

**Gold in calcrete
- 20 years on**

Mel Lintern

Acknowledgements

- **C. Butt**
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Primary Industries and Resources SA



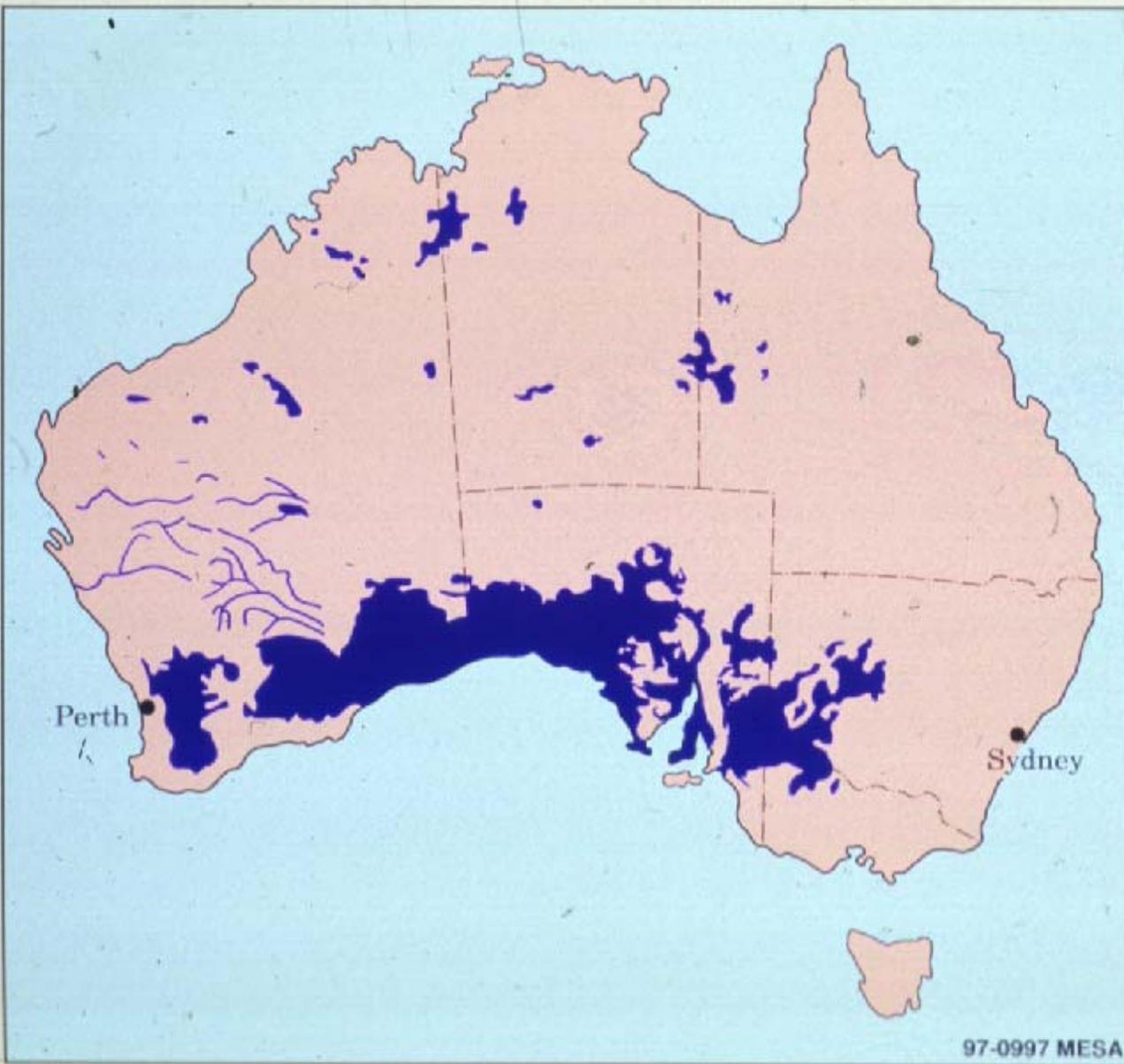
Curtin 
University of Technology



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- **C. Drown**
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- **CRC LEME staff**
- **AGSO staff**

Distribution of Calcrete

*(after Northcote et al., 1975;
Scott, 1982;
Churchward, 1983;
Lintern, own observations)*

