The role of vegetation in anomaly formation at Barns Gold Prospect, Eyre Peninsula South Australia

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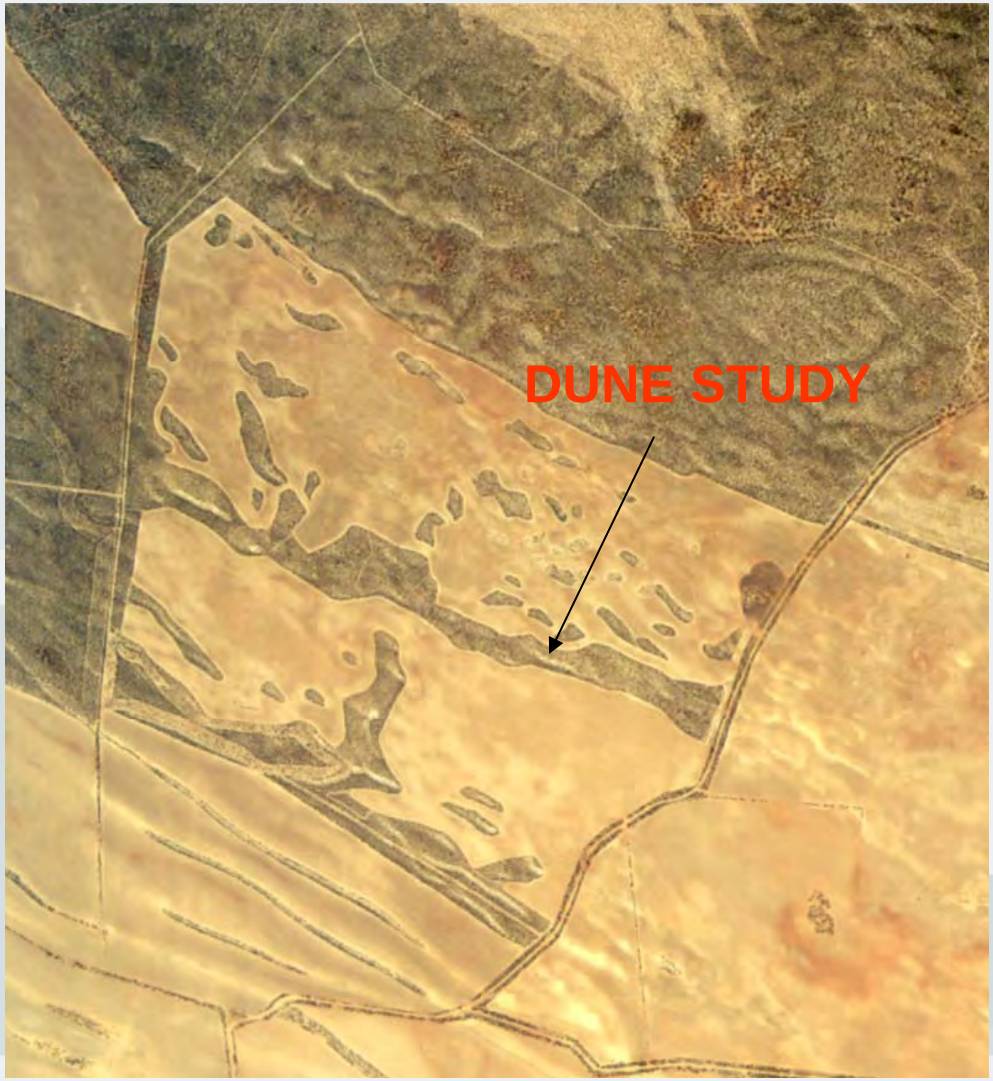
The Big Galah –Eyre Peninsula

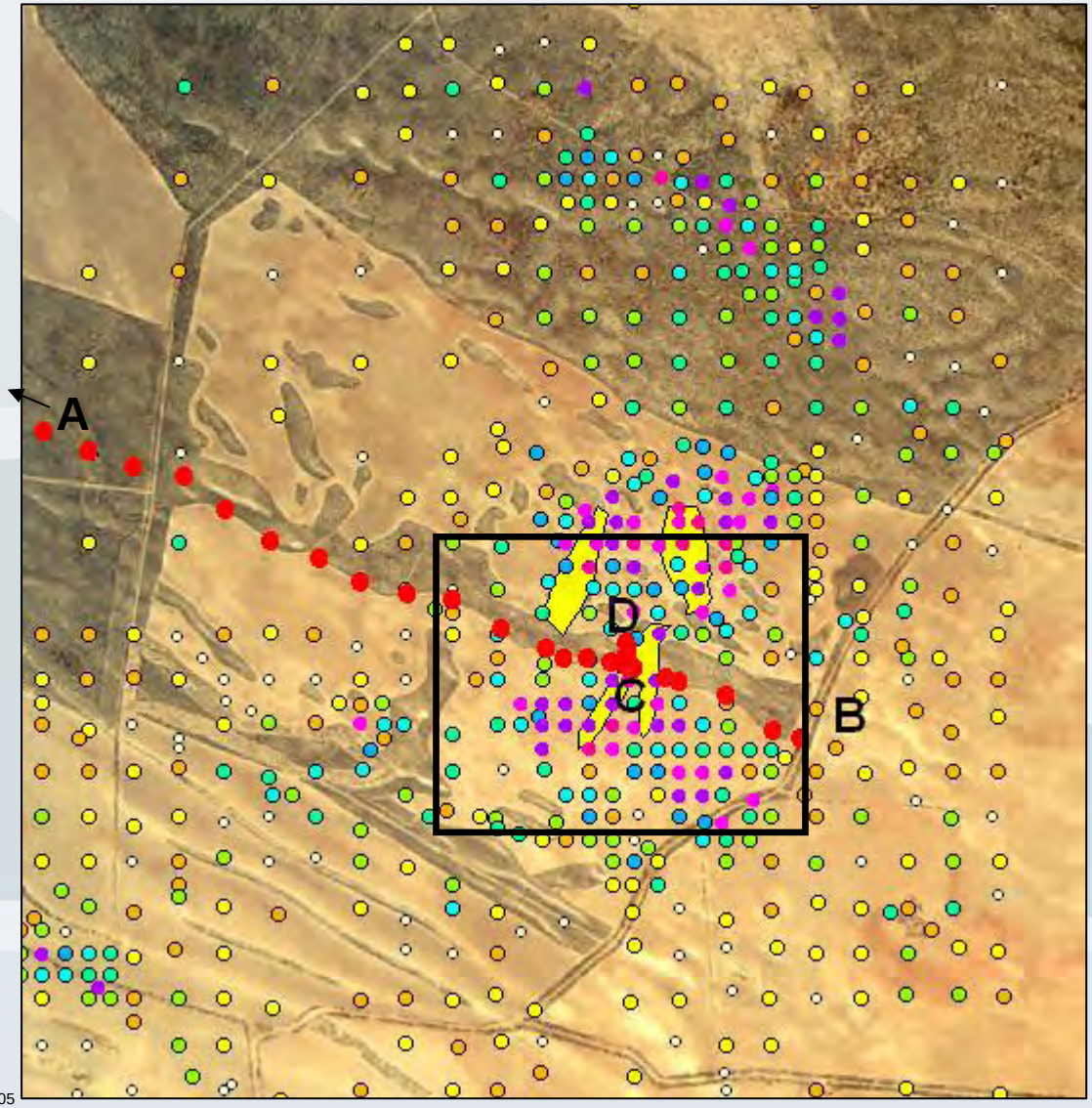


3 km

Barns

Eyre Peninsula
South Australia

Barns



Gold in calcrete

- 0.01 - 0.65
- 0.65 - 1.35
- 1.35 - 2.3
- 2.3 - 3.8
- 3.8 - 6
- 6 - 9
- 9 - 13
- 13 - 20
- 20 - 31

