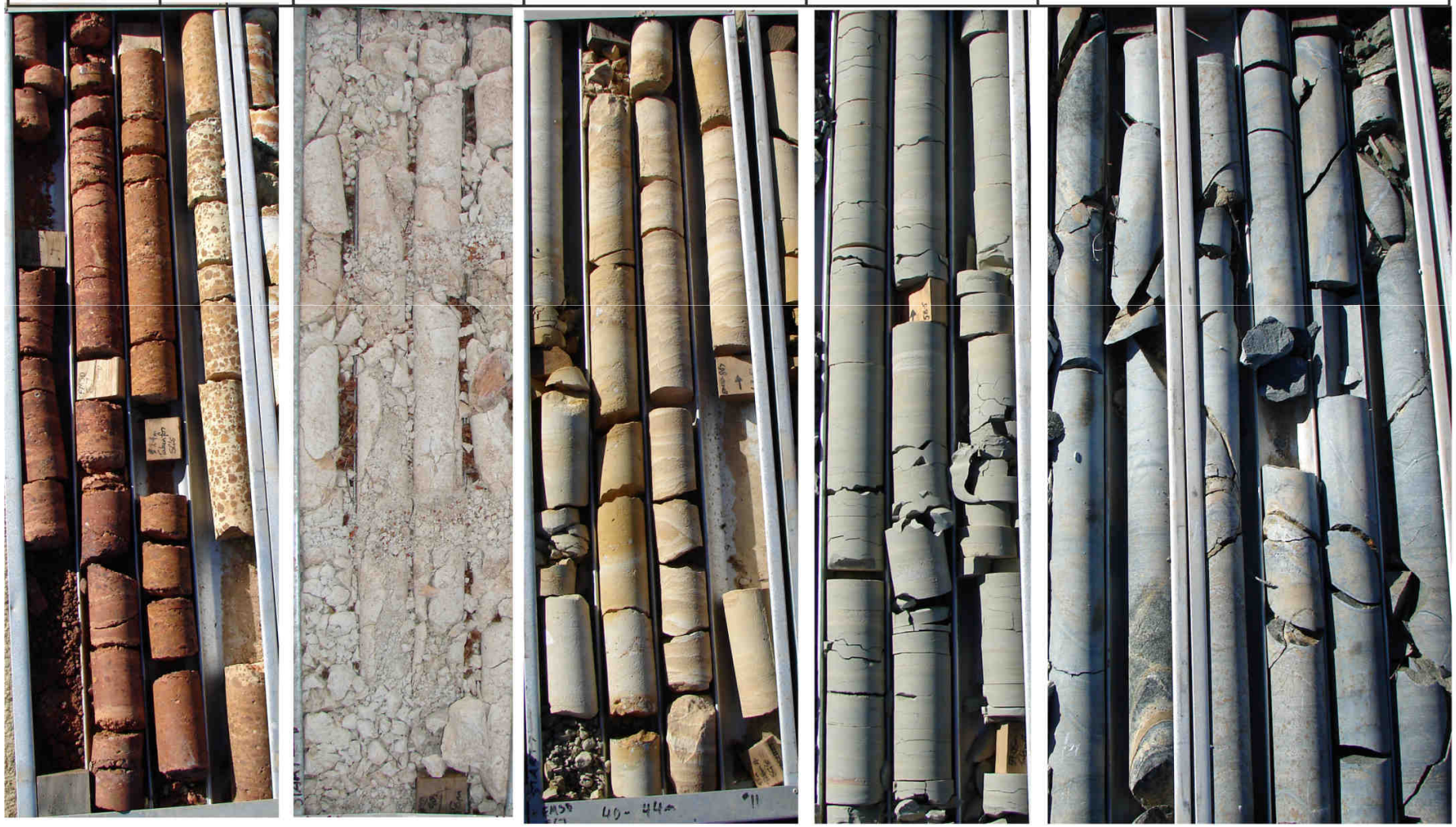
Modified after Eyles and De Broekert, 2001 and Eyles et al., 2002




Thickness
30 - 70m
71 - 80m
80 - 90m
90 - 110m
110 - 130m
130 - 190m
255000
260000
6915000
6910000
6905000
6900000
EMSC4725
EMSC4729
EMSC4730
EMSC4732
EMSC4738
EMSC4740
EMSC4741
EMSC4742
EMSC4743
EMSC4744
EMSC4745
EMSD909
EMSC4557
EMSC4556
EMSC4555
EMSC4547
EMSC4548
EMSC4541
EMSC4542
EMSC4538
EMSC4539
EMSD867
EMSC4558
EMSC4559
EMSC4552
EMSC4551
EMSC4550
EMSC4549
EMSC4544
EMSC4543
EMSC4540
0
1 km
Permian sediments
Salama and Anand, 2013
255000 mE
260000 mE
EMSC4724
EMSC4525
EMSC4739
EMSC4468
EMSC4743
EMSC4556
EMSC4559
EMSC4547
EMSC4552
EMSC4541
EMSC4544
EMSC4538
EMSC4540
Vivien Pit
Genesis Pit
New Holland Pit
Glasgow Lass
Hidden Secret Pit
Waroonga Pit
N
0
2 km