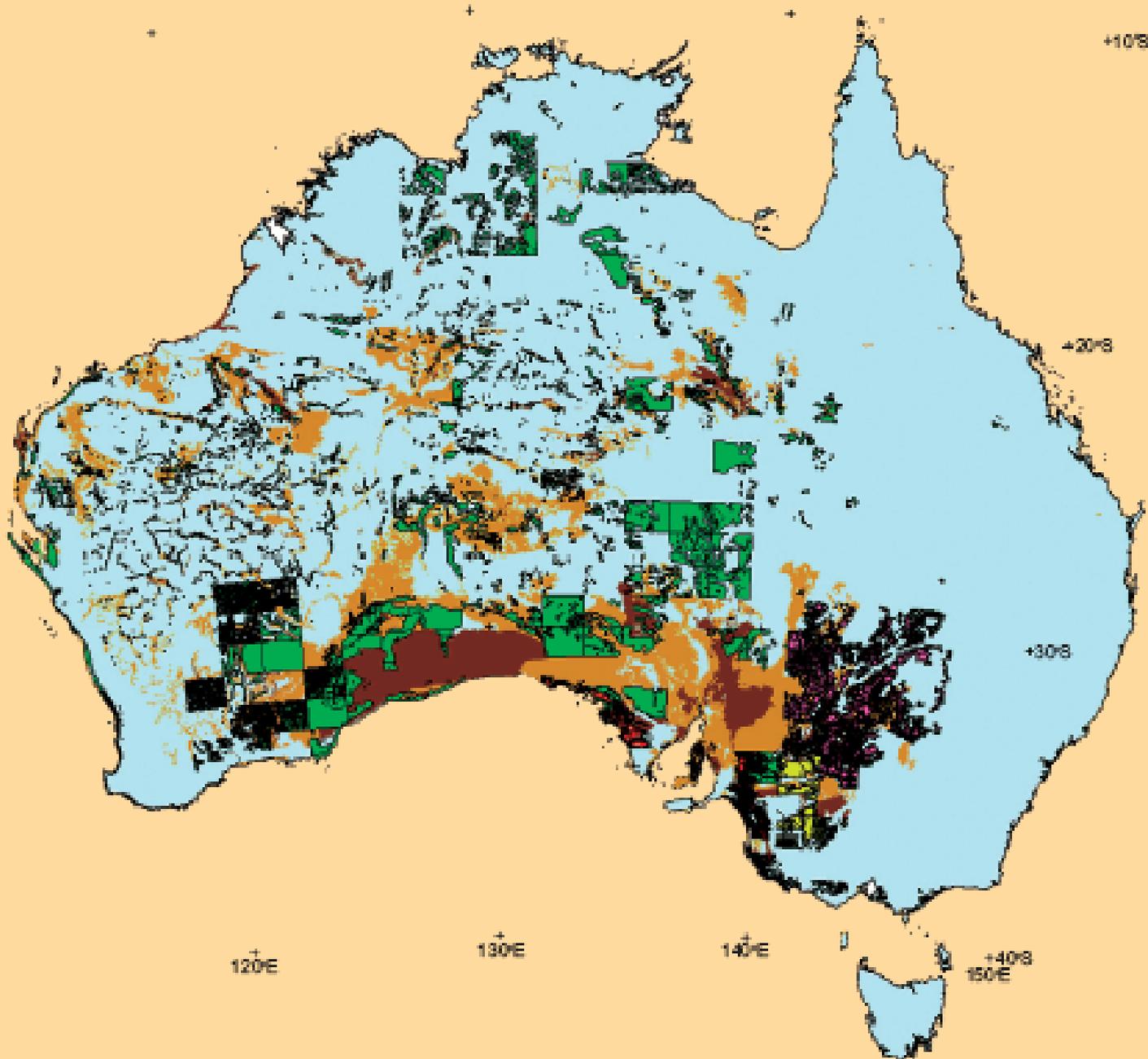


97-0997 MESA

**MINES and ENERGY
RESOURCES**

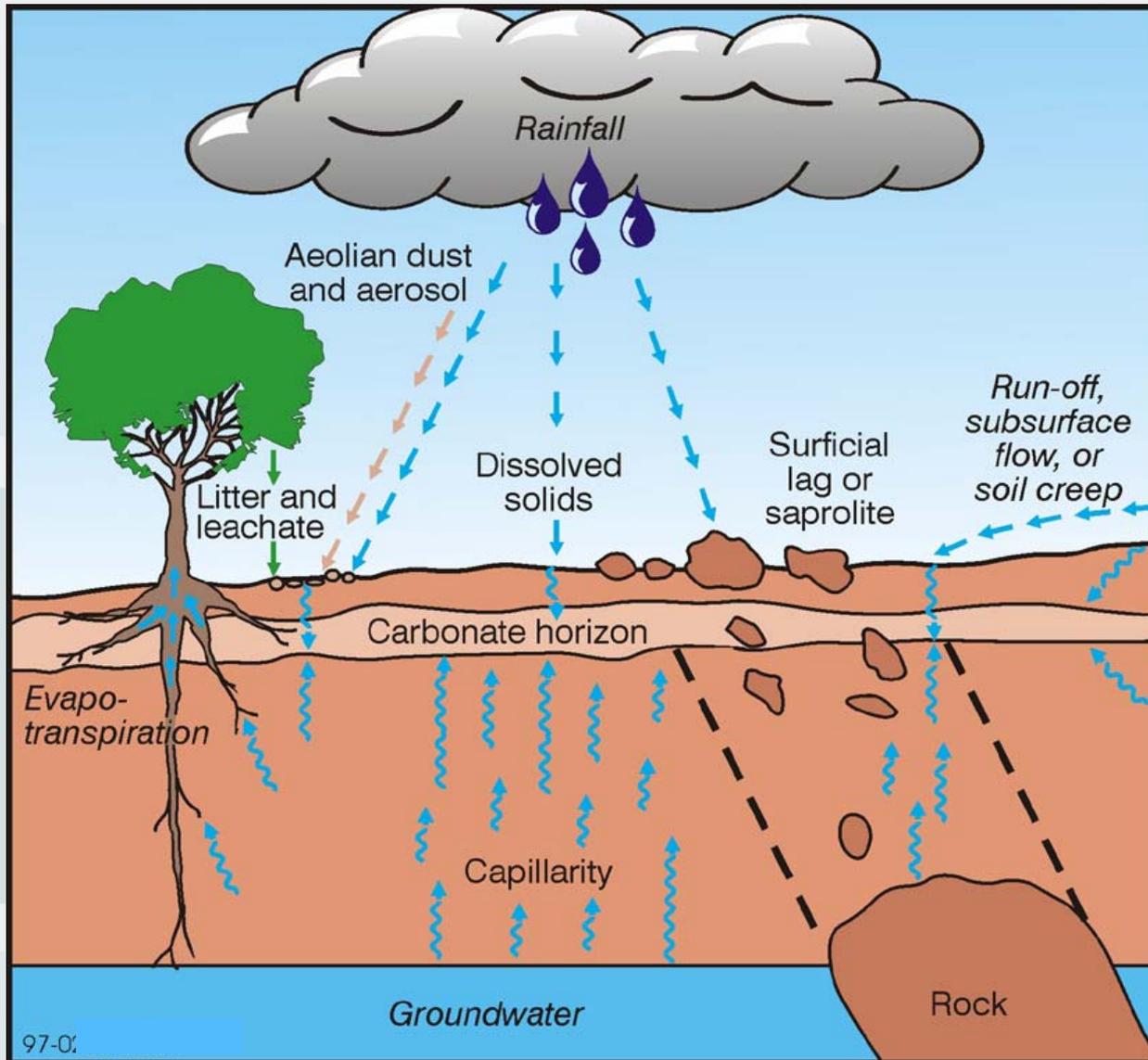


Distribution of calcrete



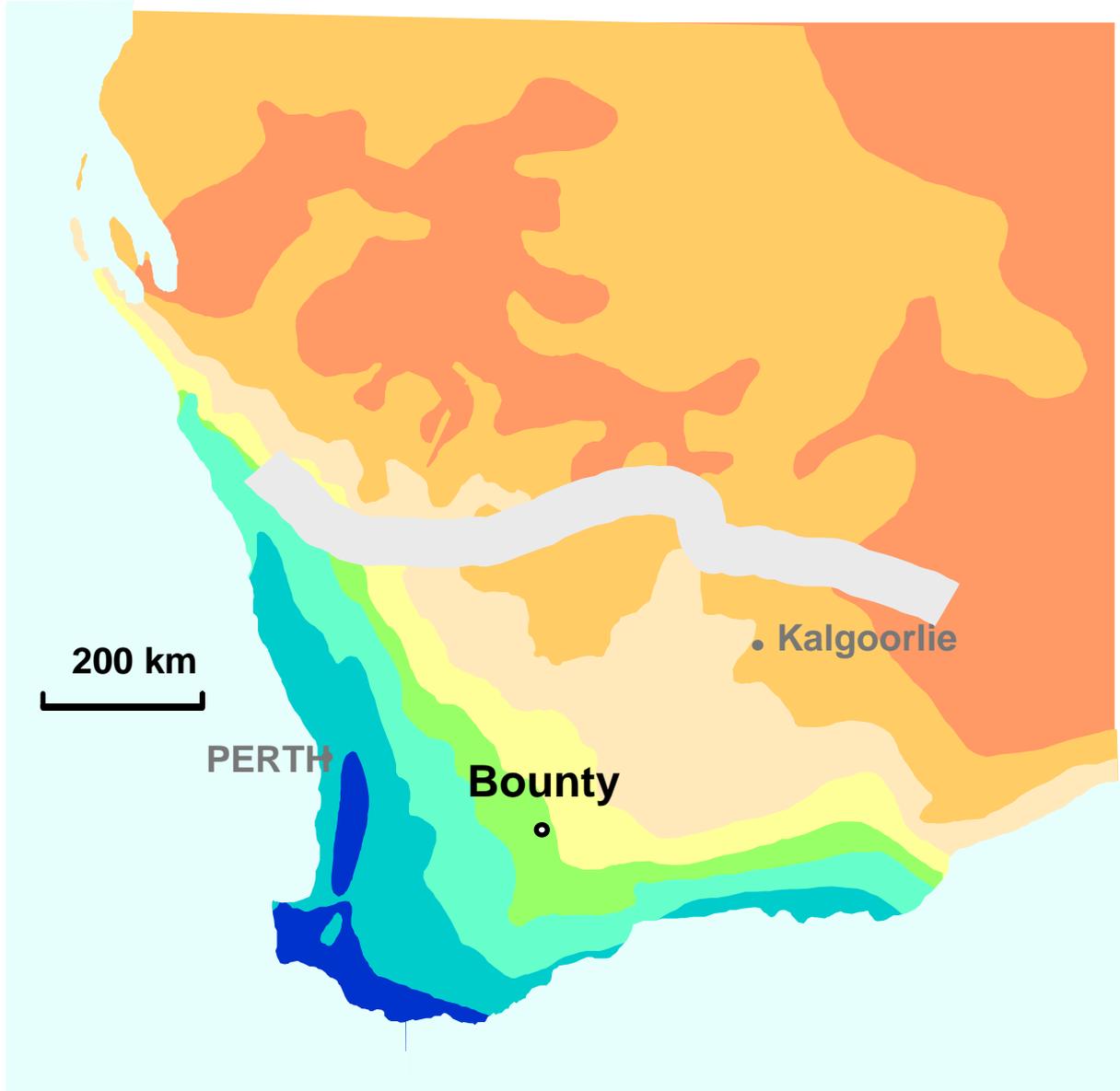
Roach, 2002

Sources of pedogenic carbonate



- aeolian
- regolith
- run-off
- water
- plants

Case study - Bounty

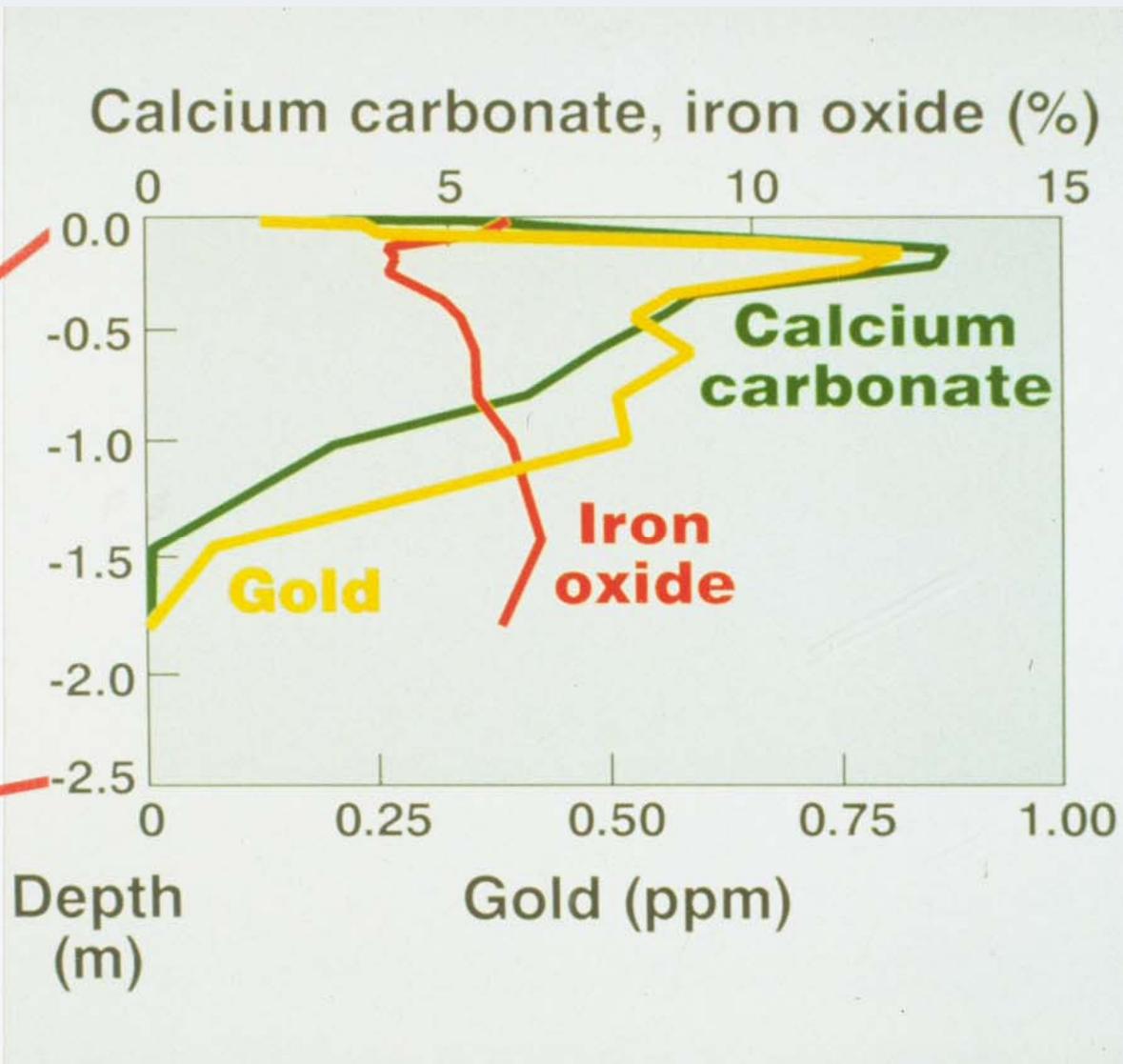


Average annual rainfall (mm)



Menzies Line

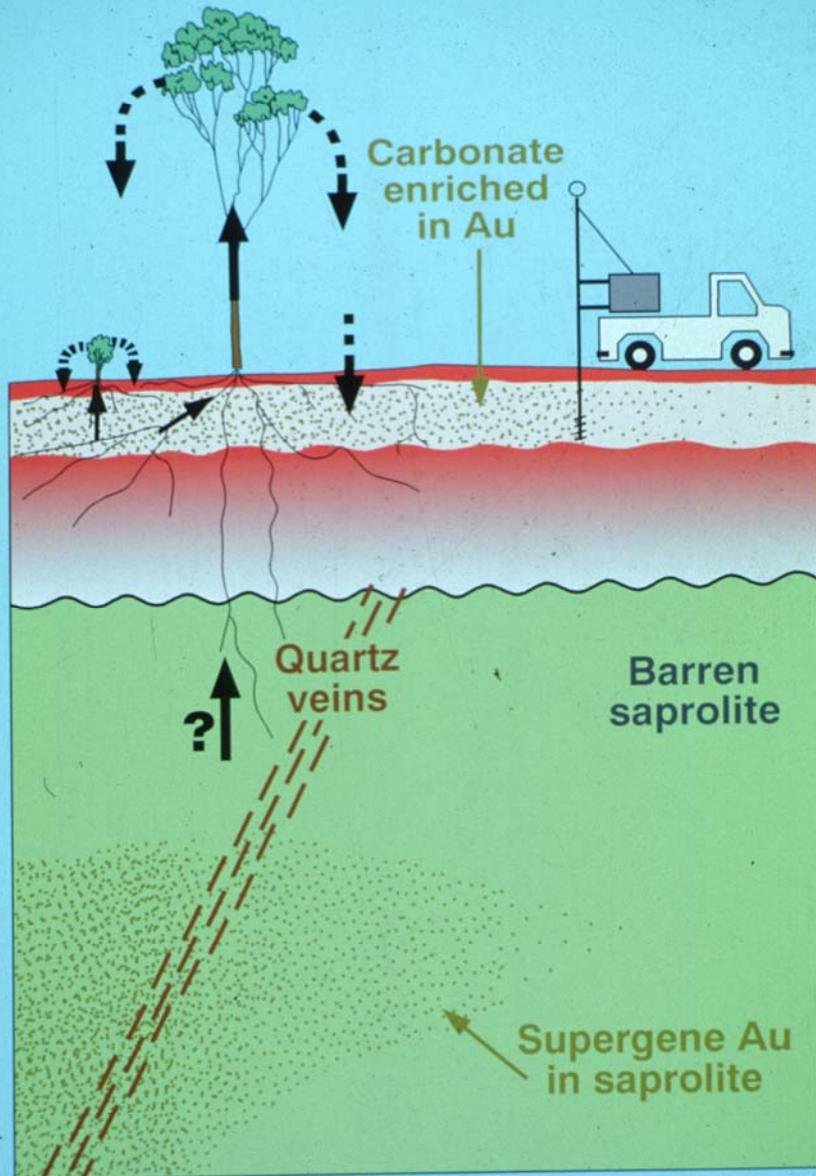




1987

First soil profile

Early model for Au dispersion into calcrete

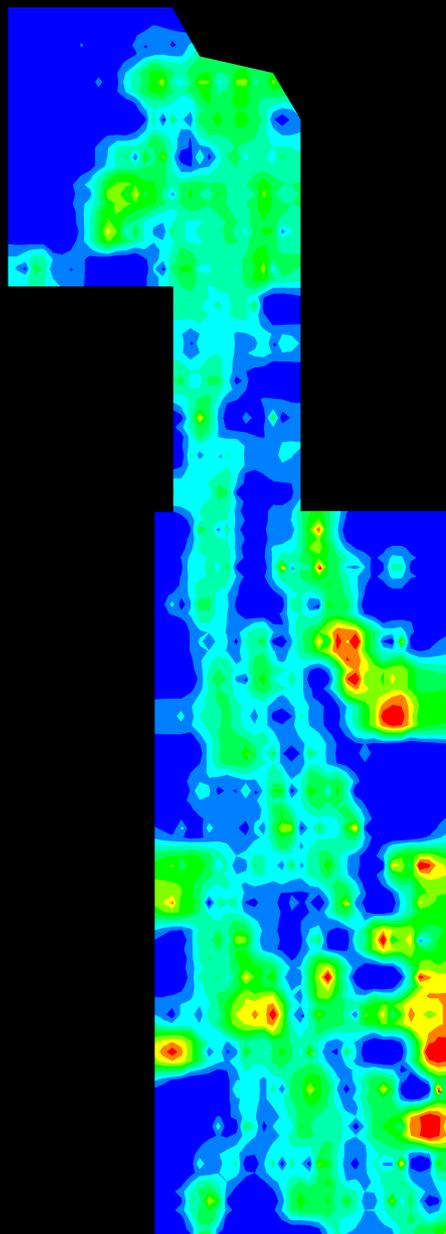


1987

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Bounty

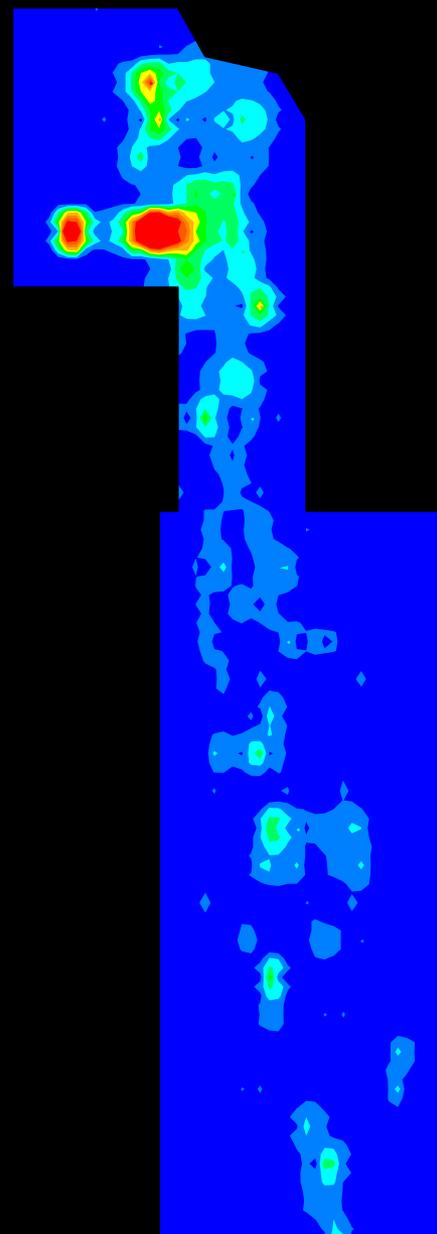
0 - 1 m



Ca (%)



1 km

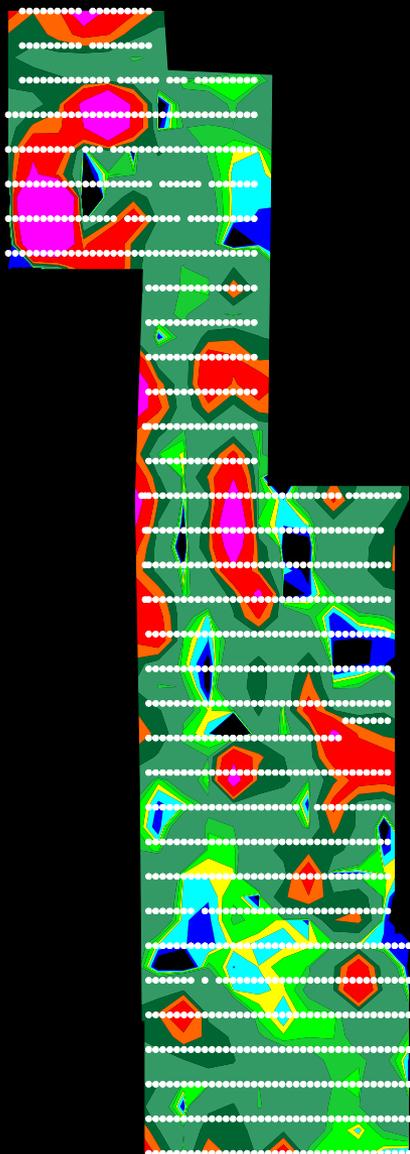


Au (ppb)