Biota/soil sample sites

Mineralization

1 km

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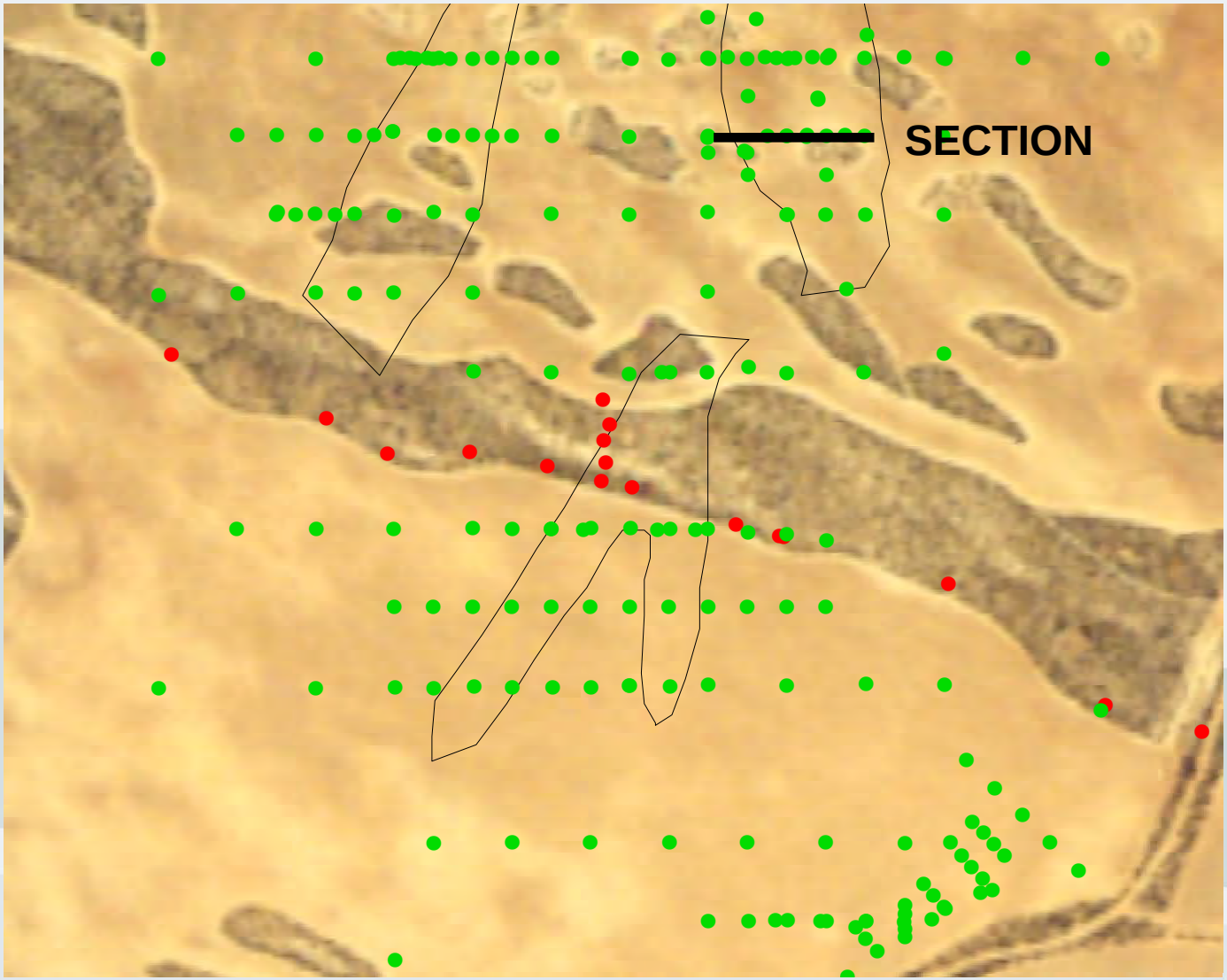
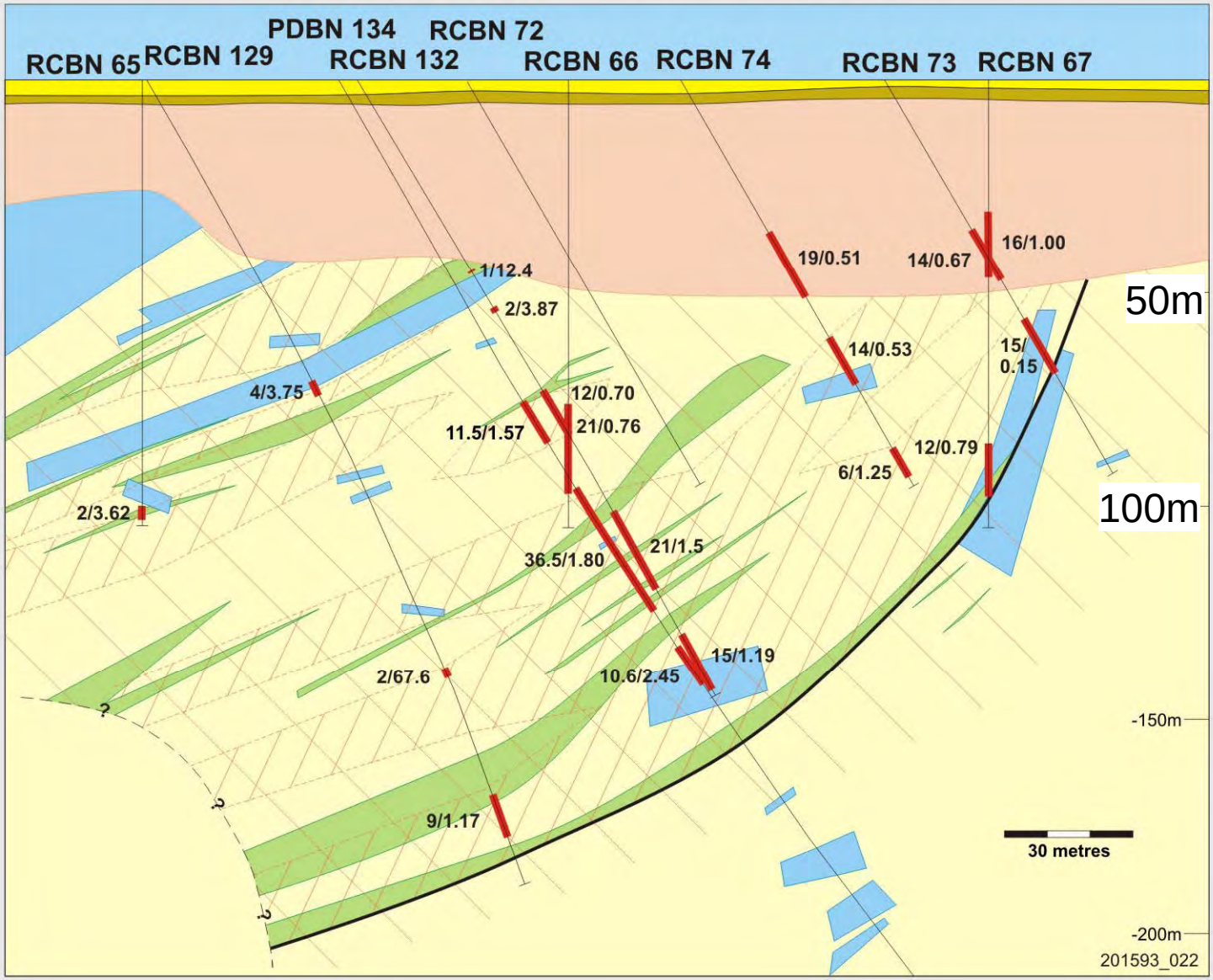
Plan showing dune detail



- Drill holes
- Biota/soil sample sites
- Mineralization

~200 m

Interpreted cross-section (6365900mN) through the Eastern Zone, Barns Gold Project.



Aeolian sand

Saprolite

Calcrete

Granodiorite

Quartzite

Mafic dykes

Propylitic alteration

Phyllic alteration

Principal fault or shear

RC/Diamond drillhole

Gold intersection m/g/t Au

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(Modified from Drown)

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Study overview

- Part 1- biogeochemical survey
- Part 2 - investigation of geochemical processes occurring in a sand dune

  a) dating

  b) bulk element distributions

  c) isotopes

  d) LA ICP MS

Barns – traverse at edge of dune

Melaleuca uncinata (broombush)

Eucalyptus incrassata (lerp mallee)