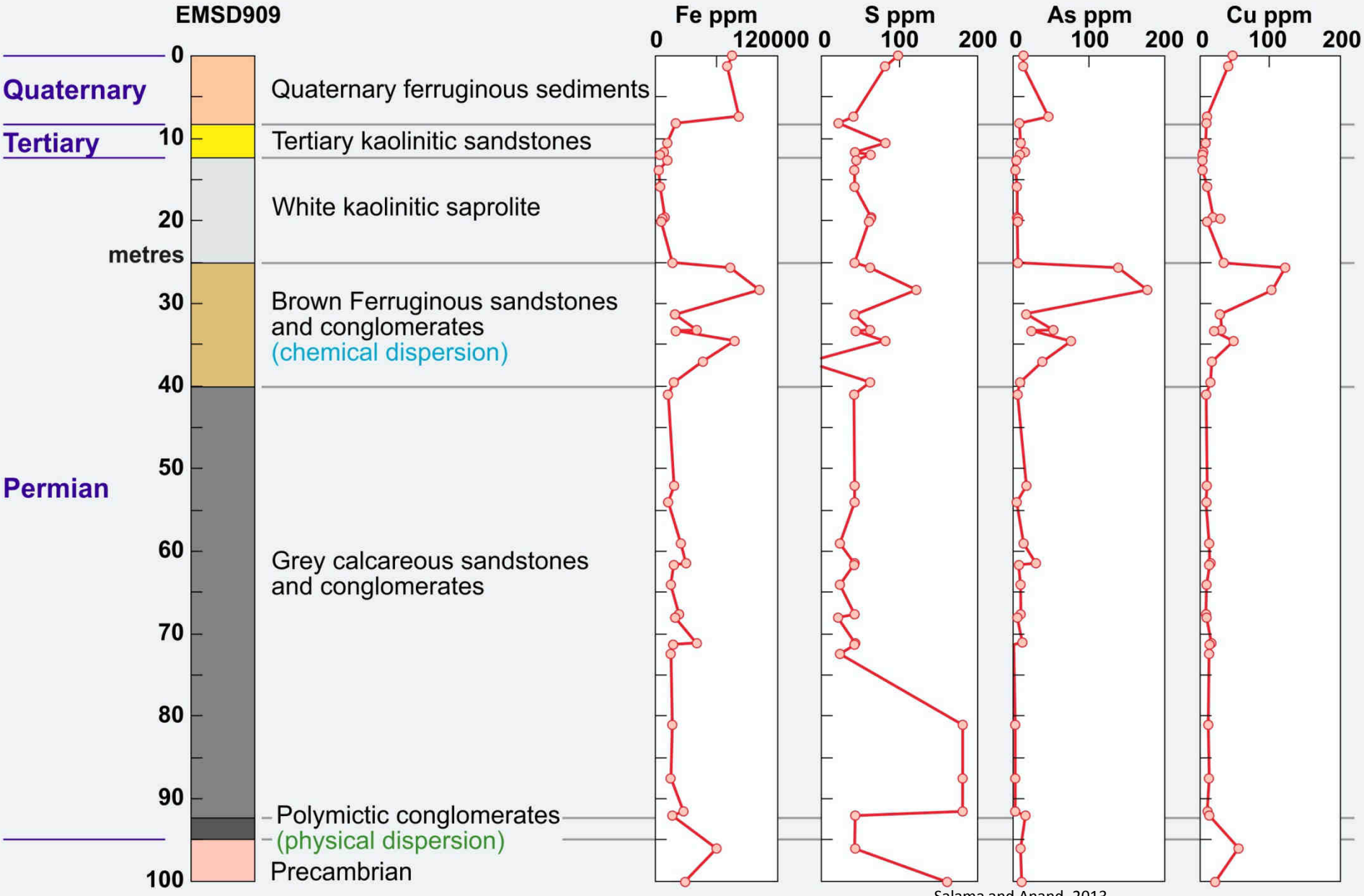
Physical and chemical interfaces

Quaternary	Tertiary	Permian sediments			Basement
		Unit III	Unit II	Unit I	
Fe-pisoliths and nodules	Fe pisoliths in clays	Kaolinitic saprolite	Ferruginous brown Sandstones	Grey calcareous Siltstones-sandtones	Ultramafic rocks