1 km

1988



Bounty
0-1 m

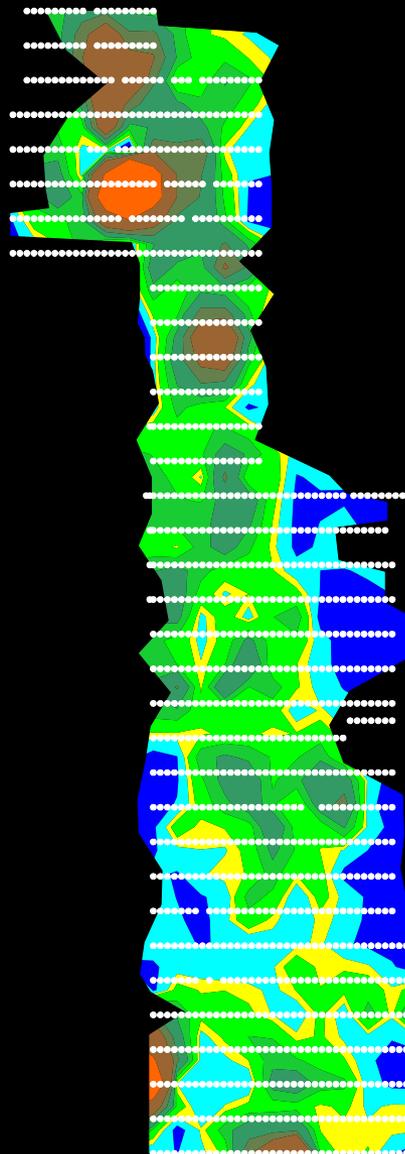
Au/Ca
(all Ca)



N

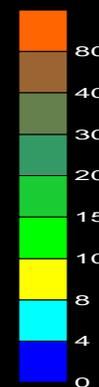


1 km



Bounty
0-1 m

Au/Ca
(Ca > 1%)



N



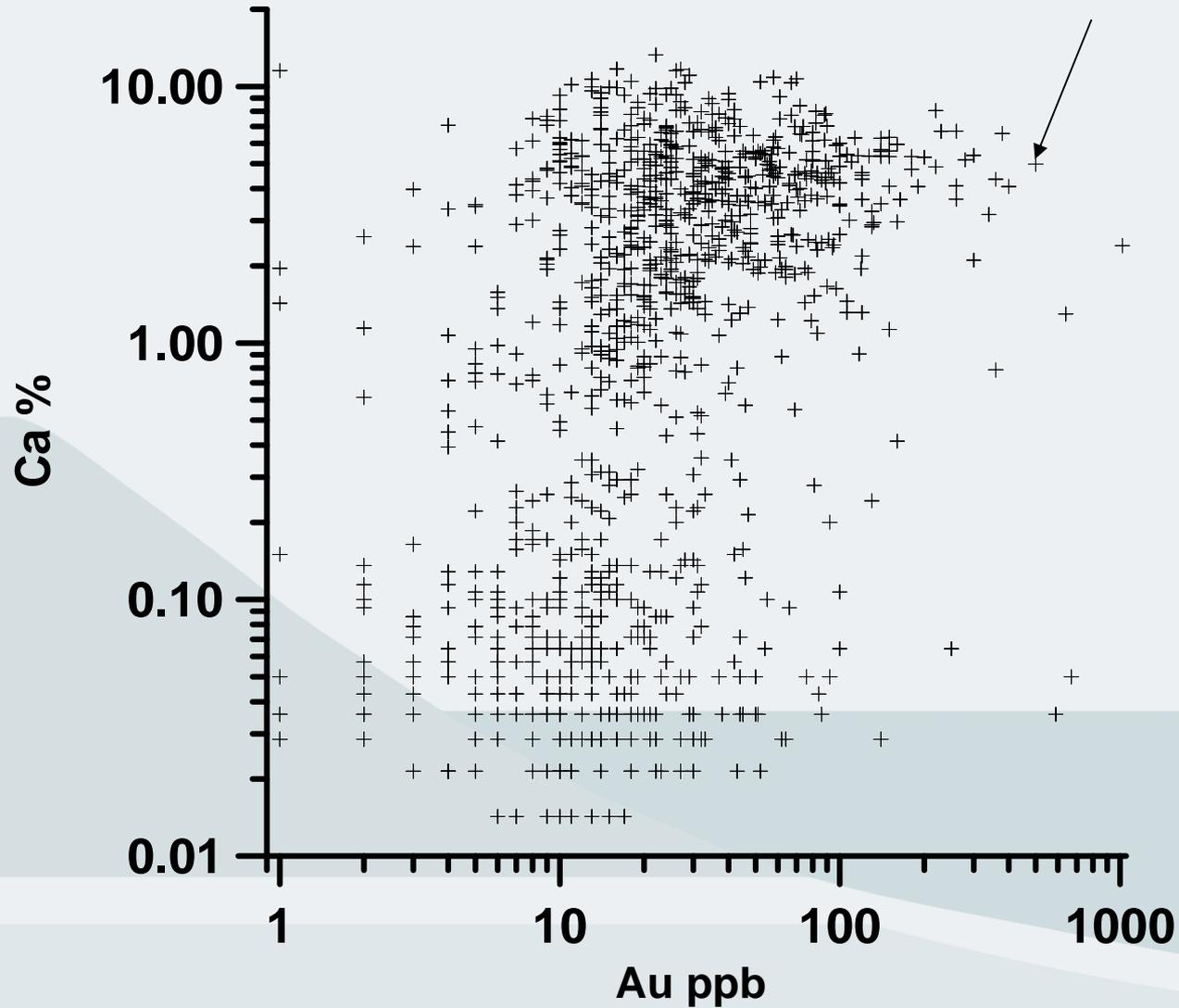
1 km



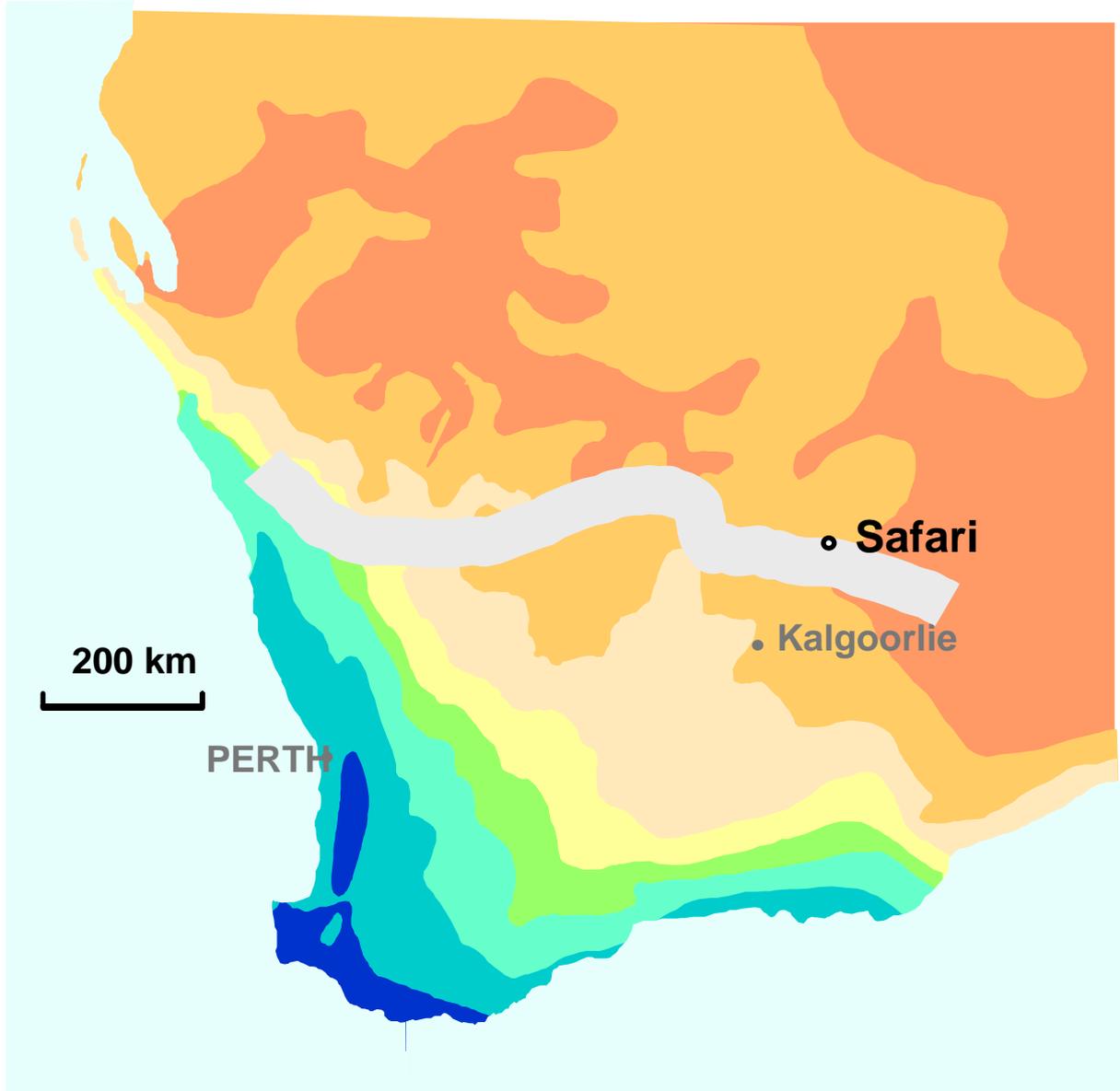
1988

0-1 m composite data

Soil profile



Case study - Safari Bore



Average annual rainfall (mm)



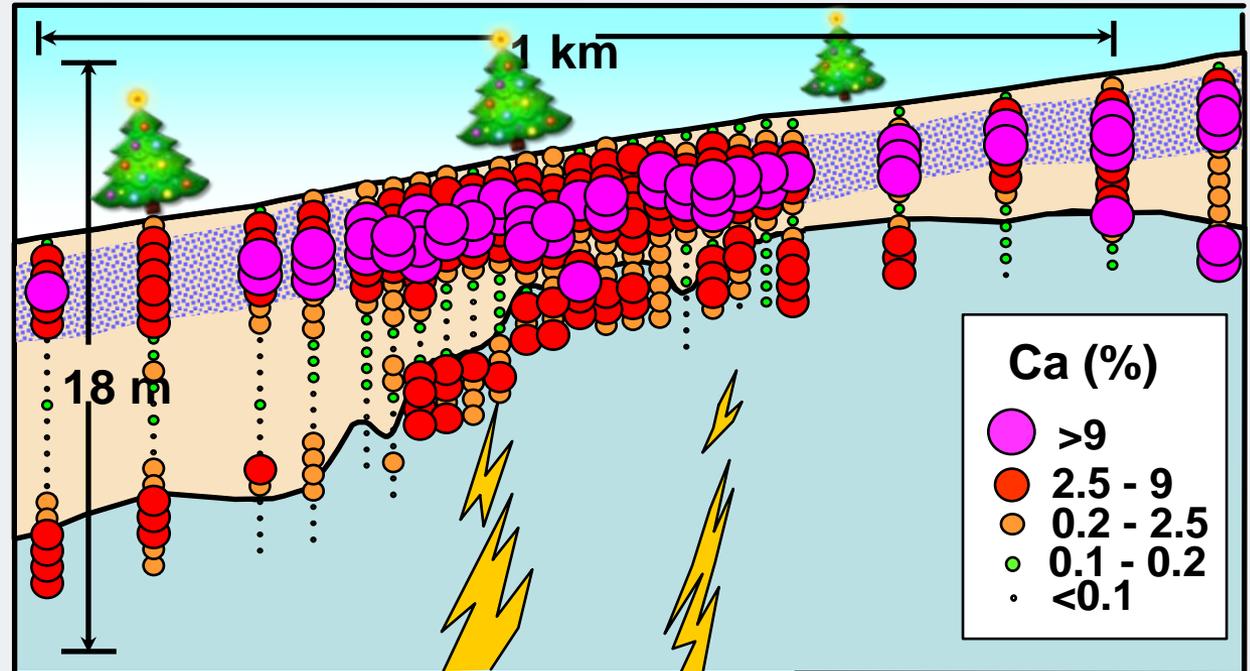
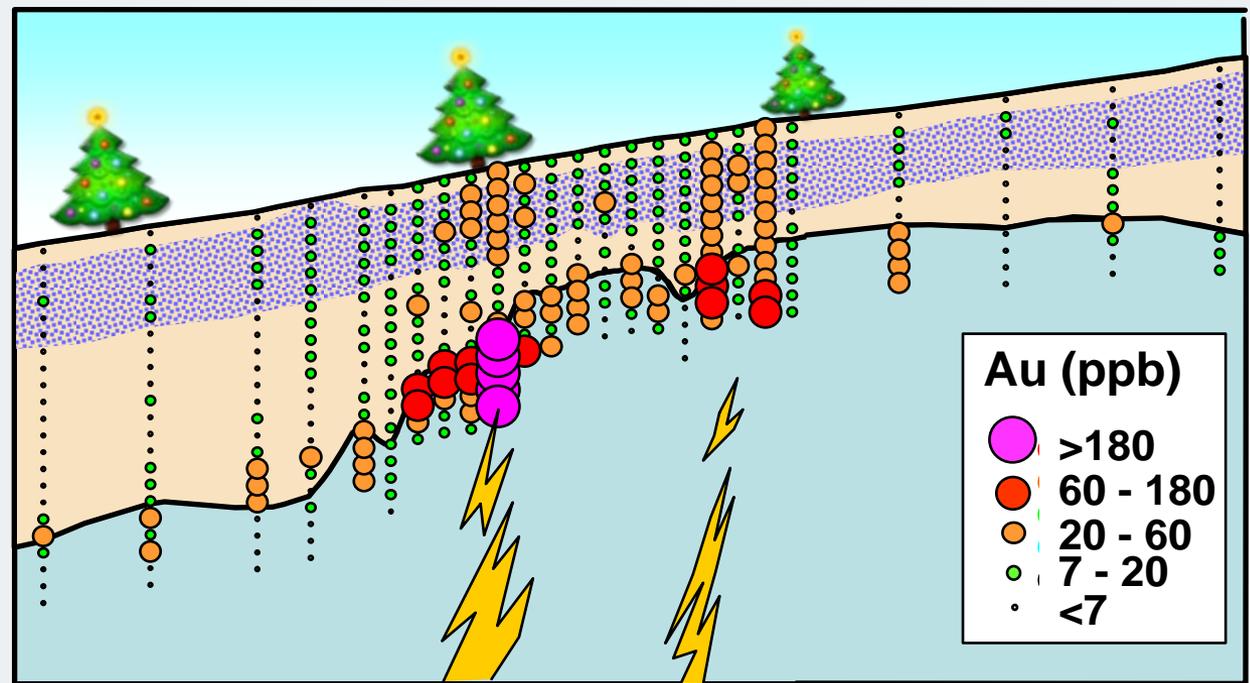
Menzies Line