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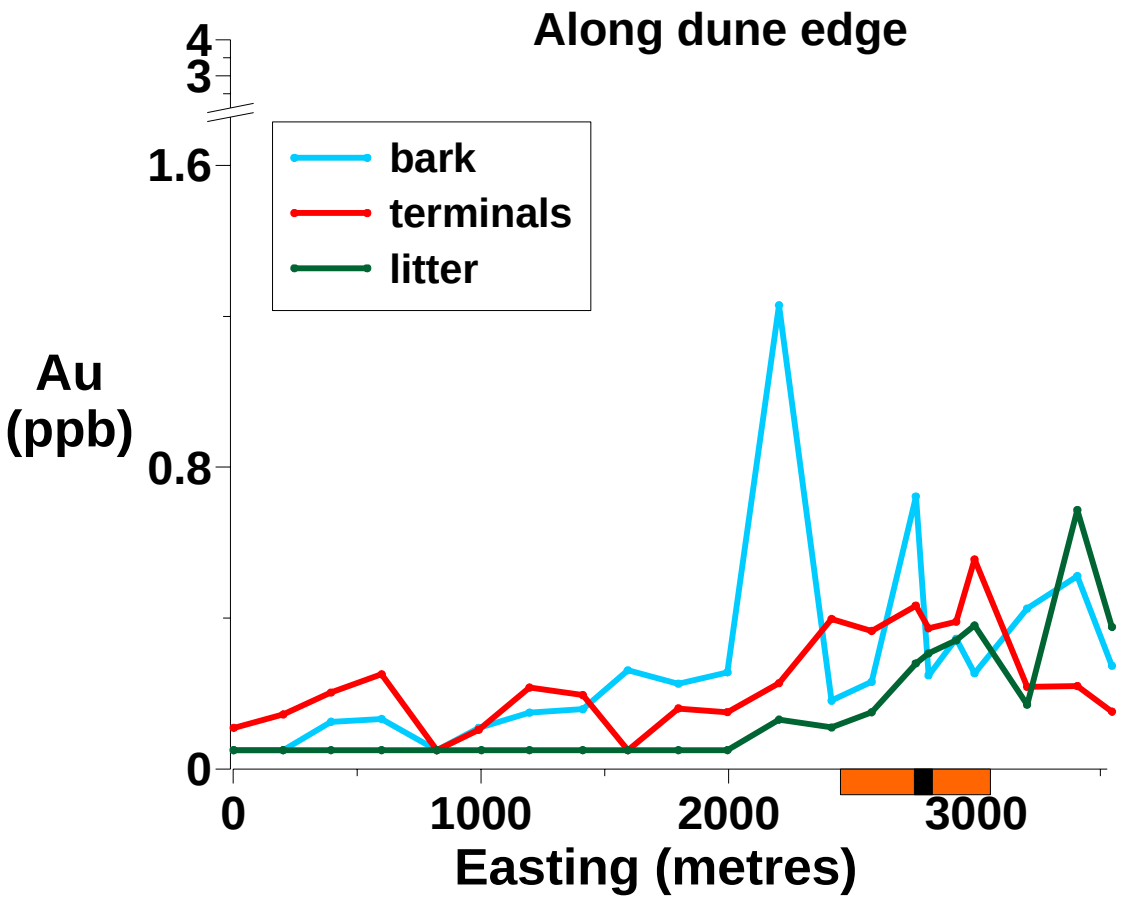
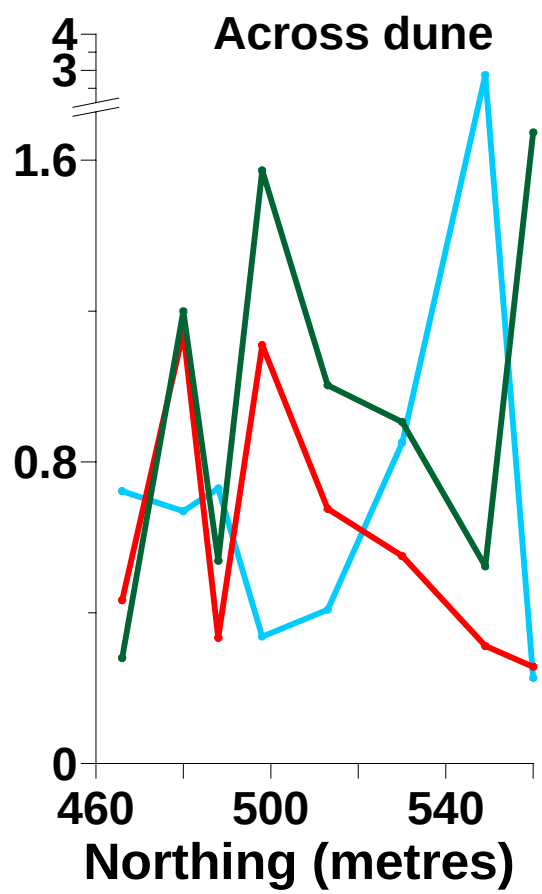
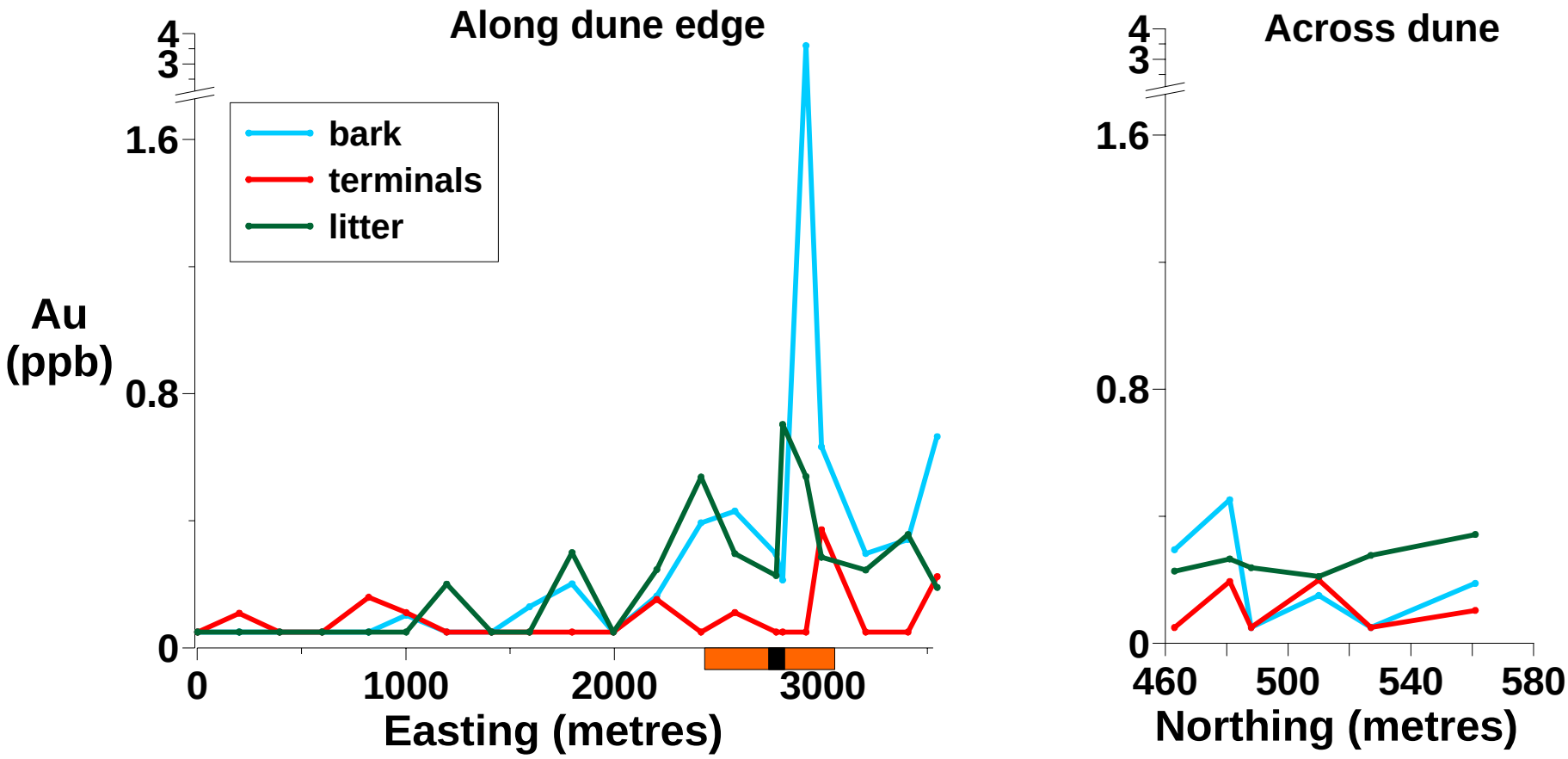
Eucalyptus incrassata