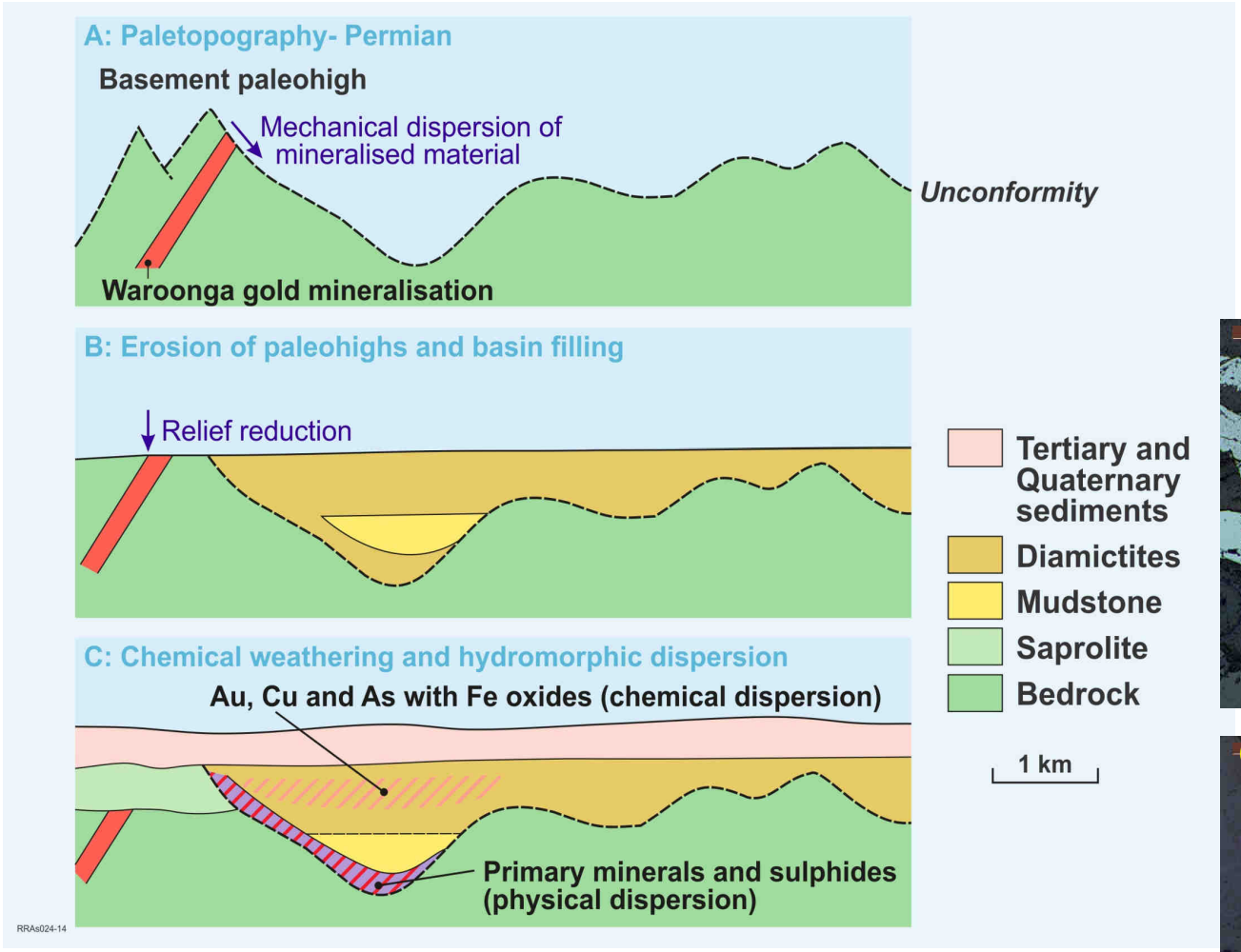
Salama and Anand, 2013

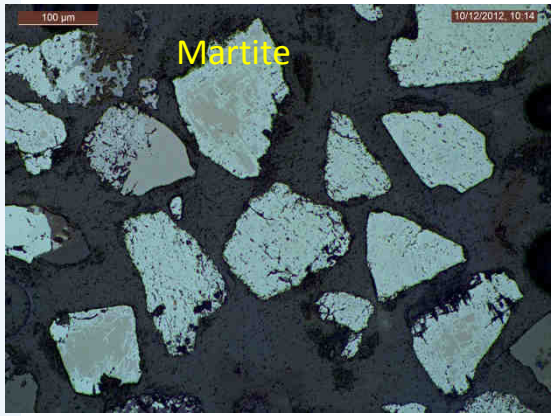
Physical and chemical dispersion footprint at interfaces