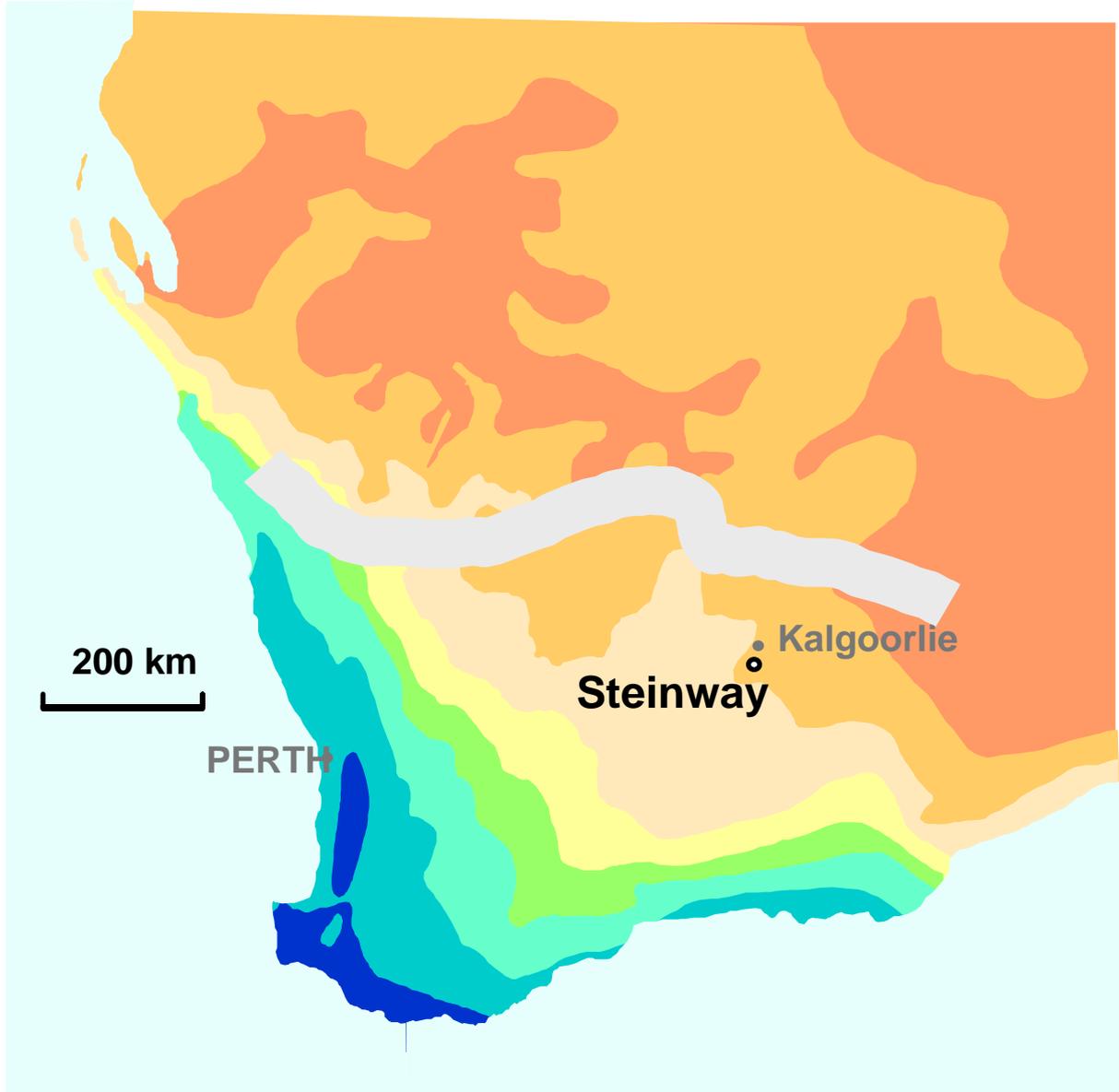
SAFARI

Aeolian sand and sandy colluvium over saprolite.

Pedogenic carbonate at 0.5 - 4.0 m



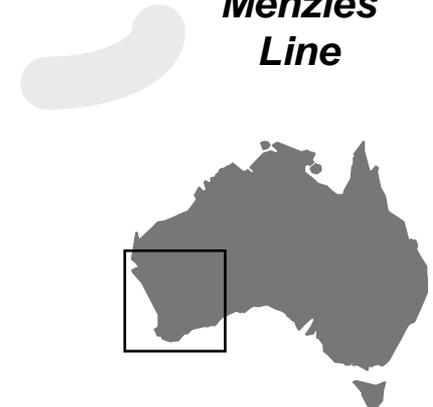
Case study - Steinway



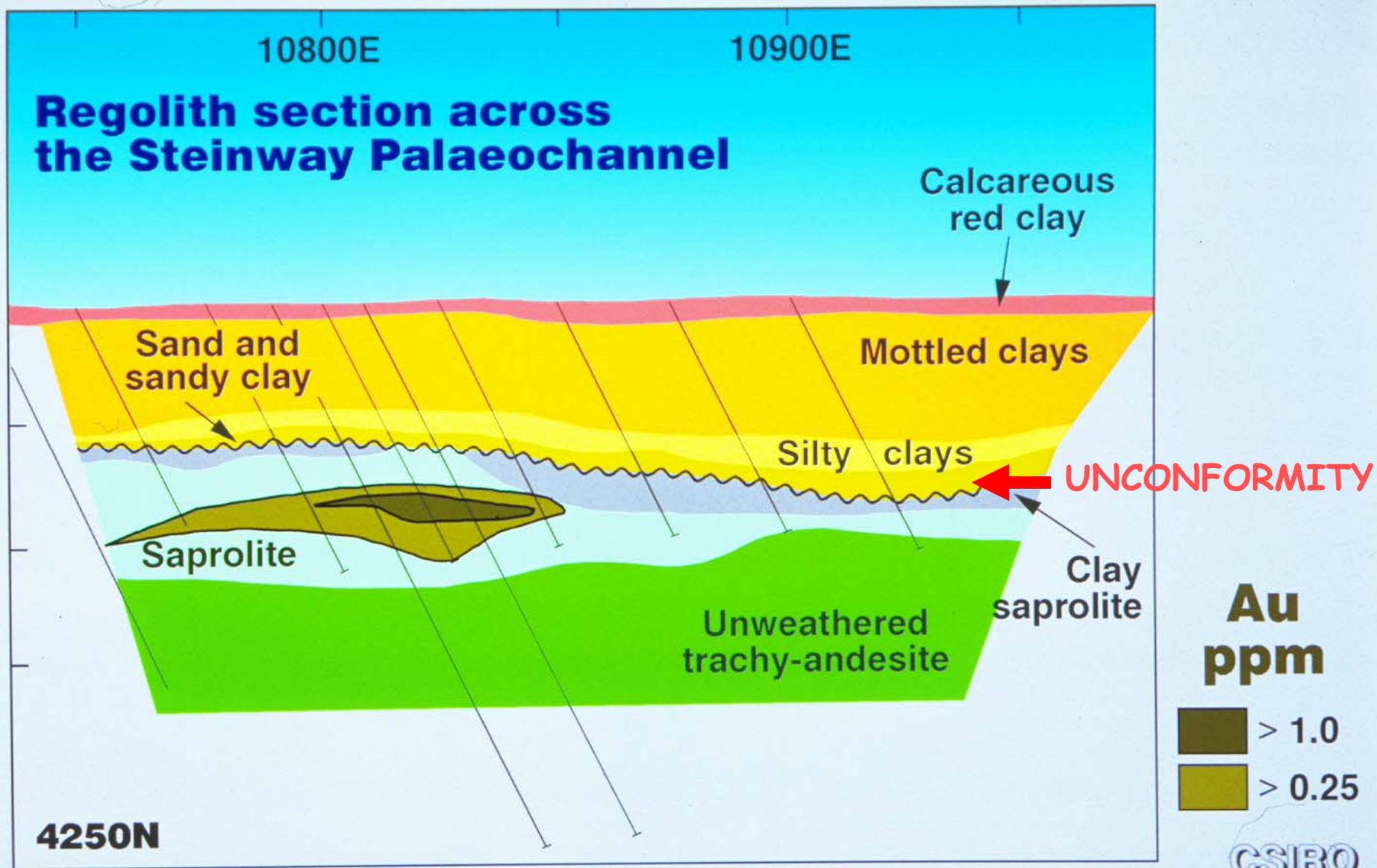
Average annual rainfall (mm)



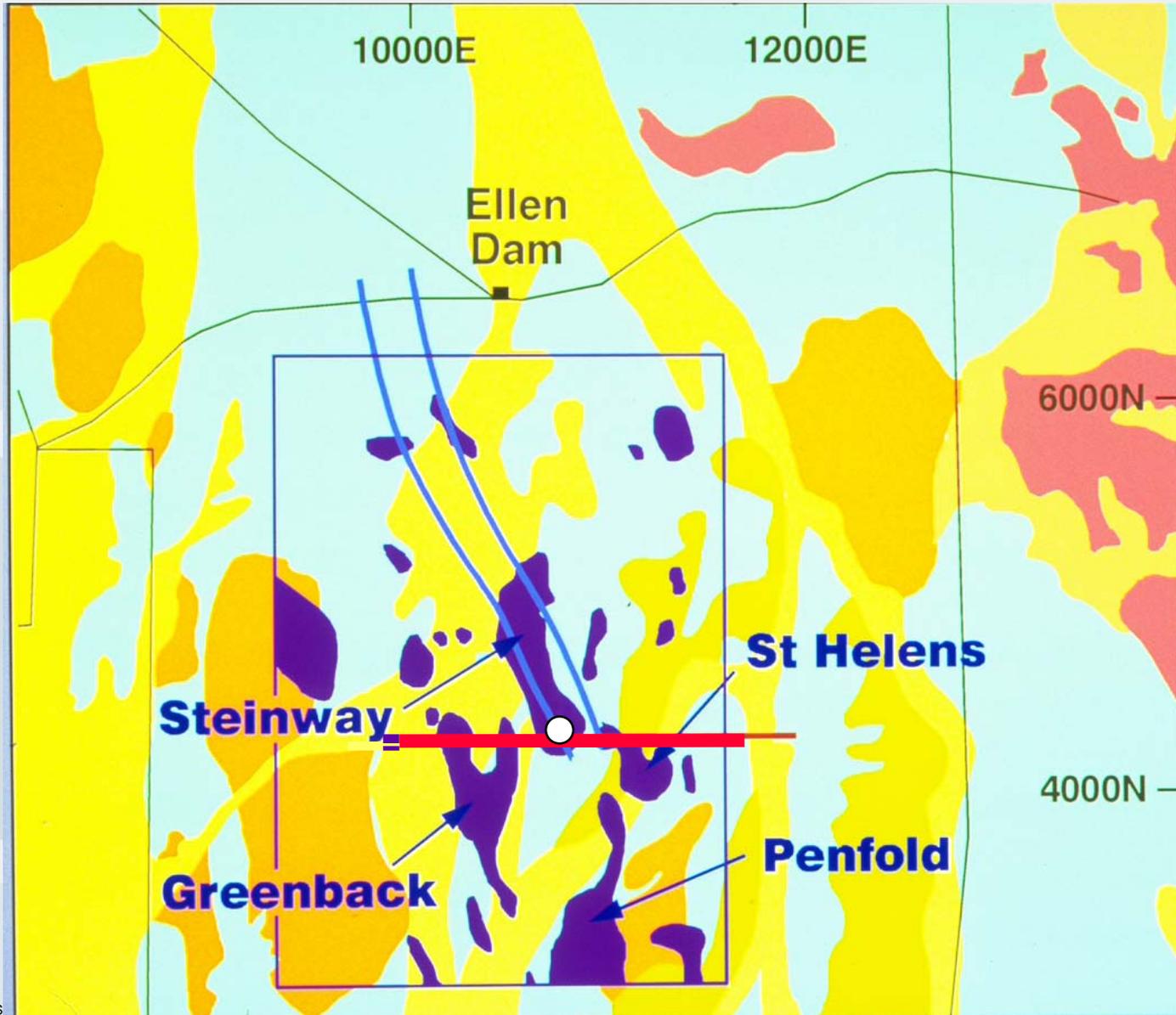
Menzies Line



Mineralisation beneath 35 m of overburden



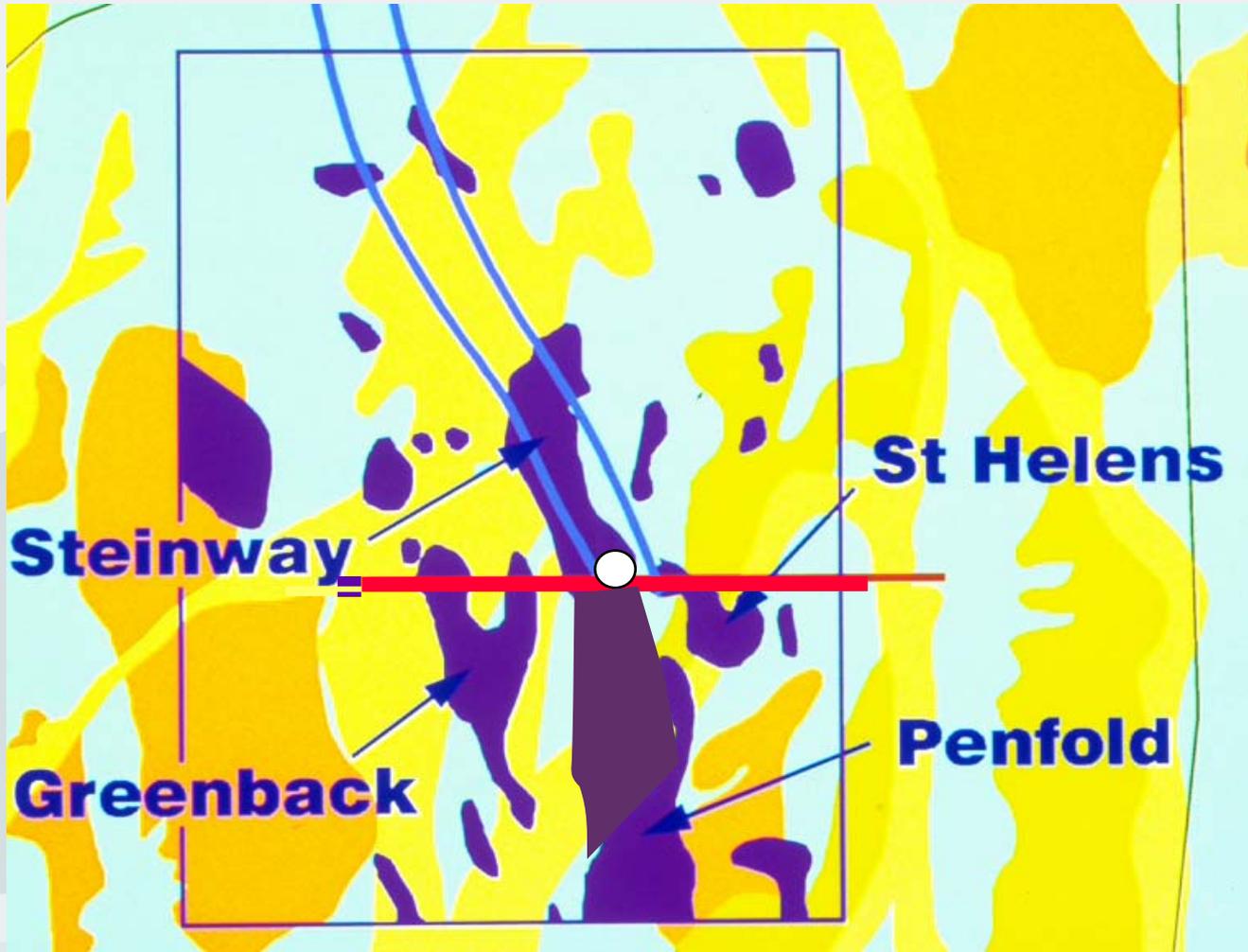
Regolith-landforms and Au in soil geochemistry