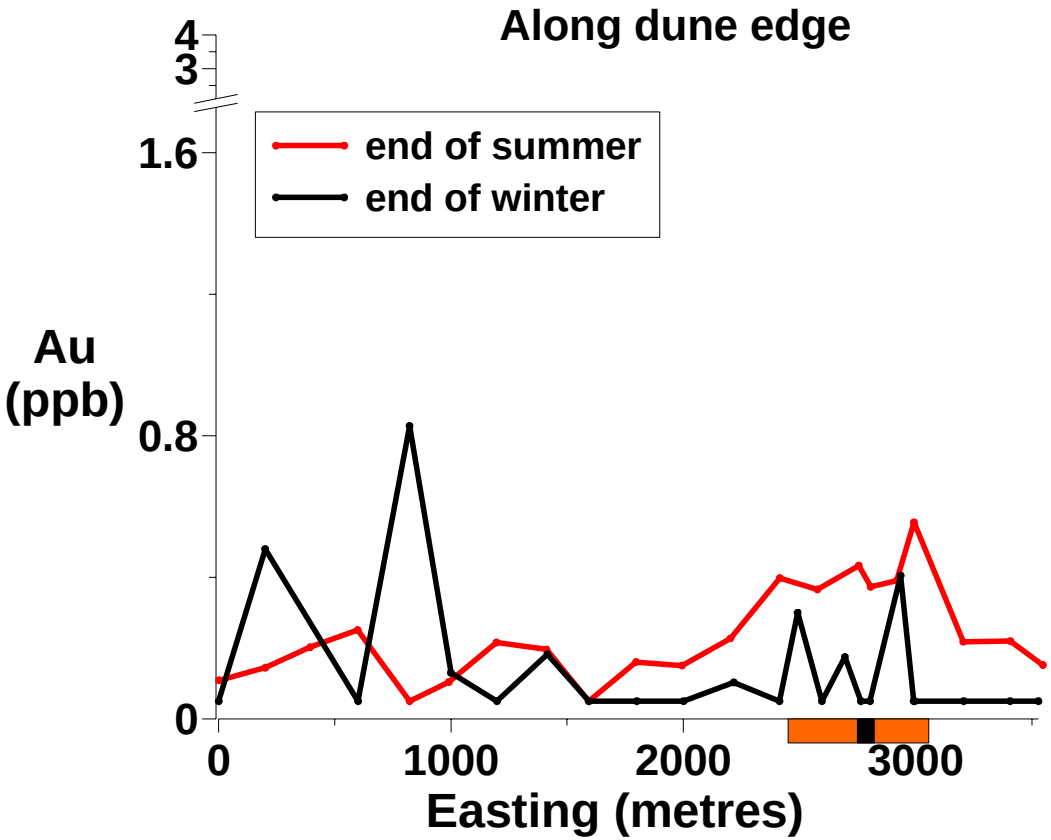


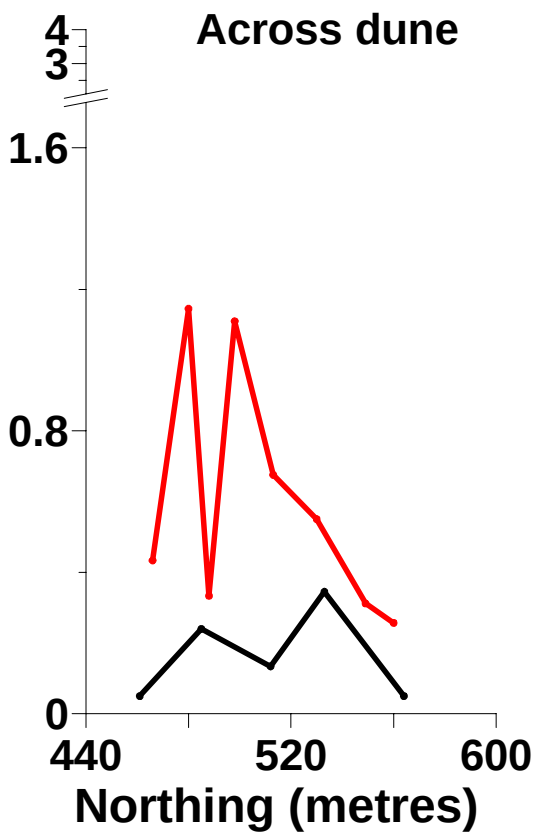
Mineralization

Melaleuca uncinata

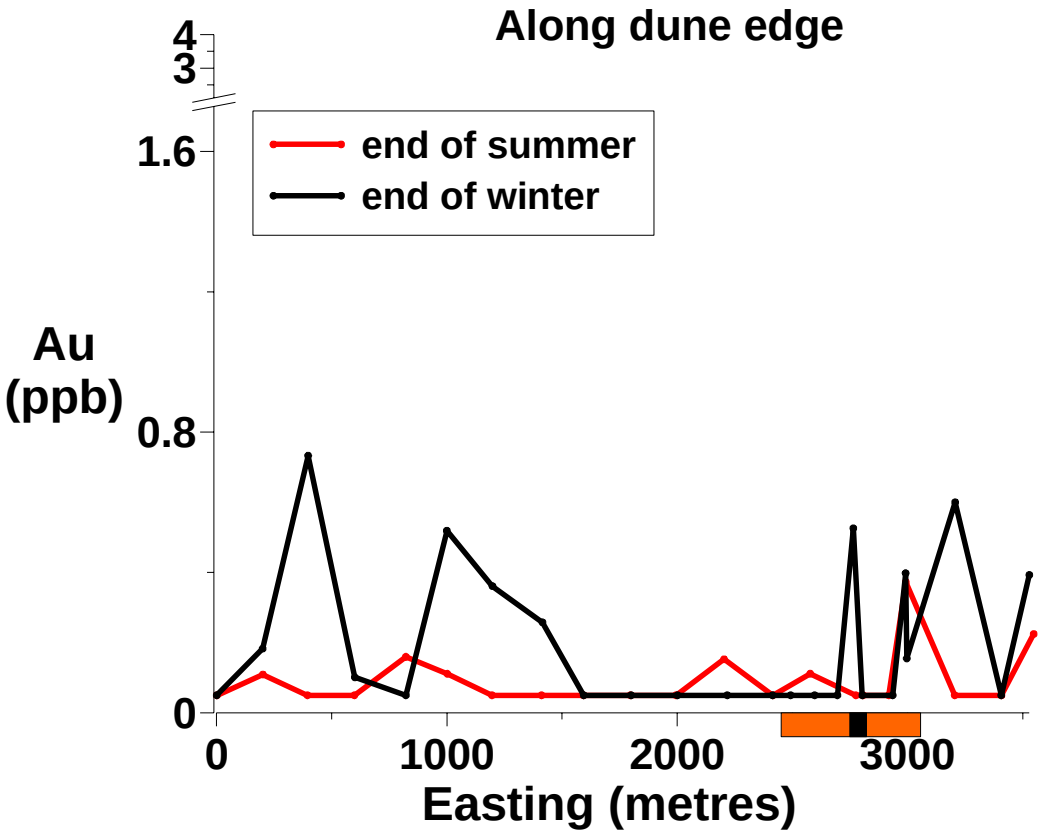


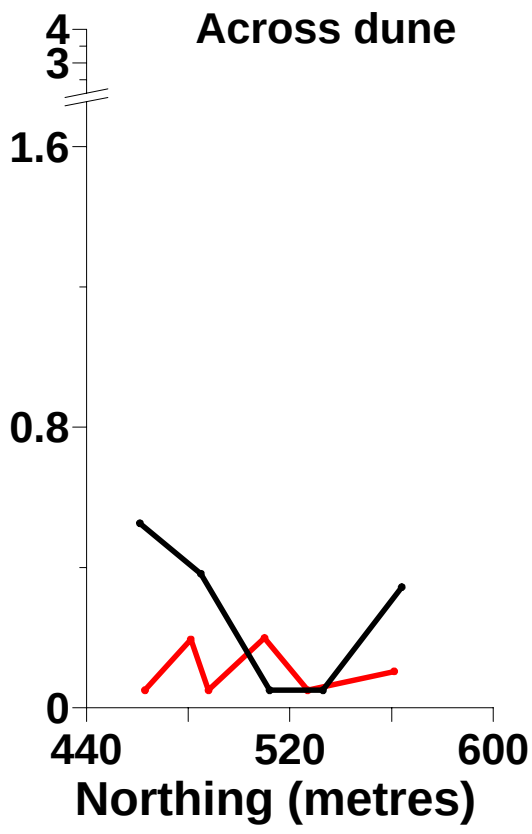
Eucalyptus incrassata terminals – *seasonal variation*