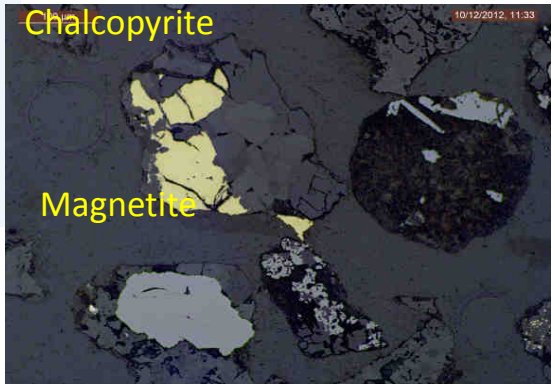


Salama and Anand, 2013

Dispersion model

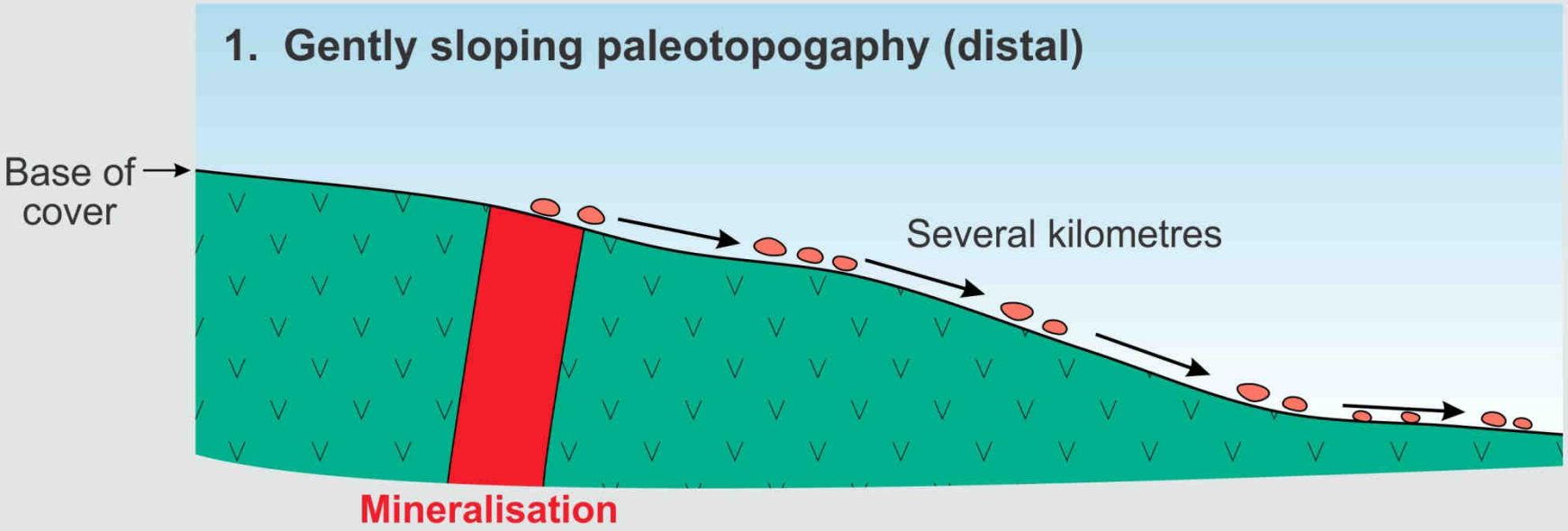


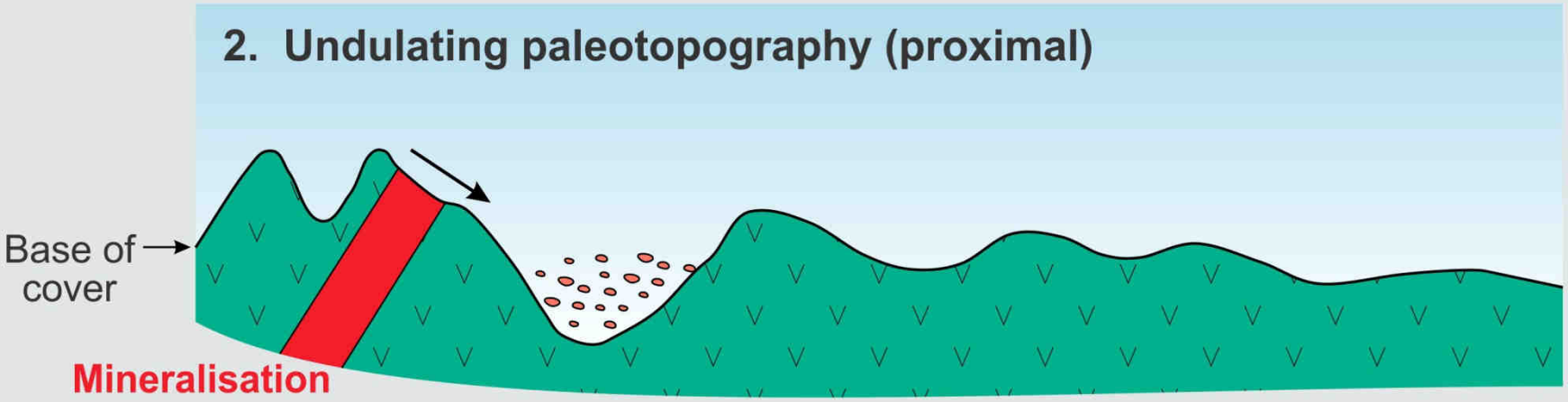




Salama and Anand, 2013

Paleotopography control on geochemical/mineralogical dispersion footprint