(after
Gardiner, 1993)

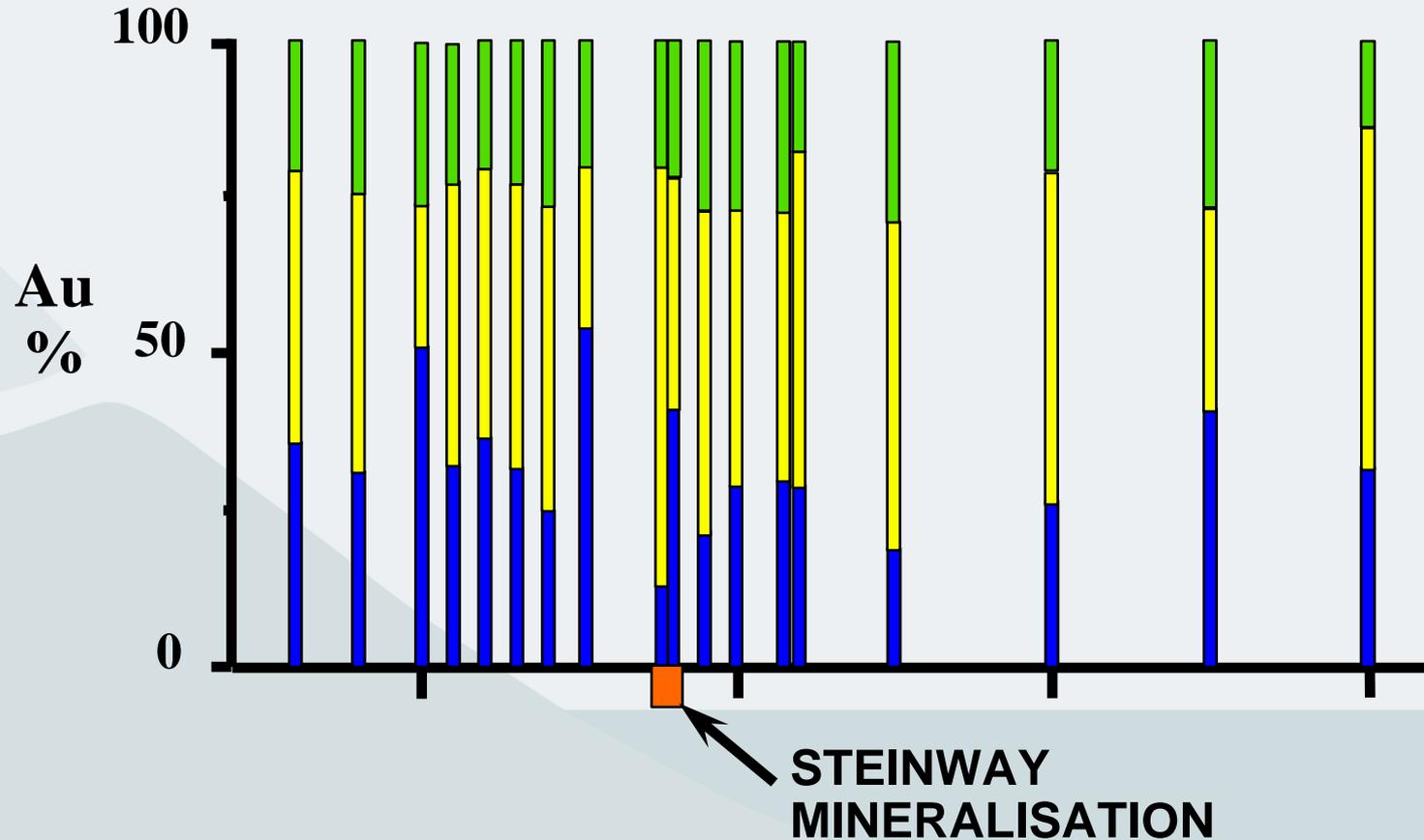
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Coincident anomaly



Once joined - but now "orphaned"

Steinway calcareous soil - an example of WATER-SOLUBLE gold



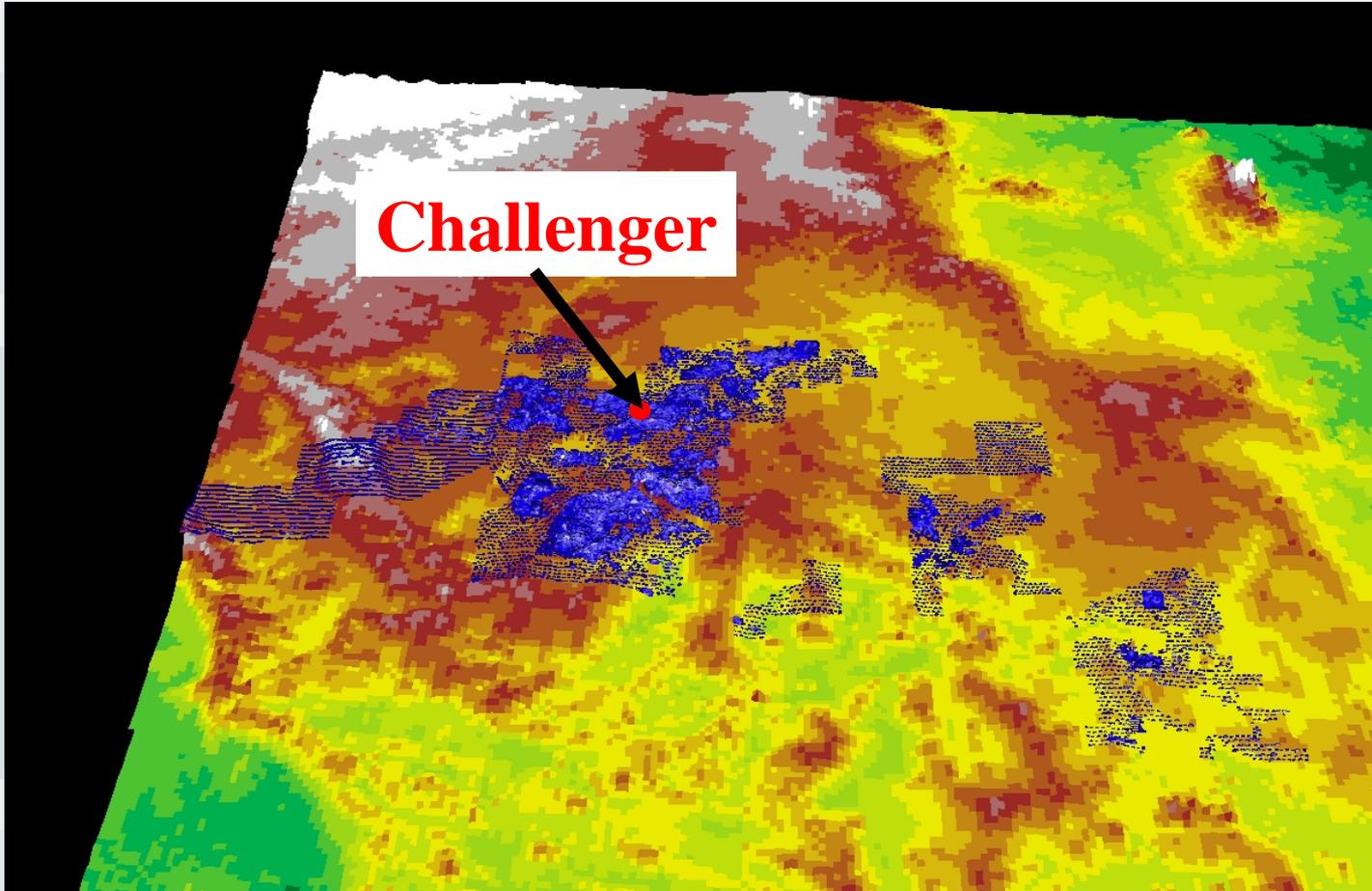
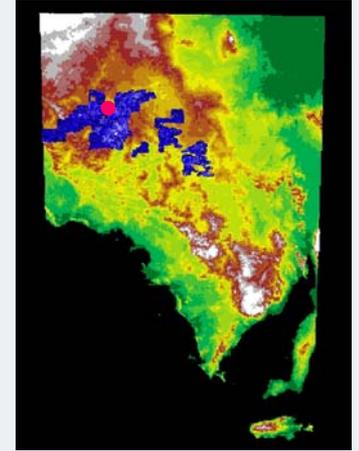
CYANIDE
IODIDE
WATER

500 m

Auger drilling recommended for red clays containing "soft" calcrete



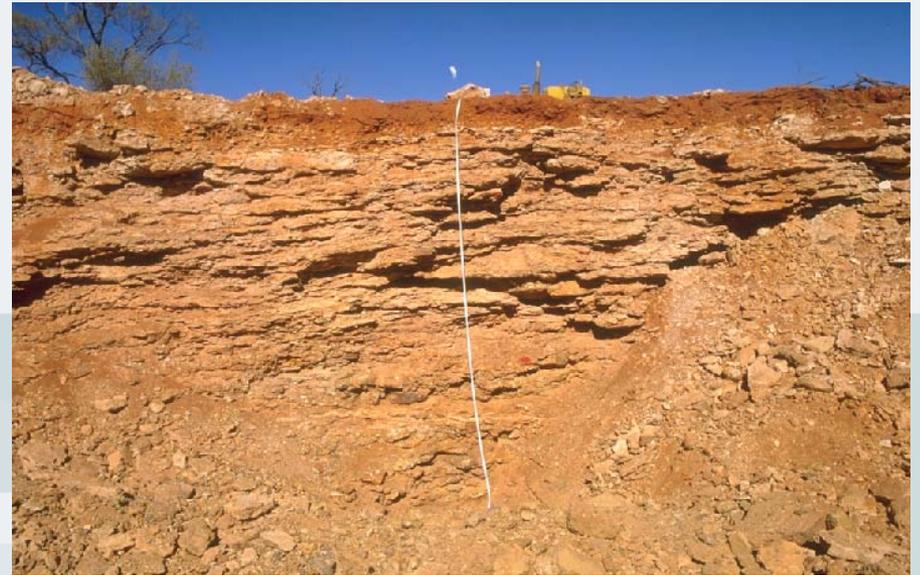
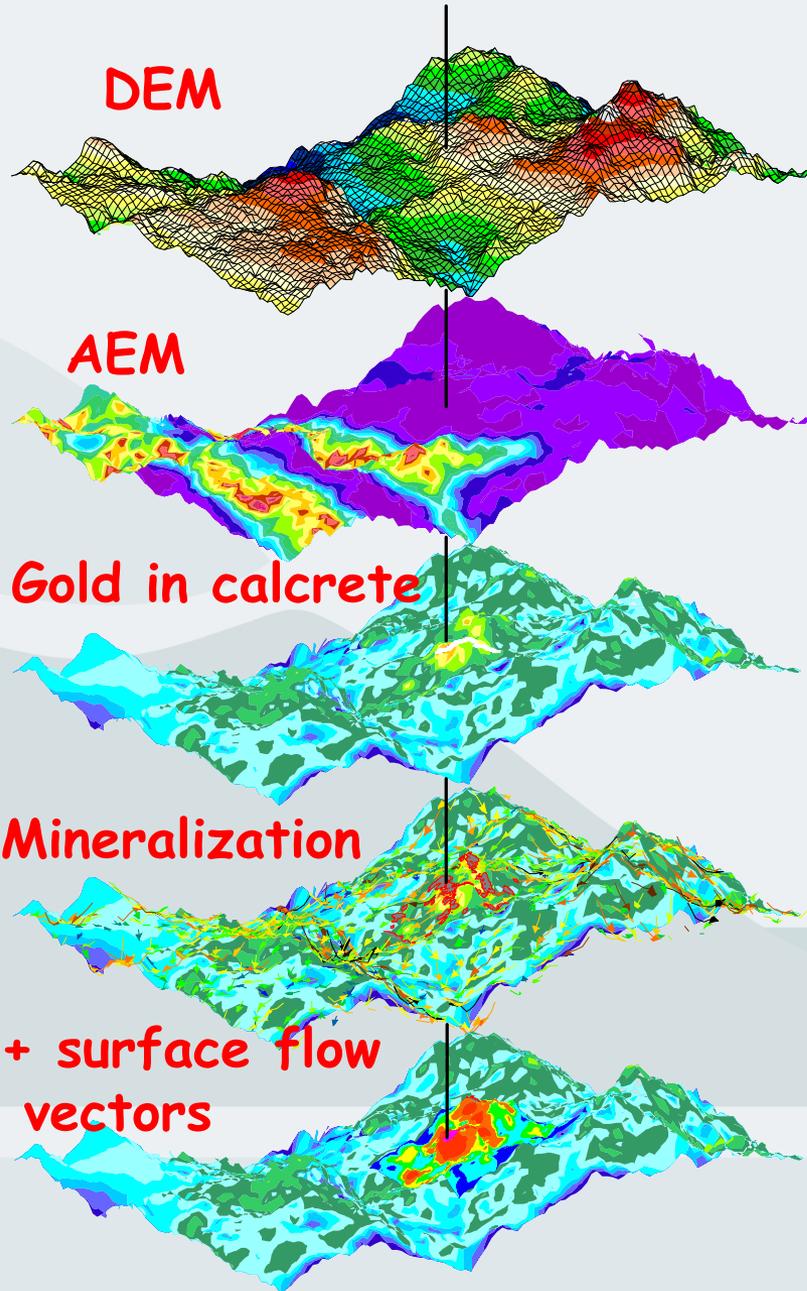
Case studies - Gawler Craton