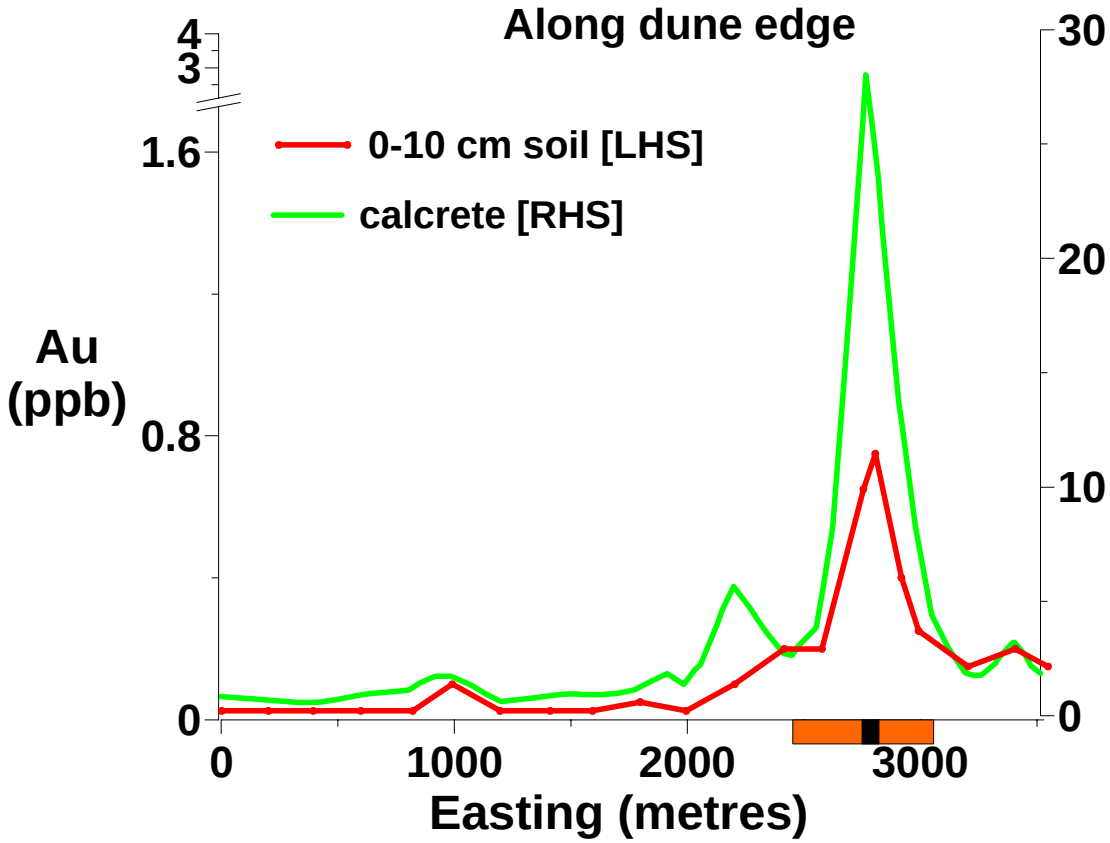


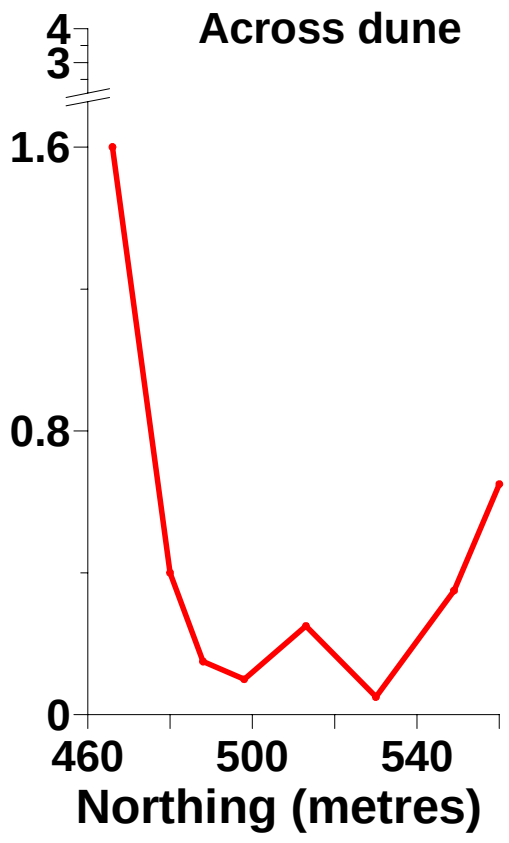
Melaleuca uncinata terminals – *seasonal variation*