Anand, 2014

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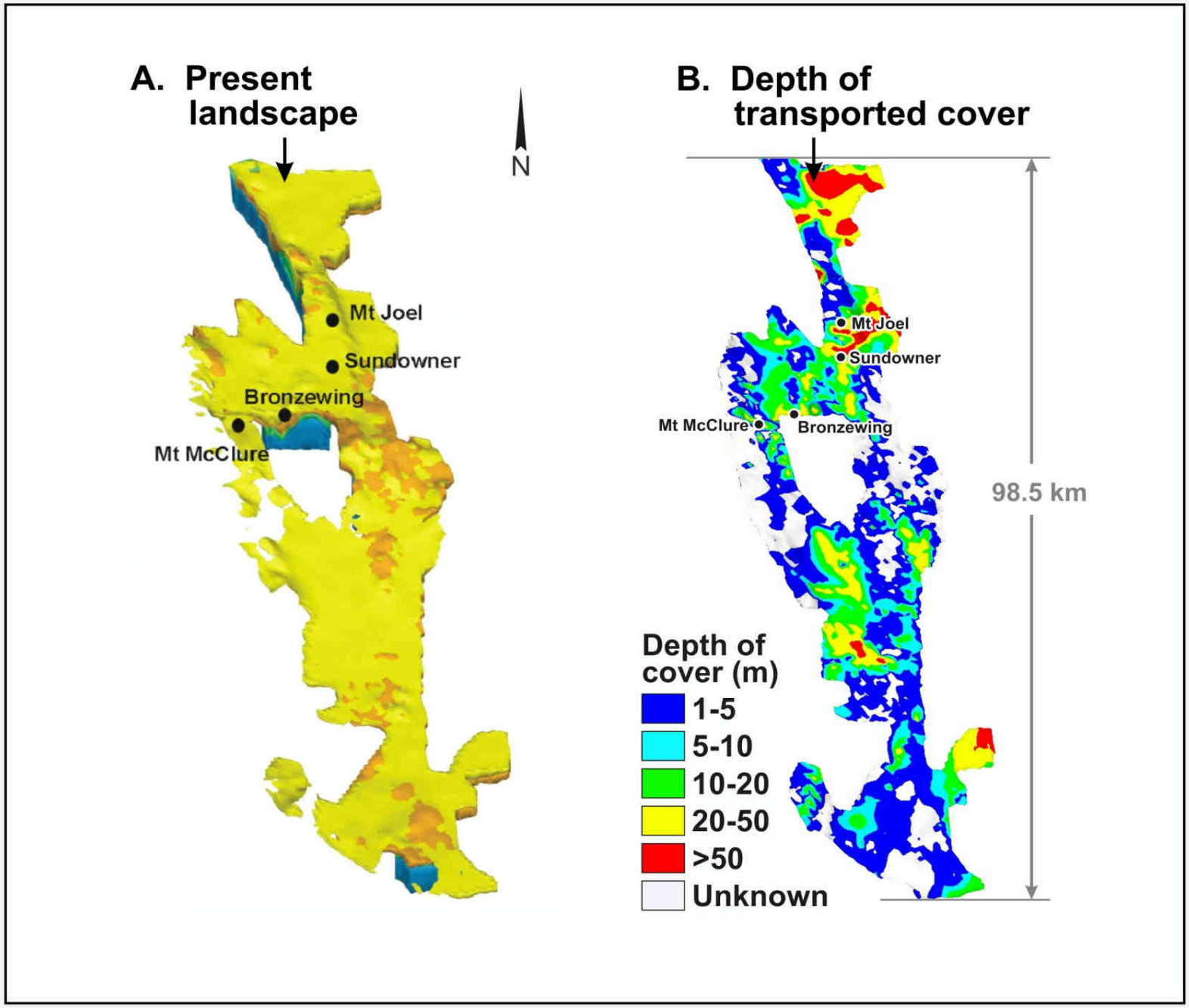
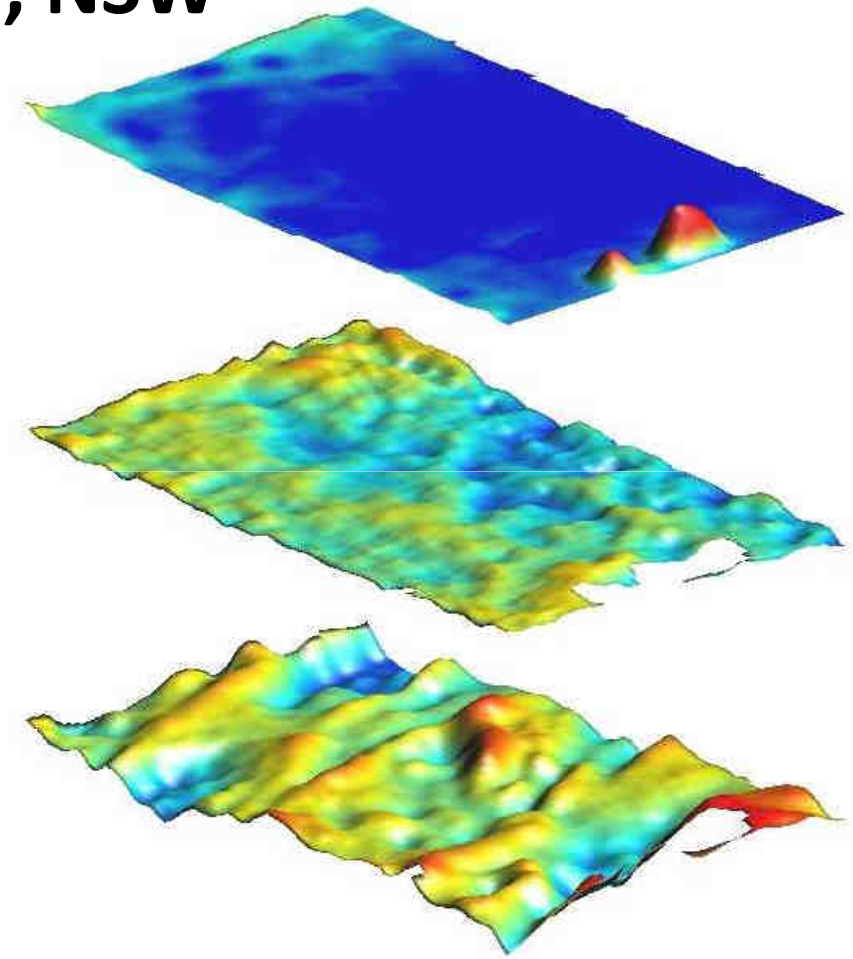
Depth of transported cover map: important first step