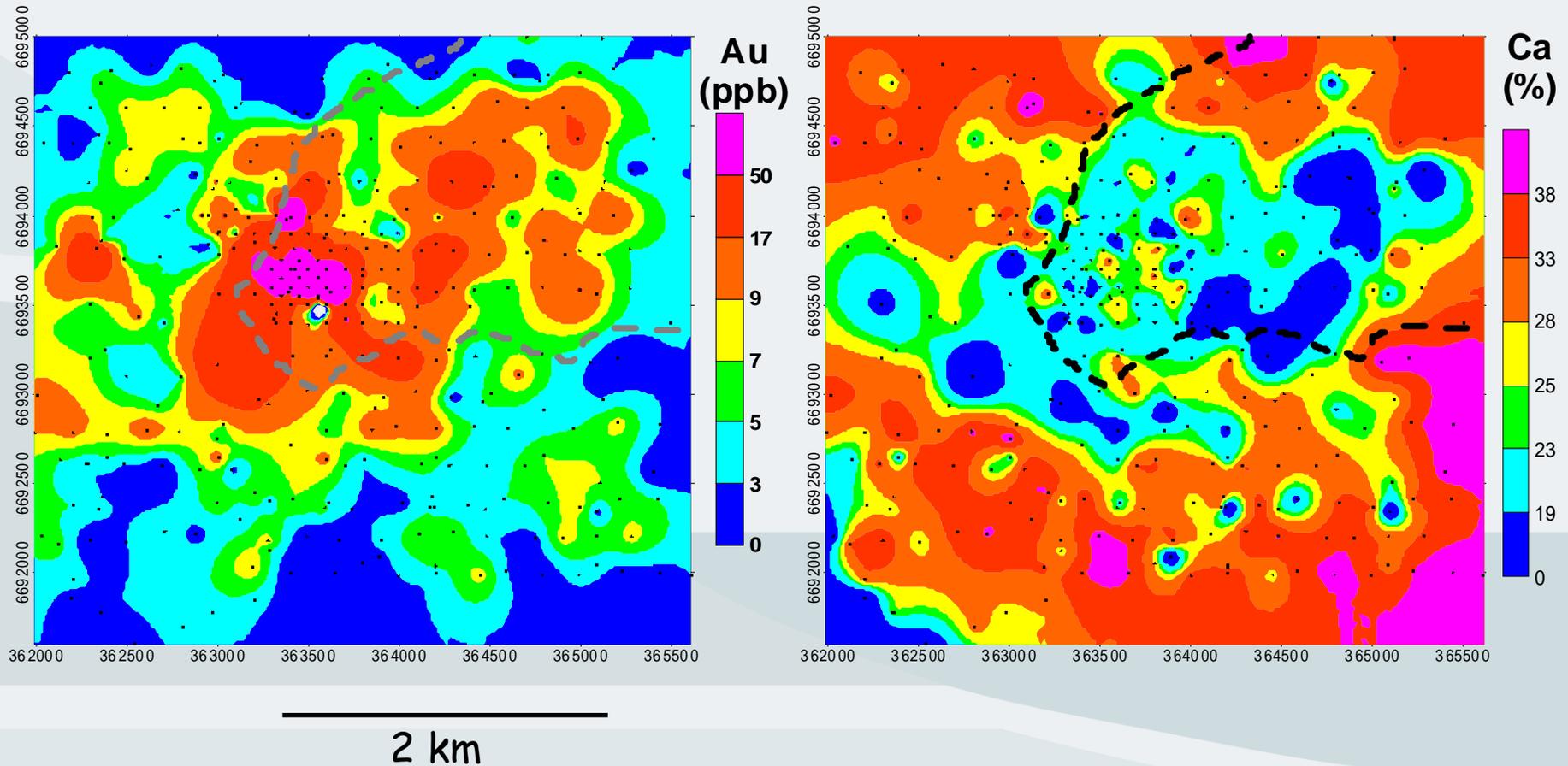
1995

Challenger

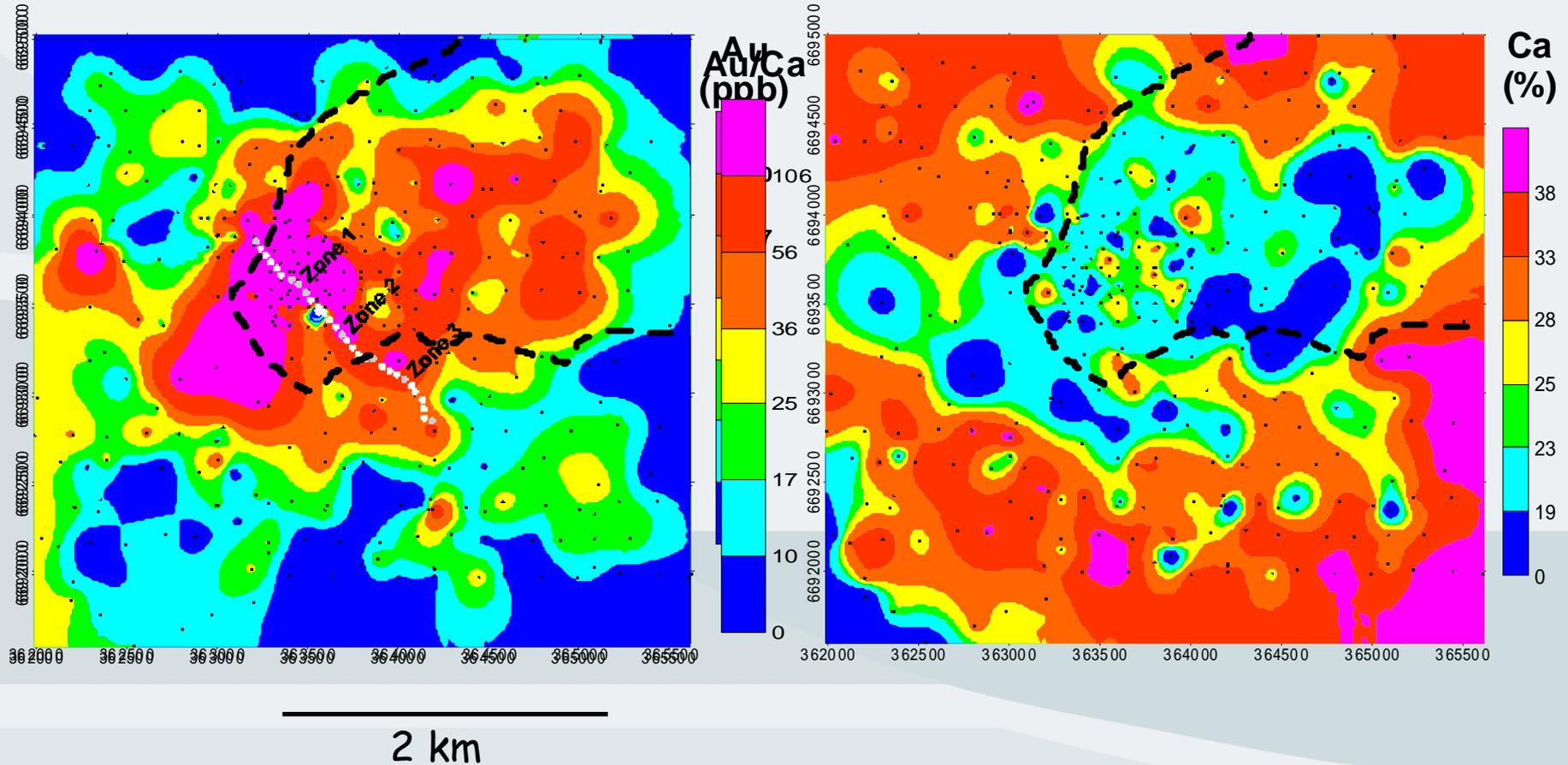
laminar + massive calcrete



Au and Ca in calcrete



Au and Ca in calcrete

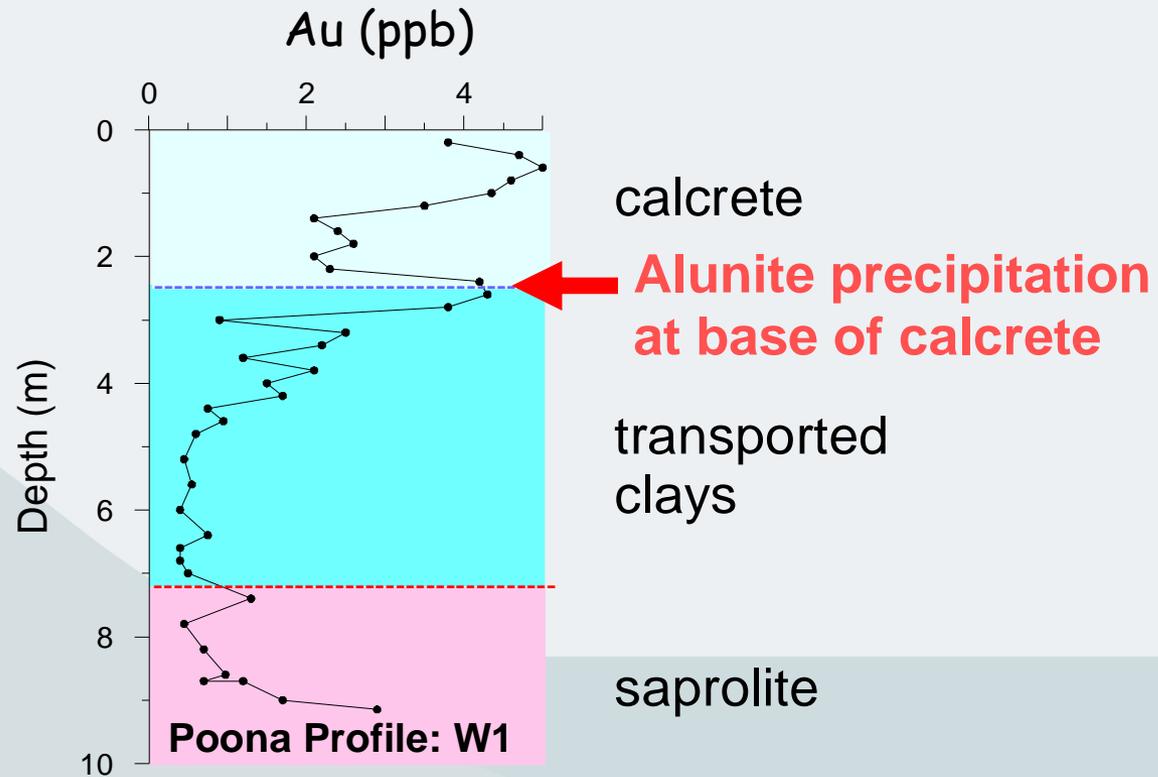


Challenger Gold Mine

- a Au in calcrete discovery



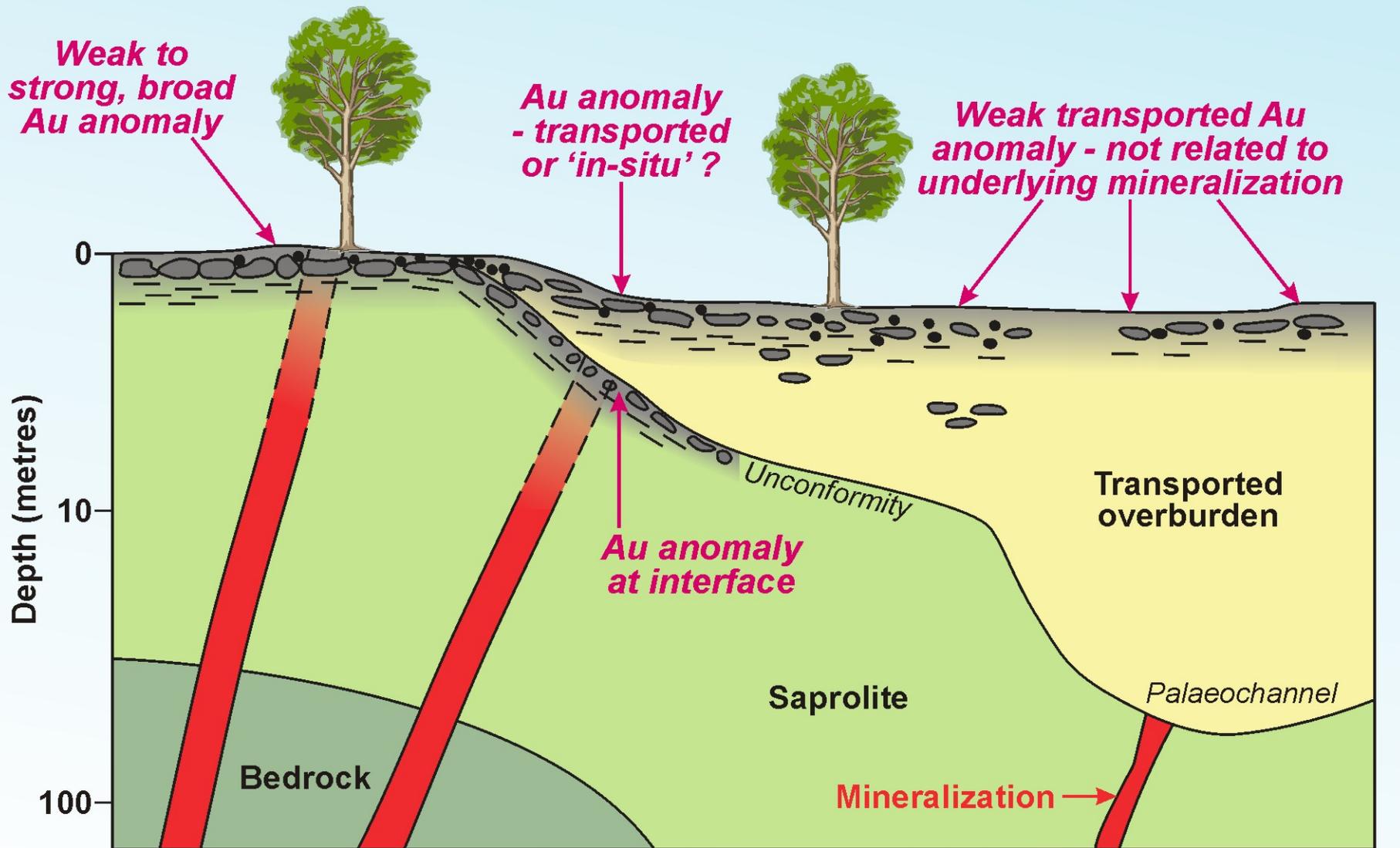
Moonta (Yorke Peninsula) - profile sampling