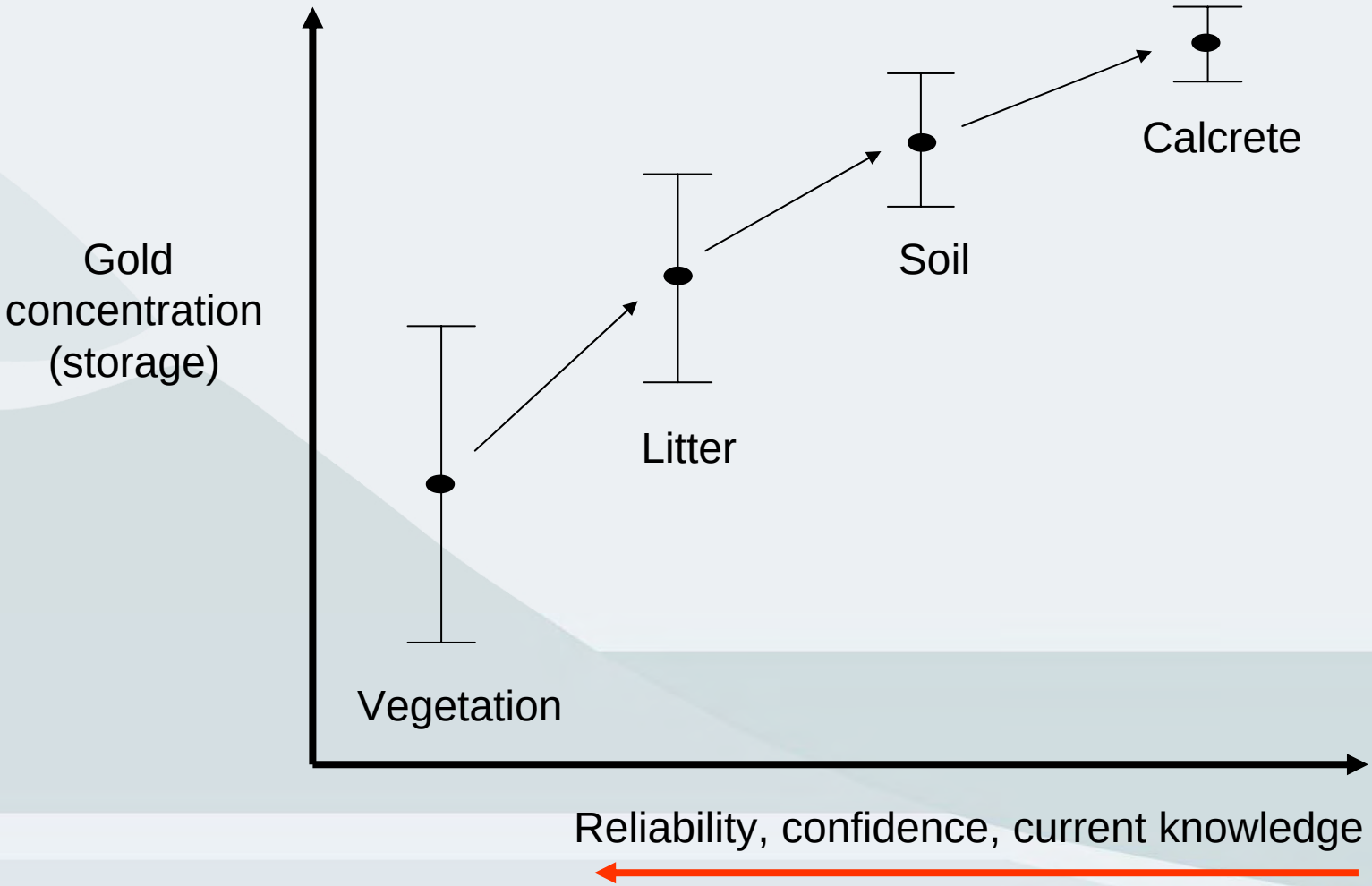


Soil and calcrete

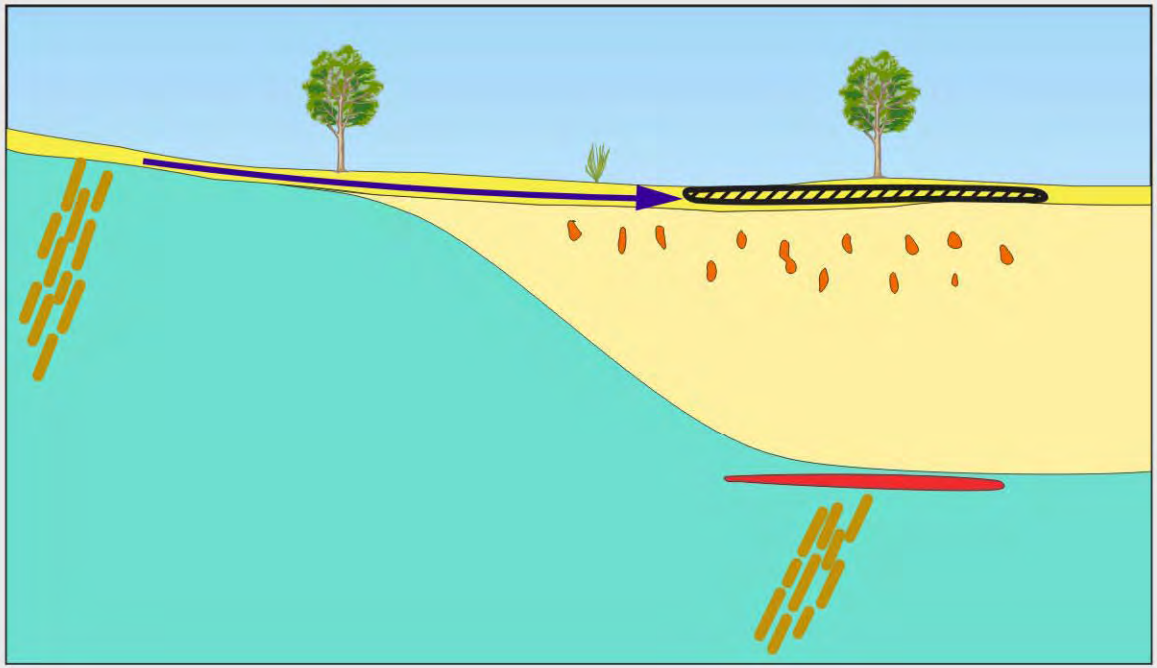




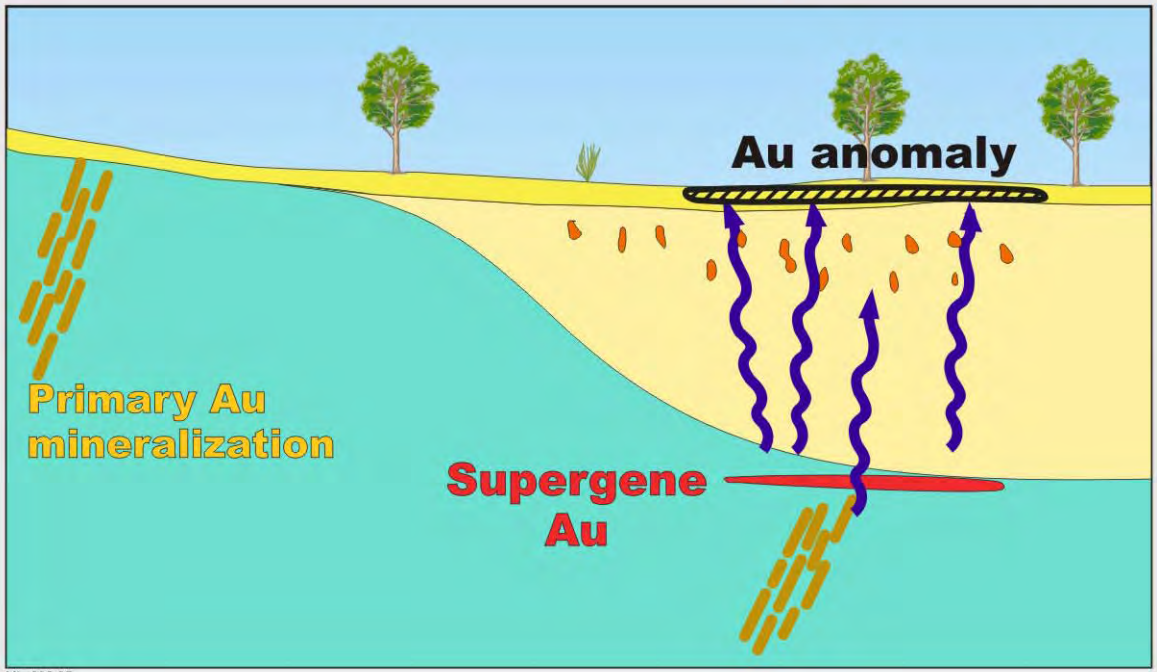
IMPLICATION FOR EXPLORATION: THE DILEMMA



Potential usefulness as sample medium in areas of cover, (but uncertainty)



Lateral chemical and physical transport



Vertical chemical transport

- Soil
- Transported clays
- Saprolite

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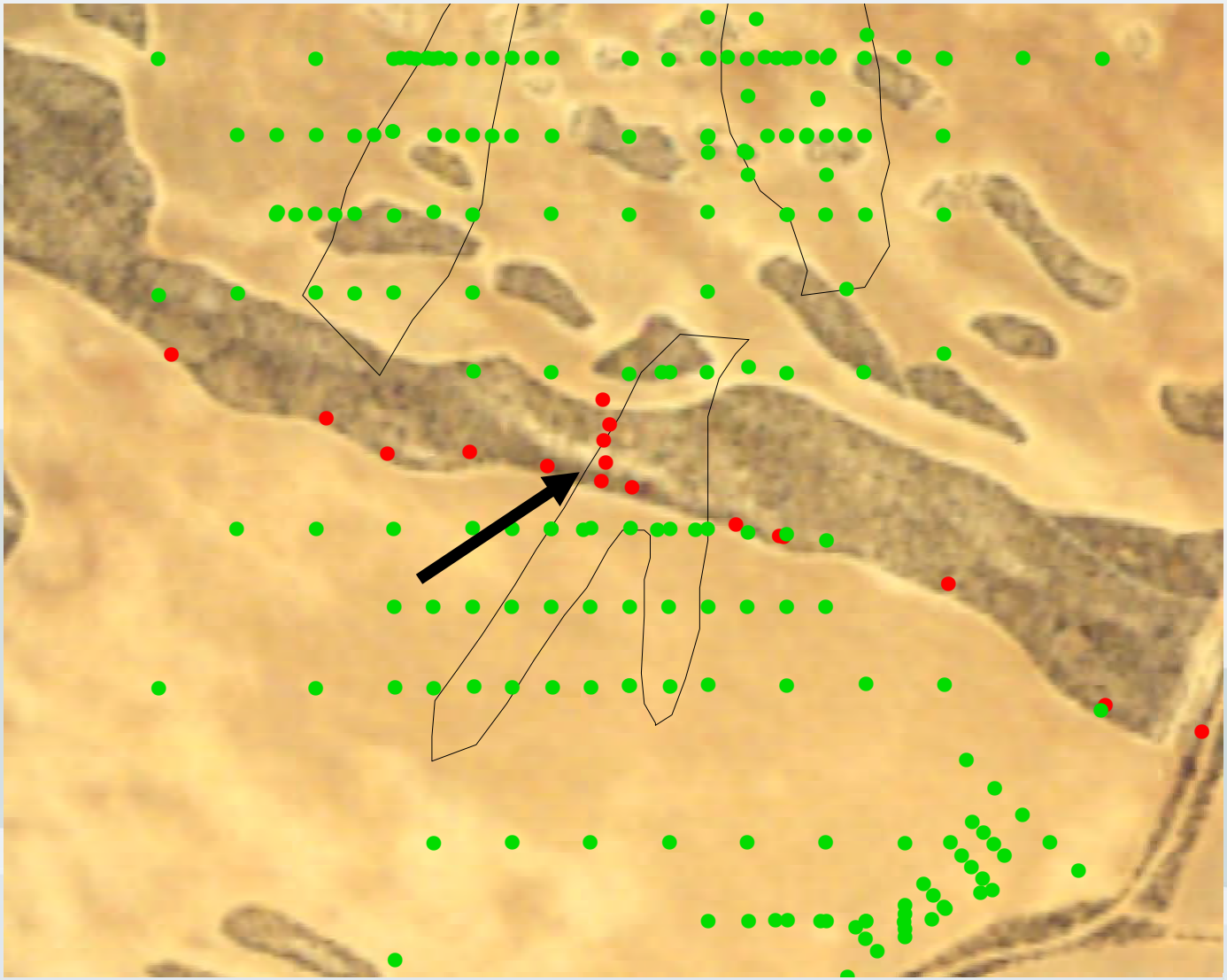
(Modified from Butt)

Plan showing dune detail



- Drill holes
- Biota/soil sample sites
- Mineralization

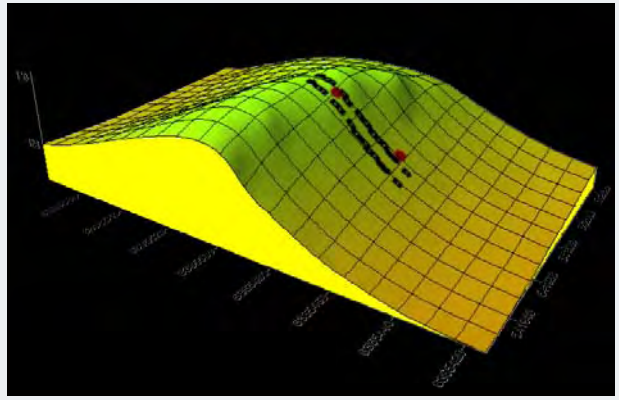
~200 m

Before …

During ...