Mapping paleosurfaces/paleotopography: Example Gilmore area, NSW



Present landscape

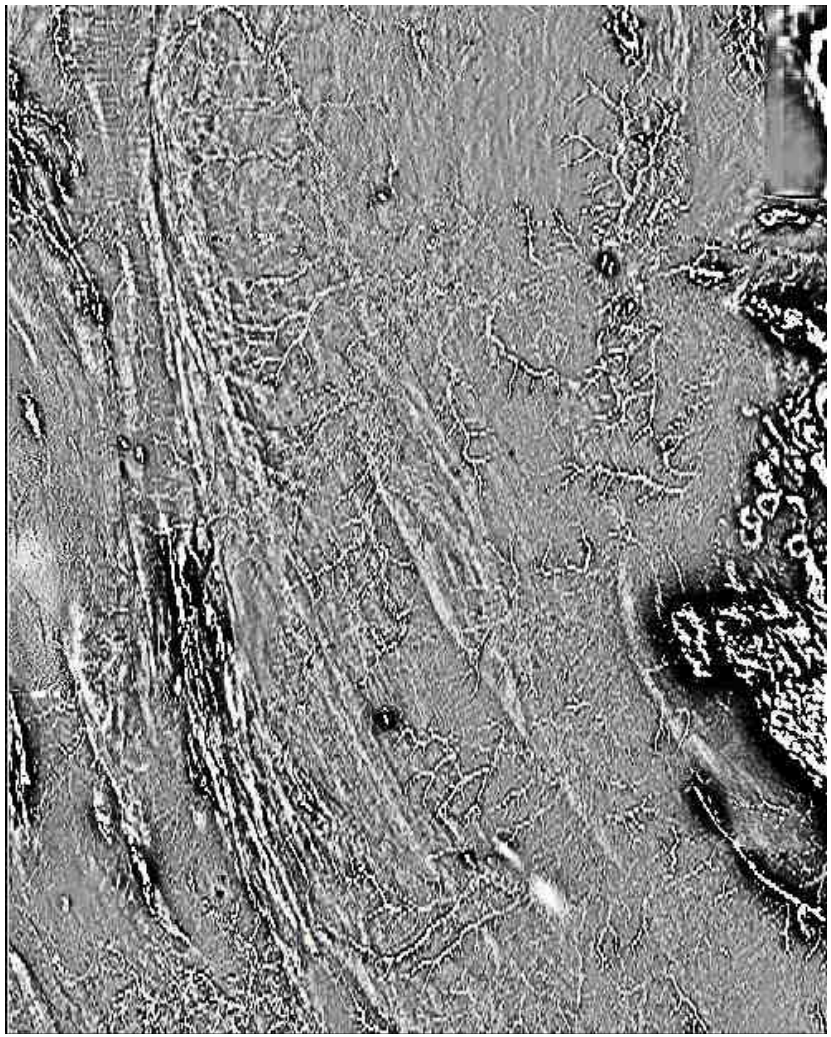
Base of cover

Weathering front

Munday, 2001

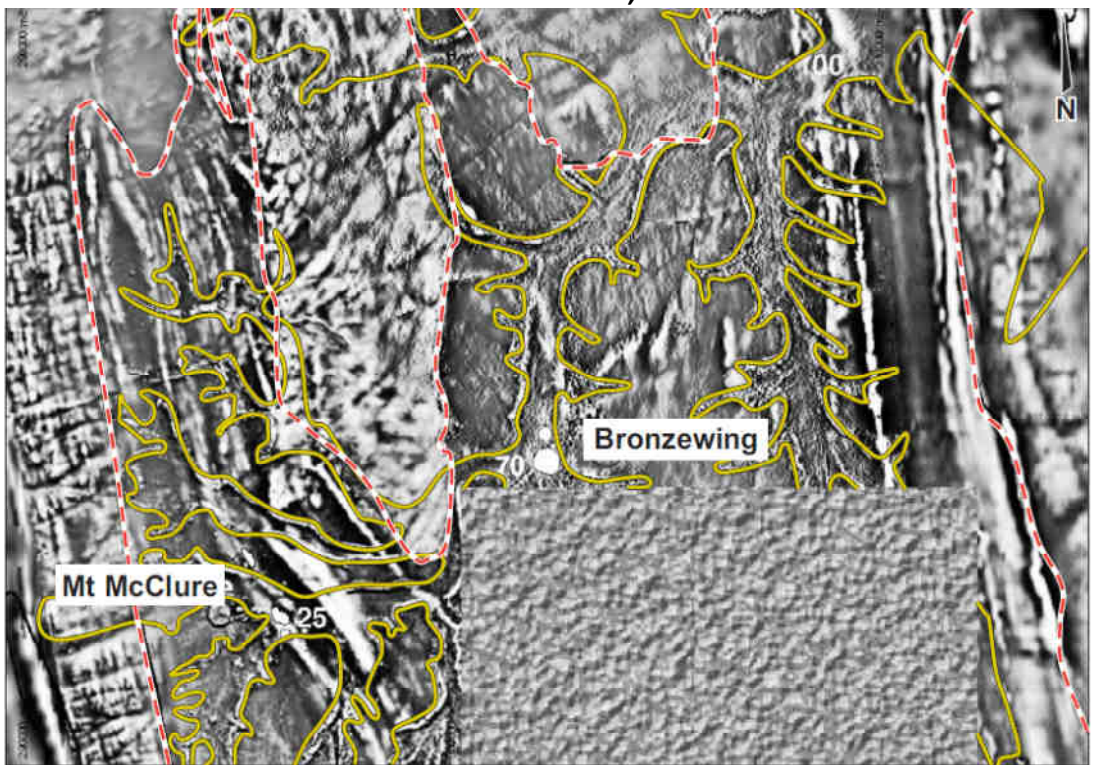
Mapping paleodrainages

Hermidale, NSW



Source: GA

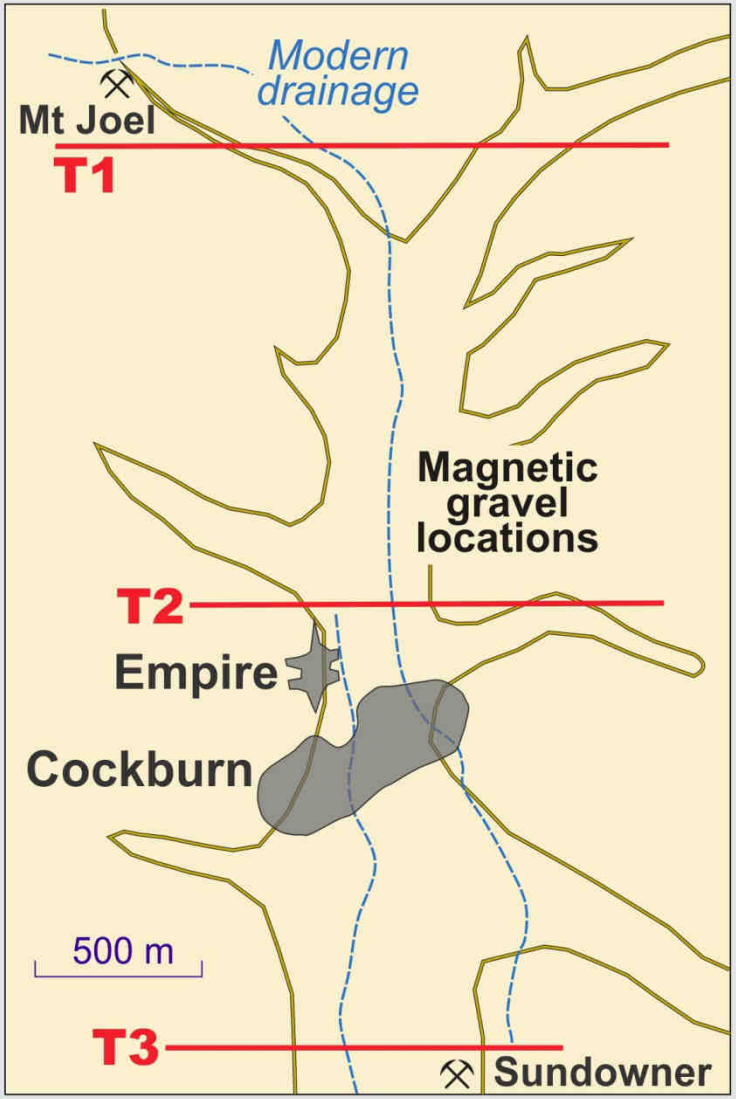