(After Hartley 2000)

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Gold in calcrete - South Australia



Siliceous massive-platy calcrete



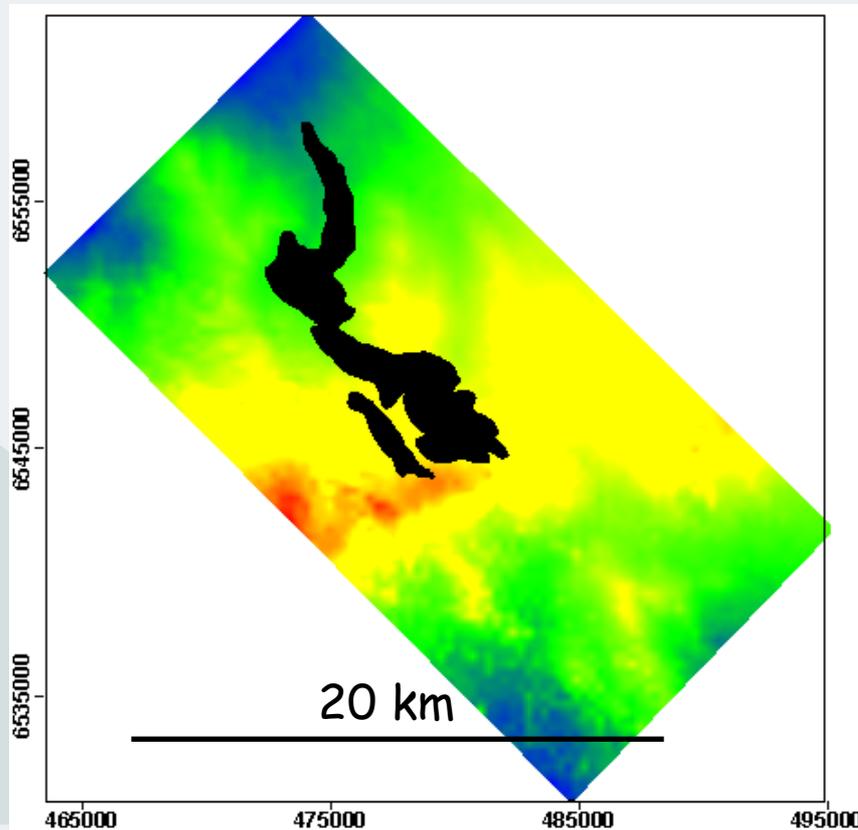
Nodular calcrete



Calcareous coatings

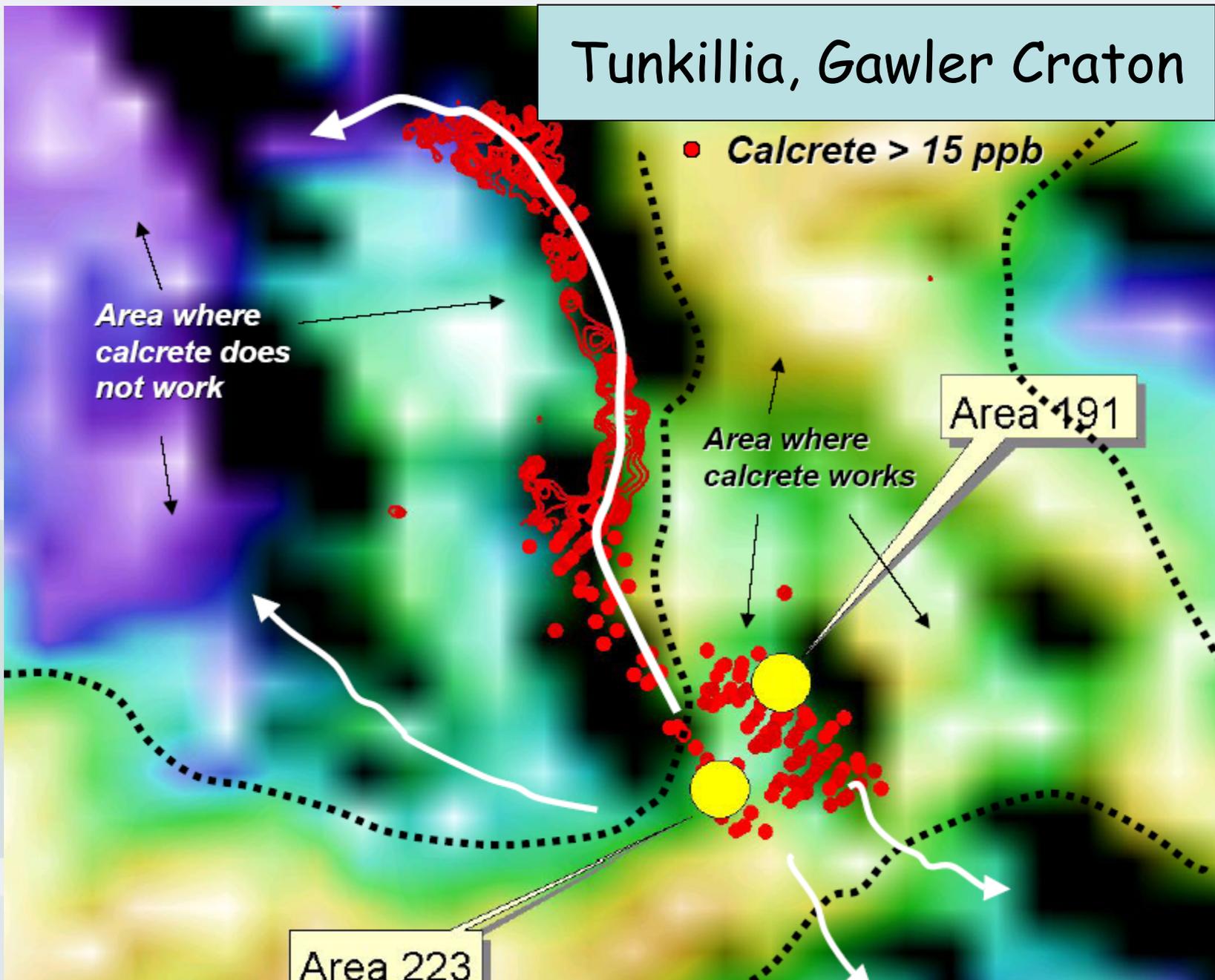
Transported Au anomalies in calcrete

TUNKILLIA/OLD WELL



(after Gibbons, 1997; and
company data)

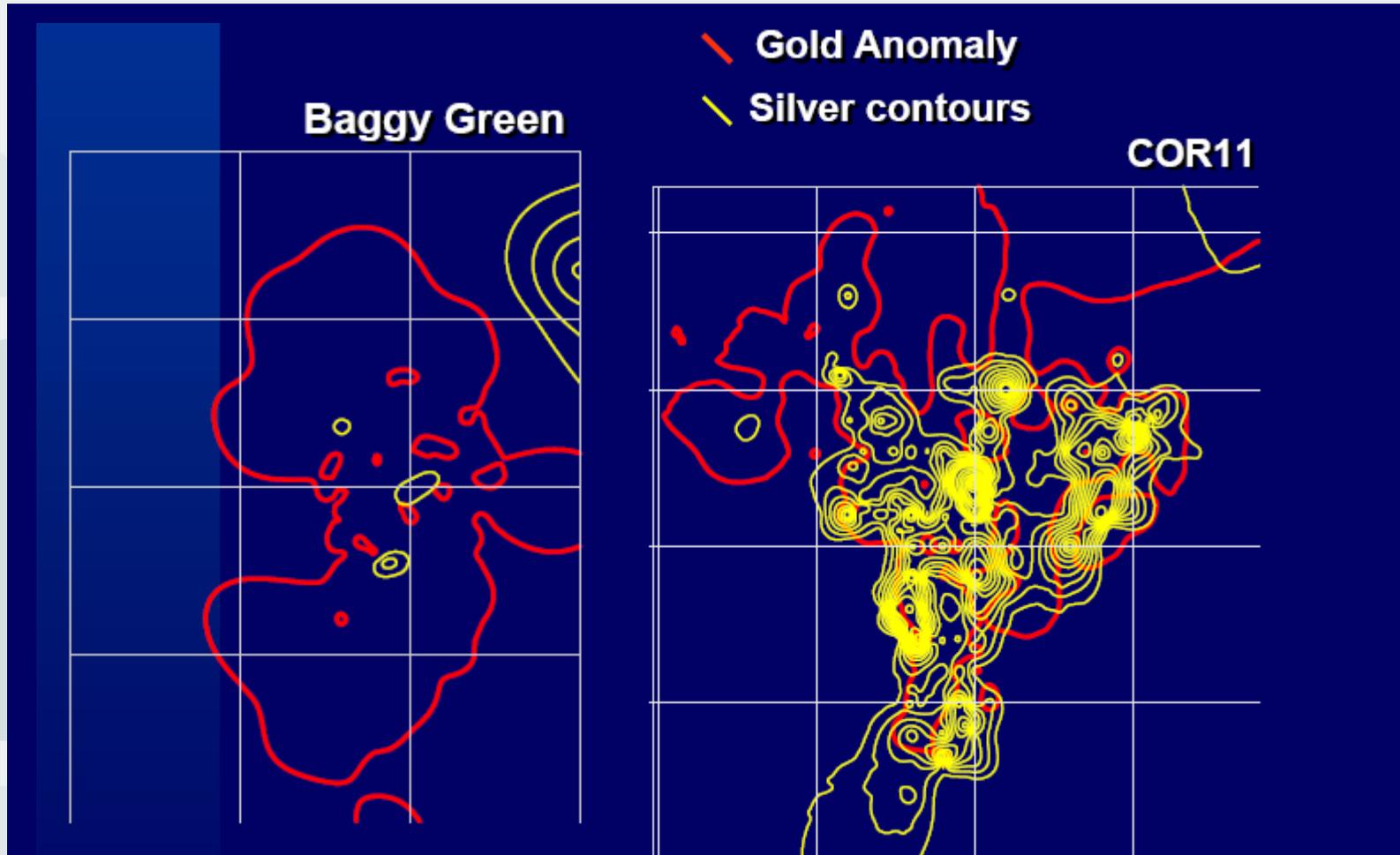
Tunkillia, Gawler Craton



Absence or presence of Ag

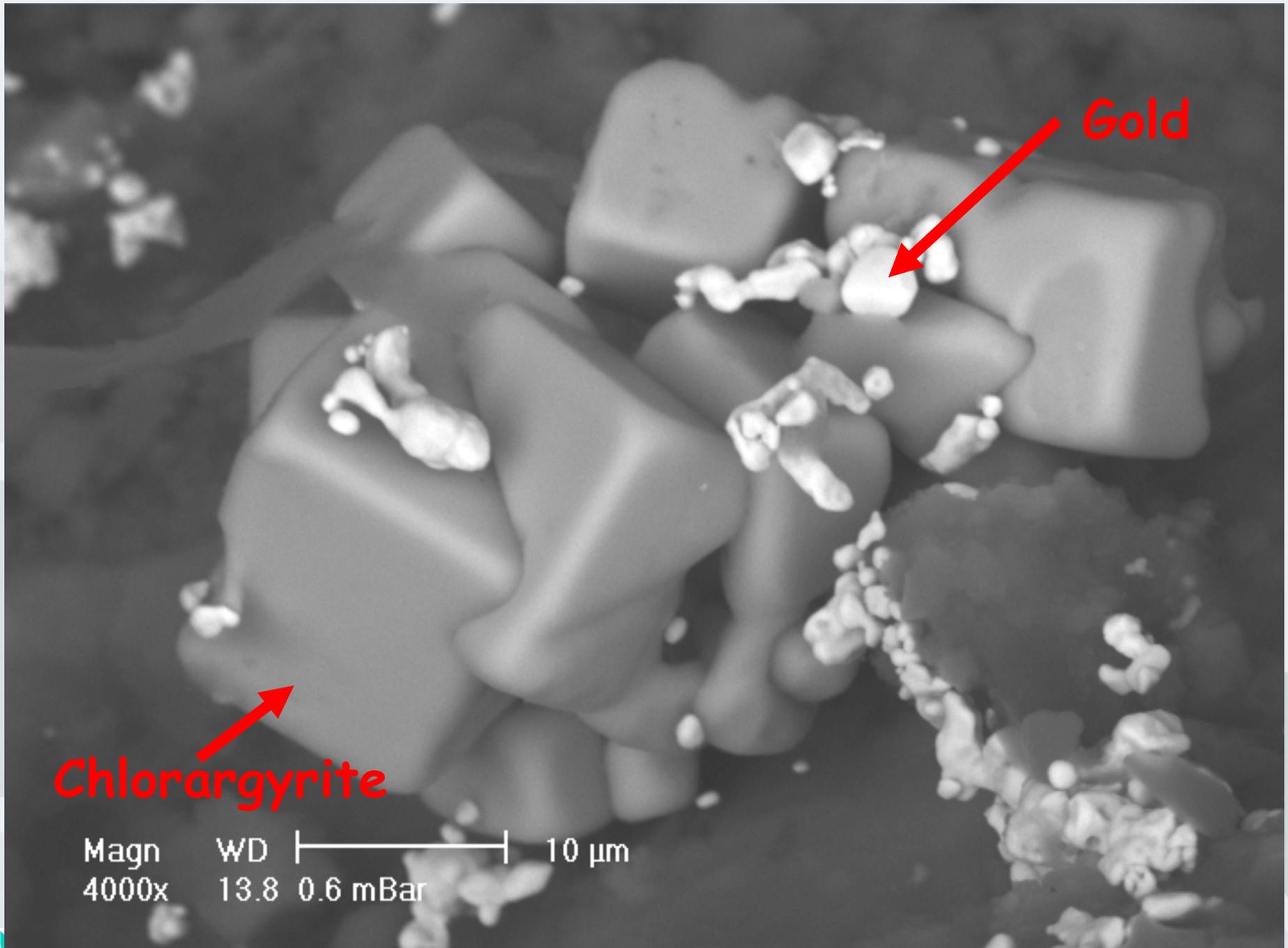
IN SITU

TRANSPORTED



Chris Drown (Adelaide Resources)