After – view from top looking into slot

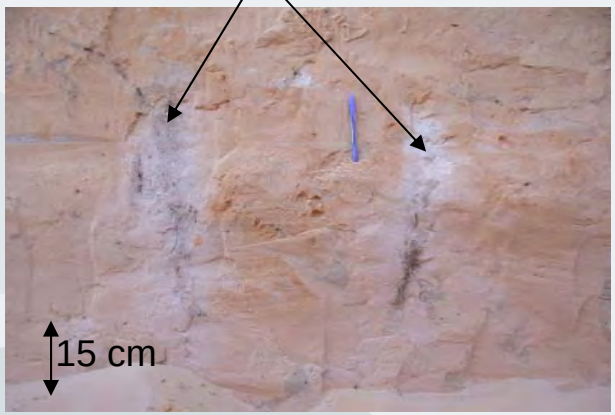
View looking south looking into slot



OSL dating sample BR2/2.4

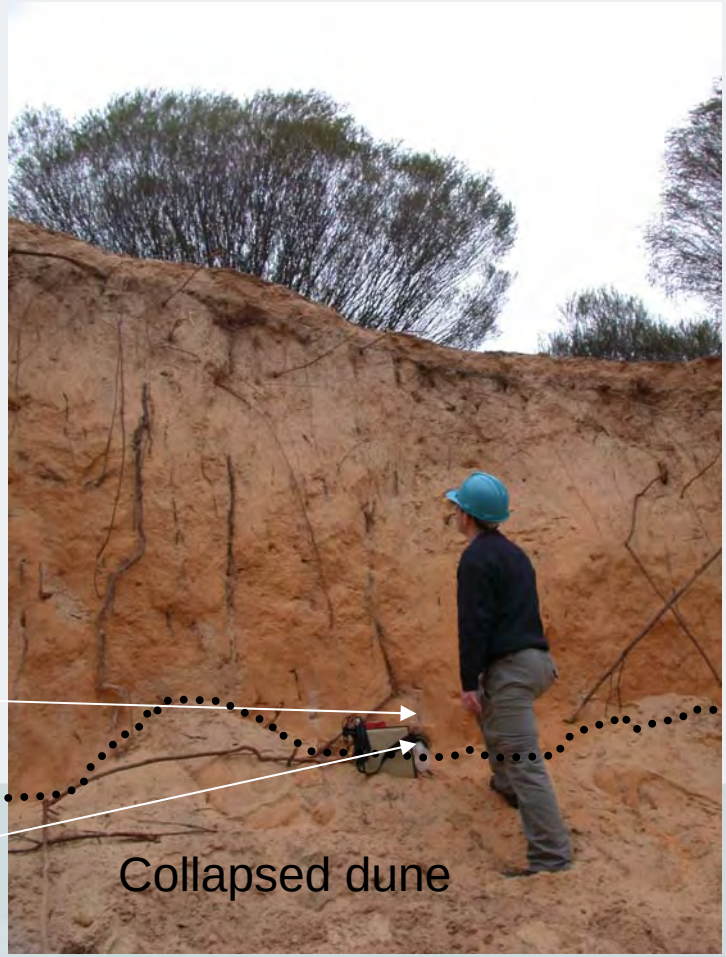
How long to form gold anomalies in calcrete?

Typical carbonate rhizomorphs containing elevated Au

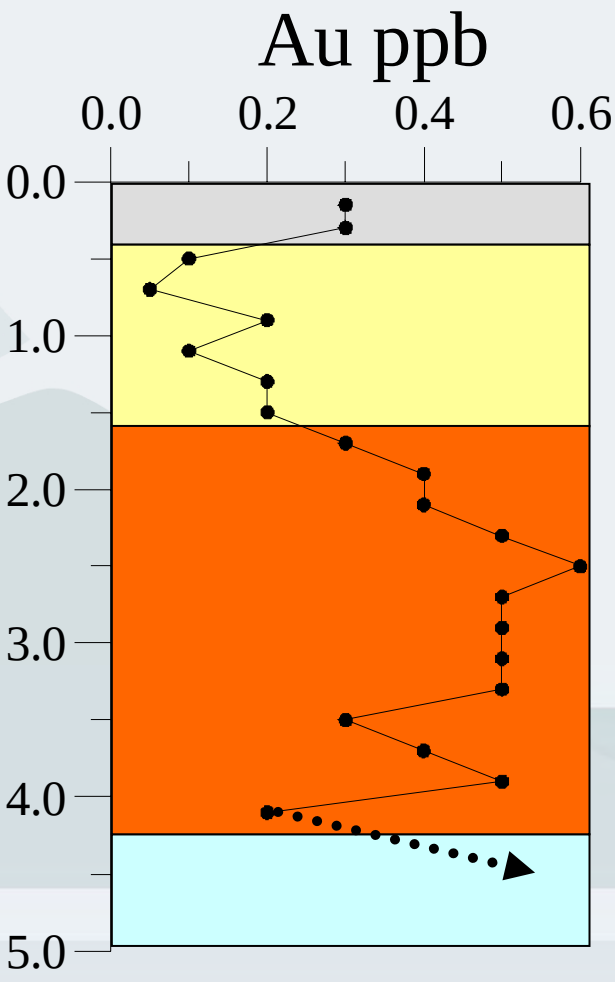


9.2 ppb Au in calcareous rhizomorph
2.5 m from top of 8 m high dune

Sand beneath rhizomorph dated at 25000 BP by OSL



Profile in dune



humic horizon (A)

eluvial horizon (O)

illuvial horizon (B)

illuvial horizon Bca (calcrete)

Gold in basal/interface calcrete = 5 - 35 ppb

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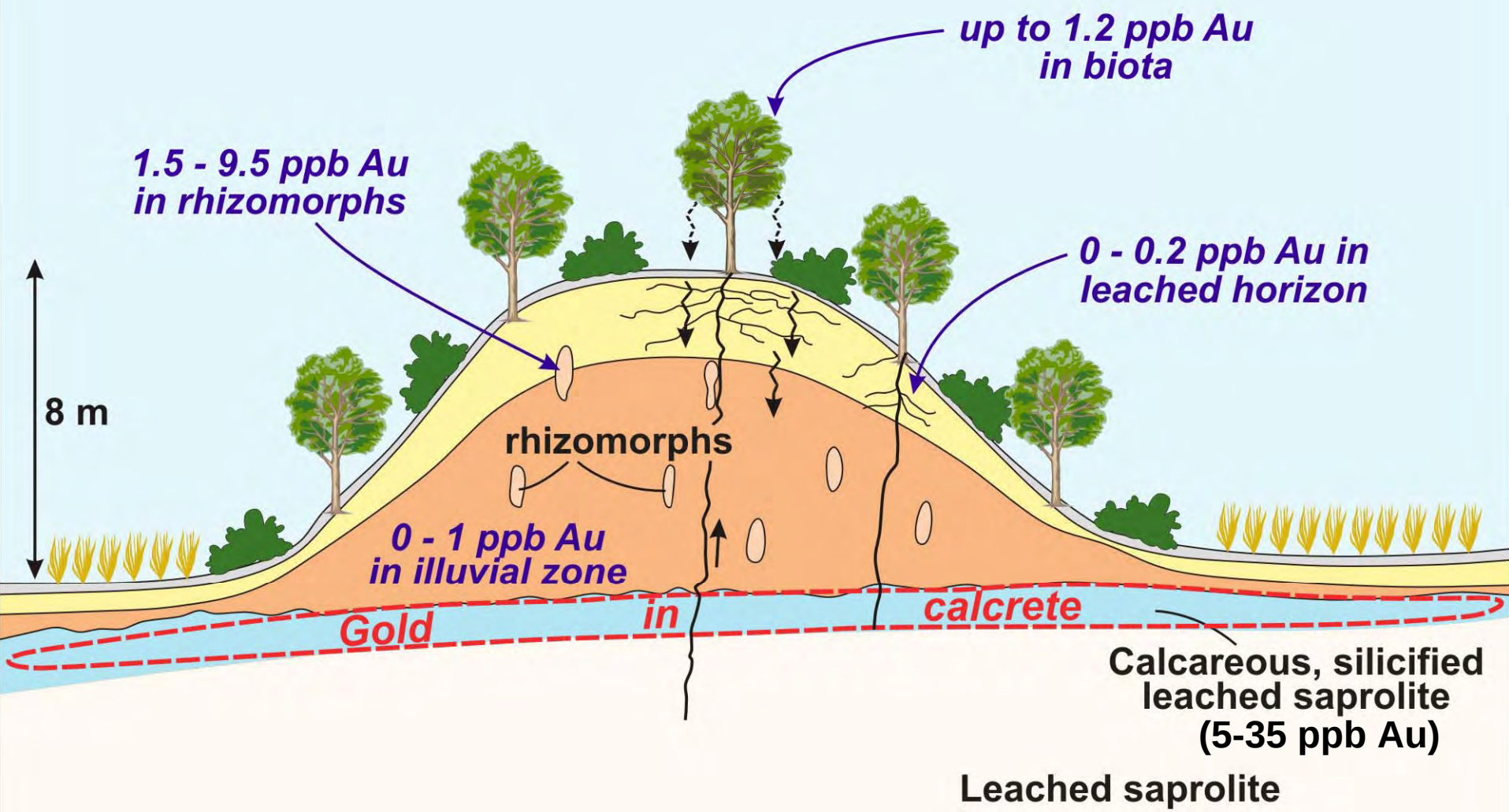
Biological mechanism for Au anomaly formation in dune