Yandal Belt, WA

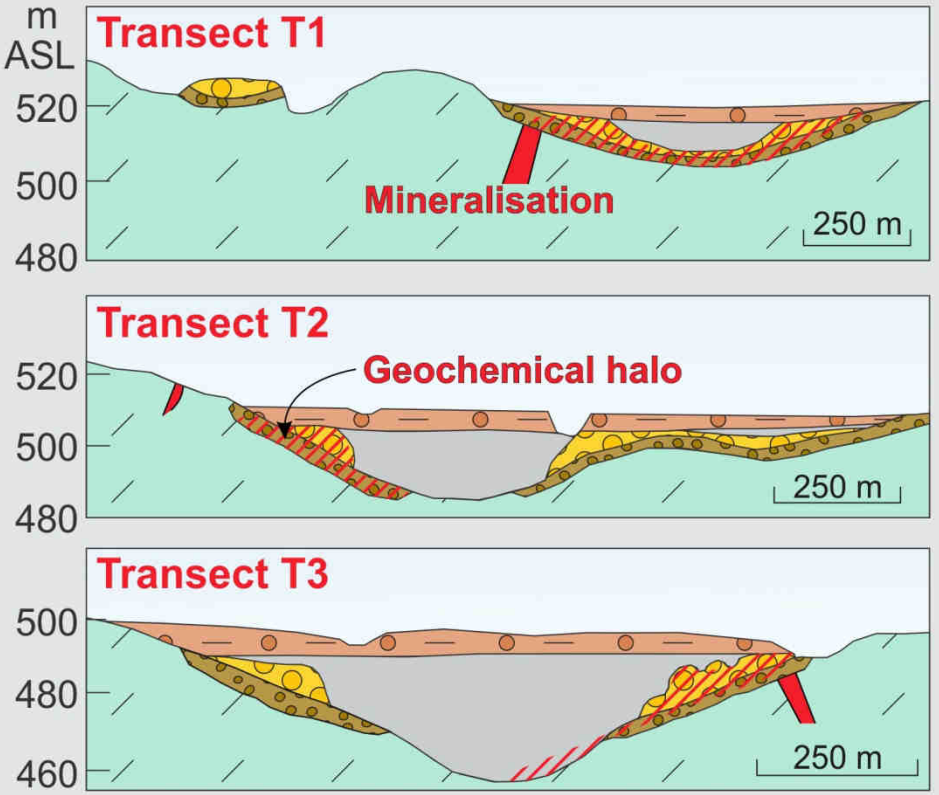


Wildman and Compston, 2000

5 km

Magnetic gravels define the channels and provide larger geochemical dispersion footprint



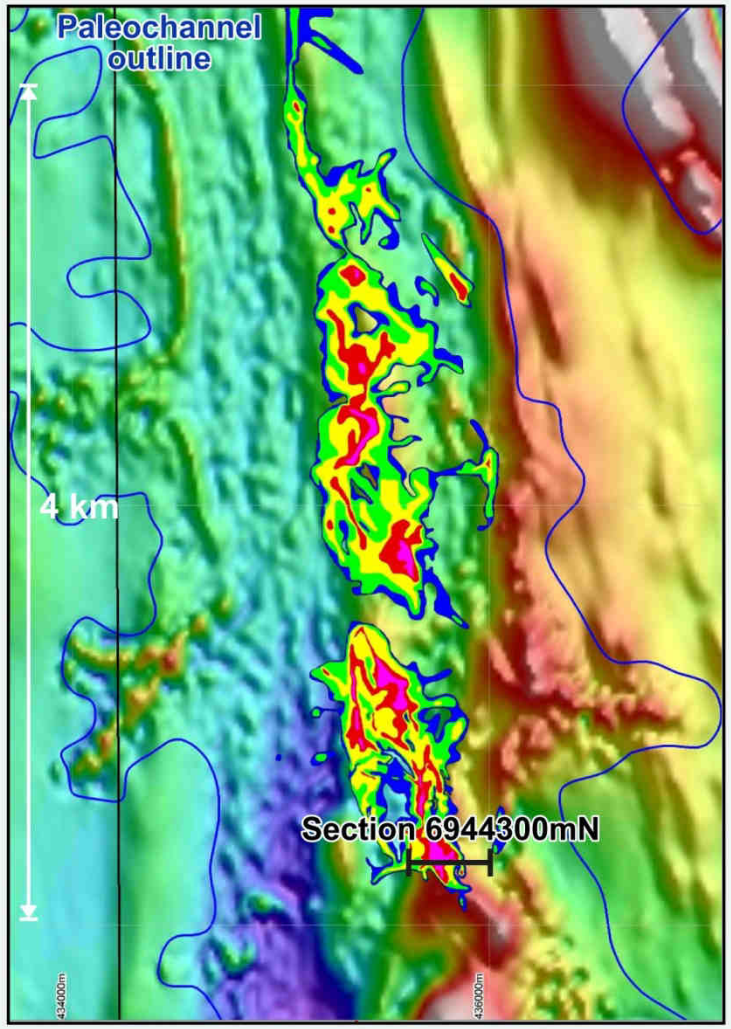


Hardpanized colluvium
Residual lateritic gravels
Magnetic gravels
Saprolite
Channel clays