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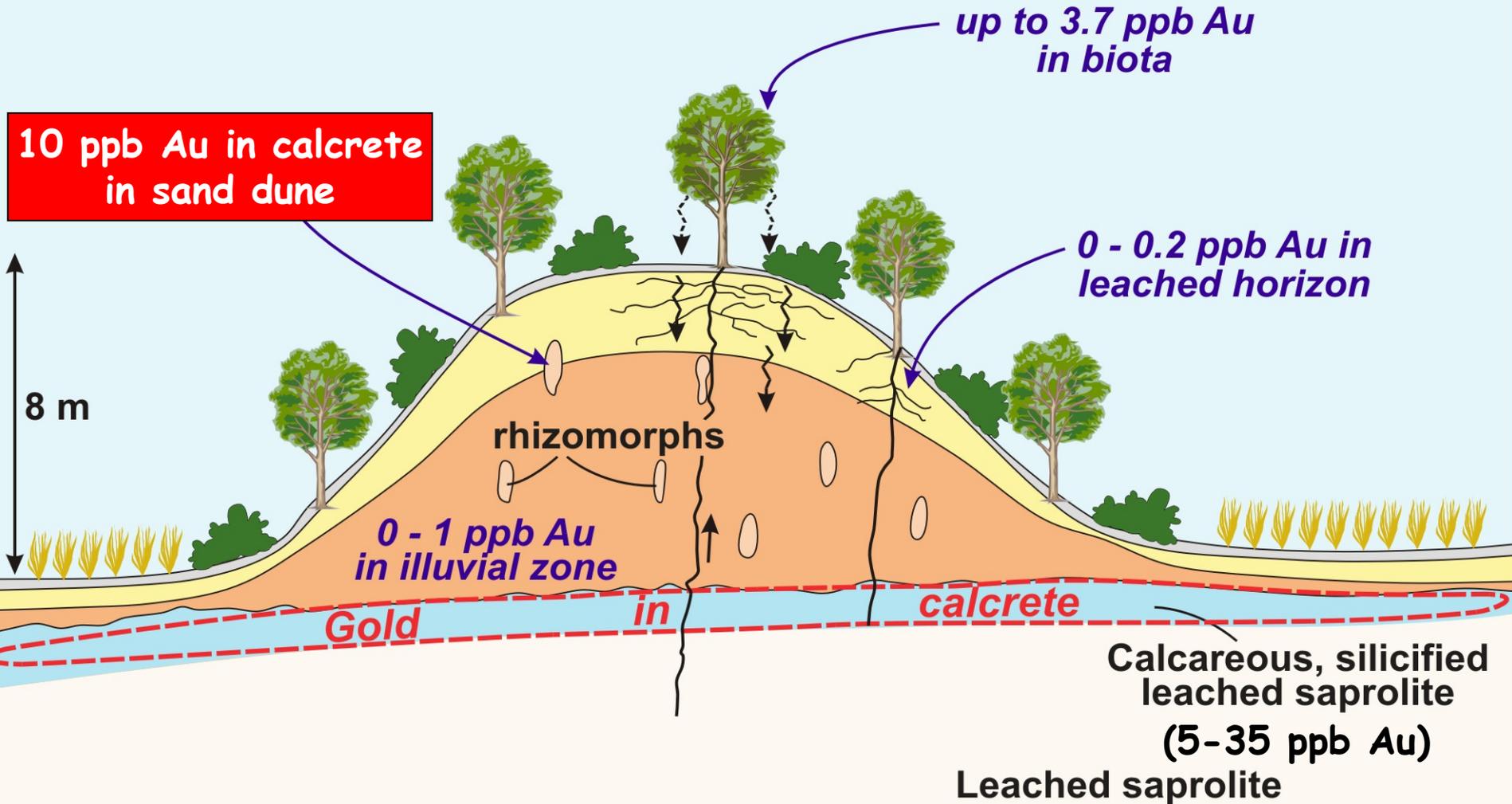


Gold

Chlorargyrite

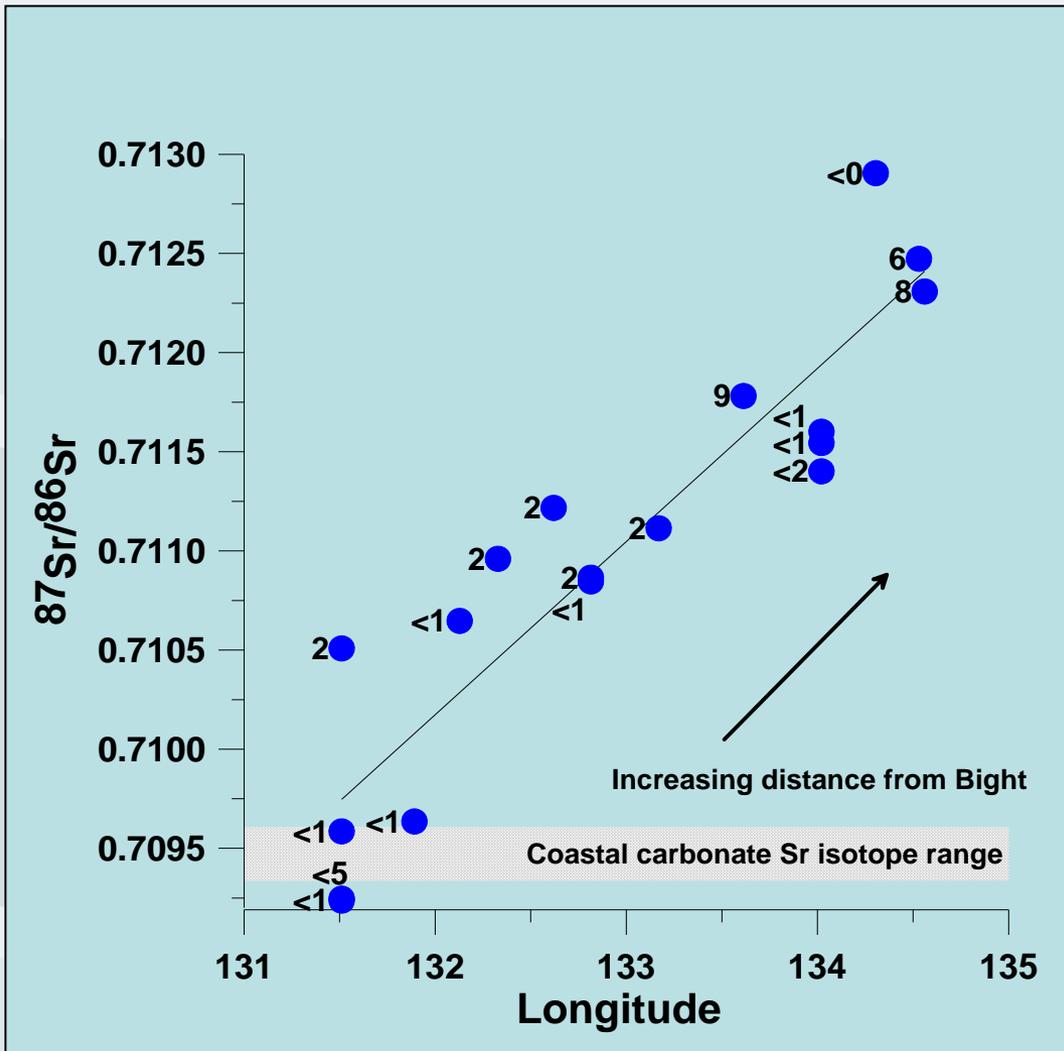
Magn 4000x WD 13.8 0.6 mBar 10 μ m

Barns - Gold anomaly formed by plants in sand dune calcrete in <24000 years



Mineralization at 40 m depth

Origin of Ca in calcrete: ocean

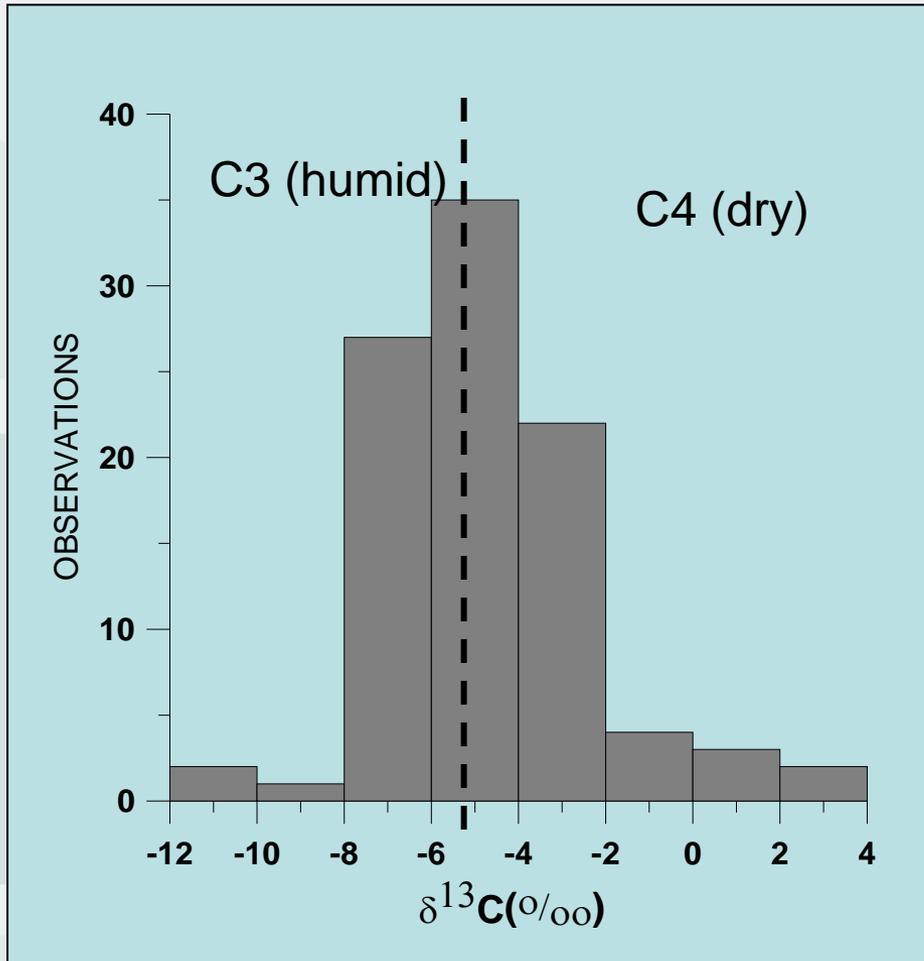


- Marine signature of calcrete decreases with increasing distance from coast

2003

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Origin of C in calcrete: plants



- Points to equal contribution from respiring C3 (trees) and C4 (grasses) plants

2003

?Micro-organism involvement in Au-calcrete anomaly formation

- Bacteria can precipitate carbonate but research links process to evaporation and root respiration (degassing with increasing depth)
- Expts. involve abnormally high concentrations of metals and bacteria to speed reactions rather than natural concentrations
- Gold and Ca co-precipitate in lab expts. – not observed in natural calcrete. Some Au is water soluble in calcrete and other particulate
- Microbes - need to be cautious



2007

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Gold in calcrete - 20 years on

- Where calcrete is found in Australia
- Many case studies in southern Australia
- Au/Ca ratios (Bounty)
- See through cover (up to 10 m in some cases)
- Critical importance of regolith control
- Methodology – chisel hard calcrete, auger soft calcrete
- Gold in calcrete is water soluble
- Age of Au-in-calcrete anomalies
- Chemistry of Au in calcrete
- Calcrete from wind blown marine Ca and C from plants
- Nanonuggets in calcrete
- Current, valid exploration technique
- Future – more chemistry, bugs, landscape considerations, other metal exploration (U)

How do Au anomalies form in calcrete?

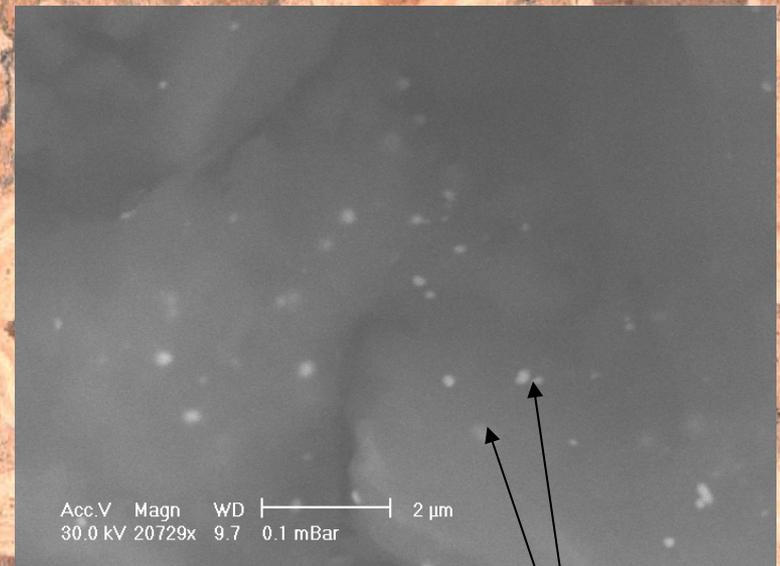
- Biota – plants+?microbes
- Abiotically – pedogenic chemically/mechanically - dispersion vertically (in situ) and downslope (transported)
- Abiotically - via groundwater precipitation/evaporation

Calcrete: characteristics, distribution and use in mineral exploration

X.Y. Chen, M.J. Lintern and I.C. Roach



Gold in calcrete



Natural Au nanonuggets
within and on micritic calcite