Mineralization at 40 m depth

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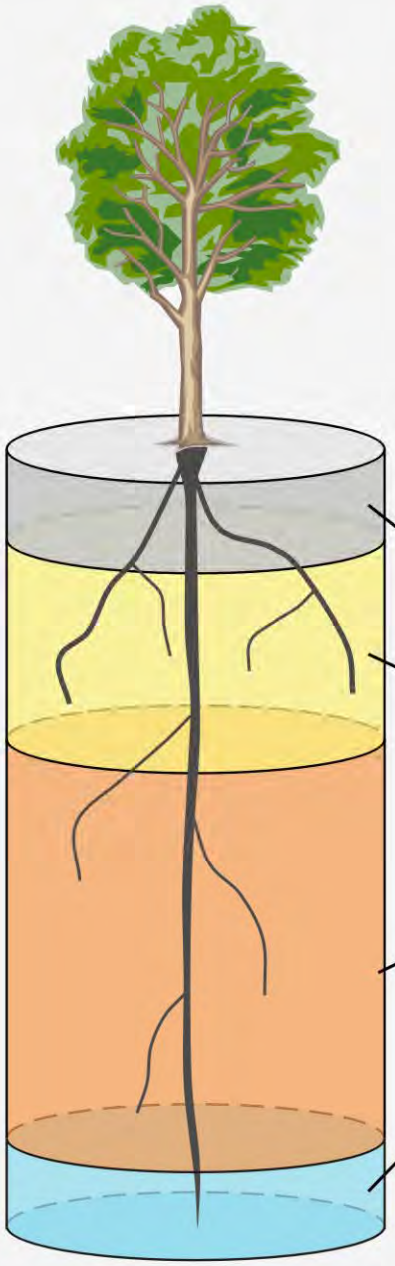


How long to accumulate this quantity of Au in the sand?

What Au concentration in biomass and production rate is required?

Assumptions

1. ***No uptake to sand of Au by capillarity***
2. ***No uptake of Au by roots in sand***
3. ***No erosion***
4. ***No Au lost from sand***
5. ***NPP rate and biomass content in equilibrium***

Horizon	Mean Au conc (ppb)	Weight Au (mg)	Mass (tonnes)
Humic (A)	0.3	3	9
Eluvial (E)	0.1	3	23
illuvial I (B)	0.7	31	45
illuvial II (B_{ca})	17.4	164	9

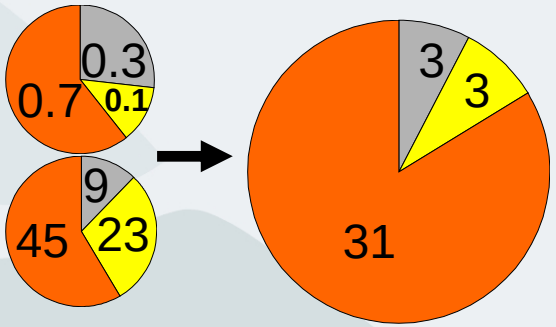
Calculations

Soil cylinder (based on tree canopy) radius = 2 m
Three horizons (A,E and B) - not calcrete

How long to accumulate this quantity of Au in the sand?

[Au] ppb sand

Au (mg) in sand



Horizon mass (tonnes)

+

NPP
kg $yr^{-1}area^{-2}$
(2.9-4.3)

[Au] vegetation
(1 ppb)

=

8600 to 12700 years for Au to accumulate in sand

< 4000 to 5900 years for Au to accumulate in calcareous rhizomorph

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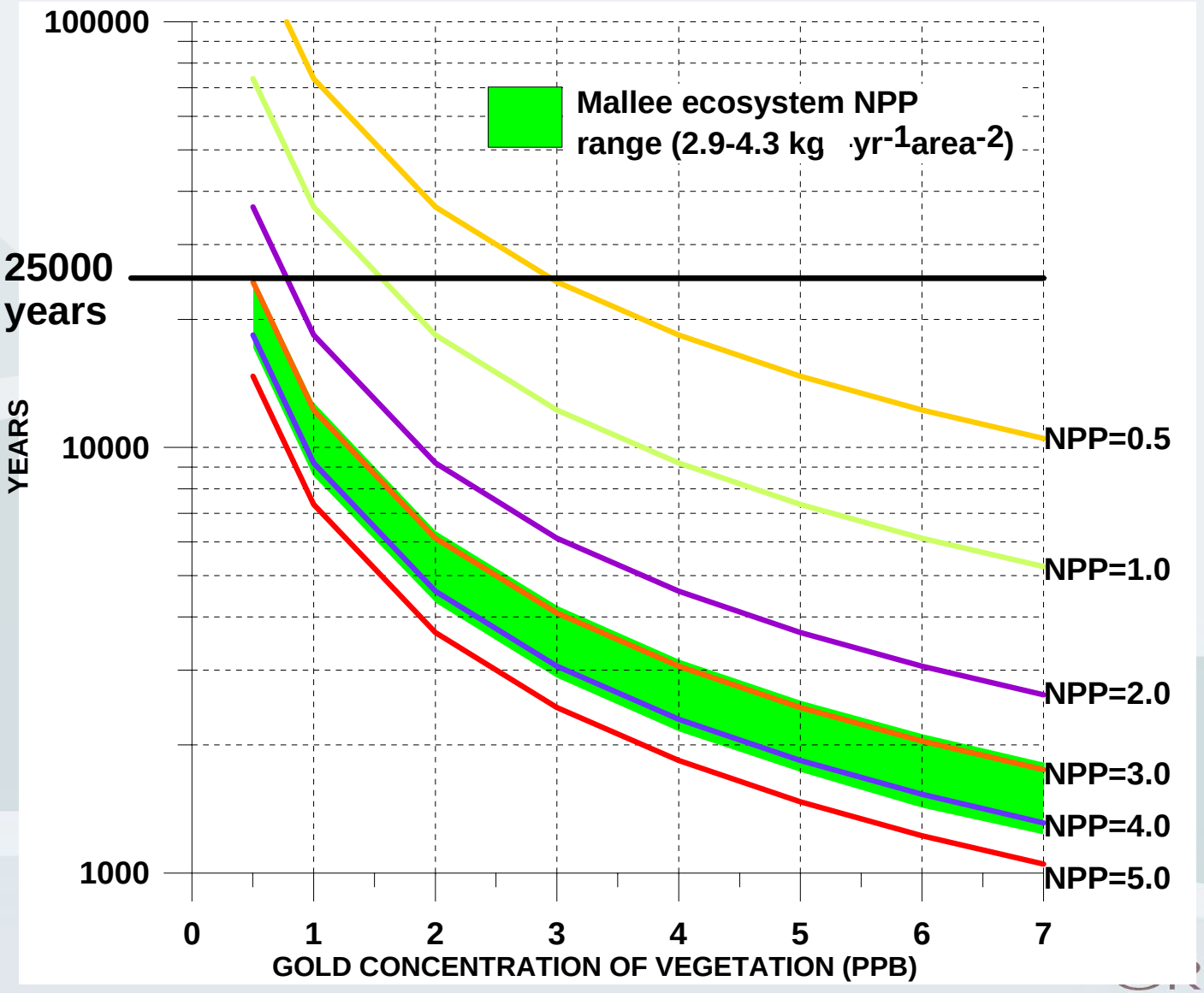
What Au concentration in biomass and production rate is required?

Gold in veg. vs time for different NPP rates



SUMMARY

- Anomalous Au in dune sand and vegetation
- Au particularly concentrated in calcareous rhizomorphs
- Dual role of roots in Au anomaly formation in the rhizomorphs
- Vegetation (via roots) capable of suppling all the Au to the sand in ~10000 years in current conditions

Acknowledgments

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- Dean Walters – land owner
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- ActLabs
- CRC LEME and CSIRO

Thank you