Modified after Wildman and Compston , 2000

Gravels provide larger geochemical dispersion footprint: Moolart Well Au deposit

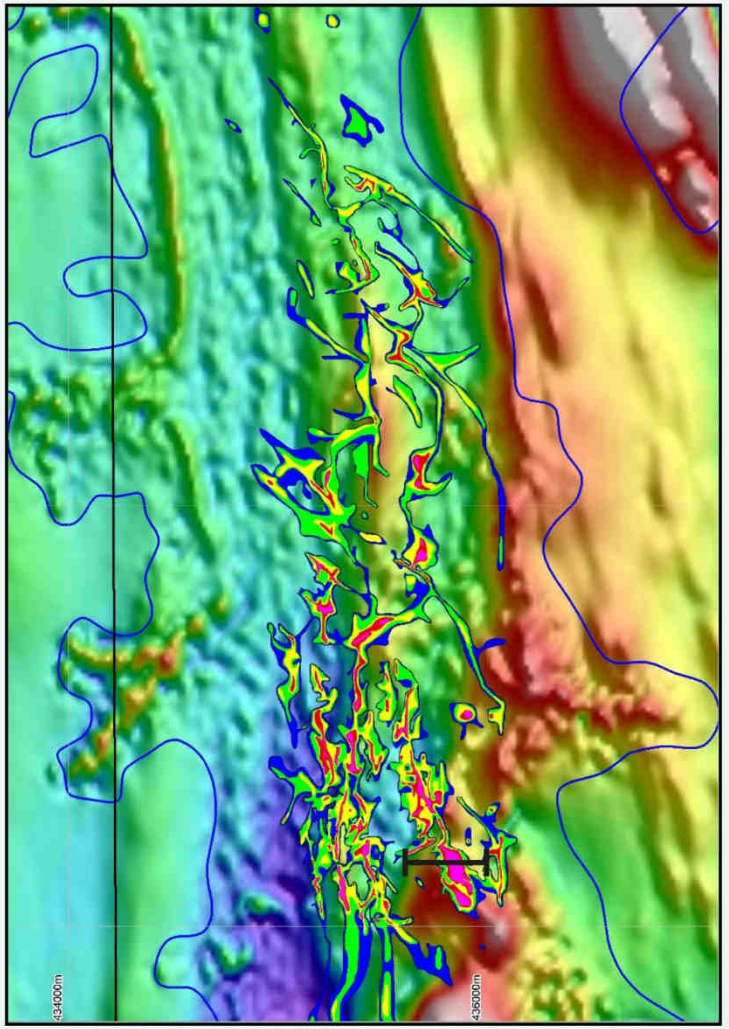
Gravels Au



Pisolith thickness x grade

>16 gm
2–4 gm
8–16 gm
1–2 gm
4–8 gm

Saprolite Au



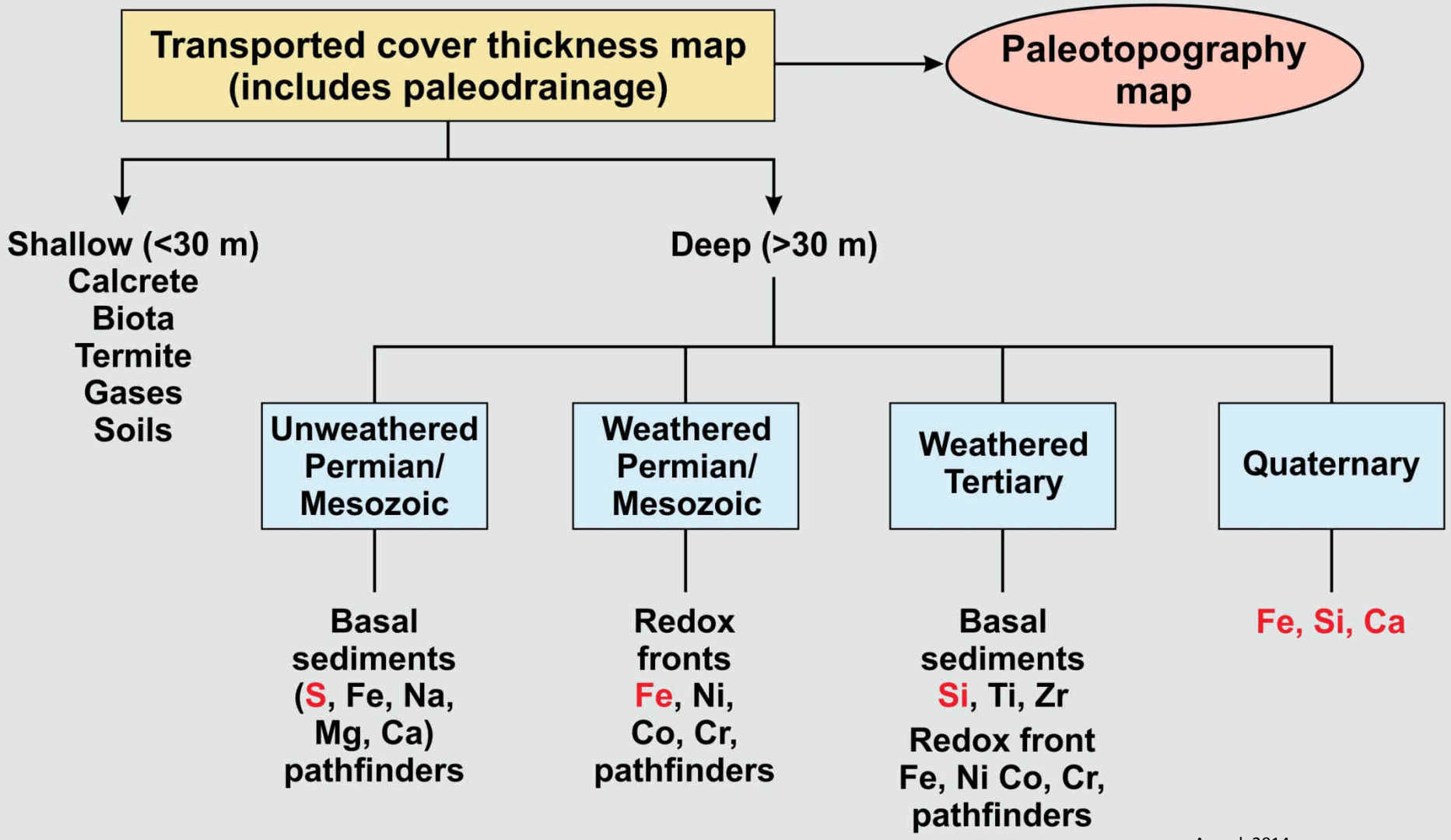
Oxide Au

>16 gm
2–4 gm
8–16 gm
1–2 gm
4–8 gm

RRAs112-12

Balkau et al., 2007; Regis resources

Characters of cover for rapid logging and sampling



Anand, 2014

Conclusions

Surface techniques (e.g., biota, calcrete, termites, gases) are likely to be effective in shallow cover.

In deep cover, surface response unlikely. However, physical interfaces (unconformities, lag deposits, heavy minerals) and chemical interfaces (paleoredox fronts, secondary minerals) are promising sample media.

Need to map the depth of cover to prioritise the areas and designing sampling strategy.

Character of the cover such as physical and chemical interfaces need to be mapped

Age of cover

Acknowledgements

- Numerous mining companies
- CSIRO/MDU
- AMIRA
- DETCRC