



Australian Government
Geoscience Australia



Eastern Tanami Mineralisation

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¹ Geoscience Australia

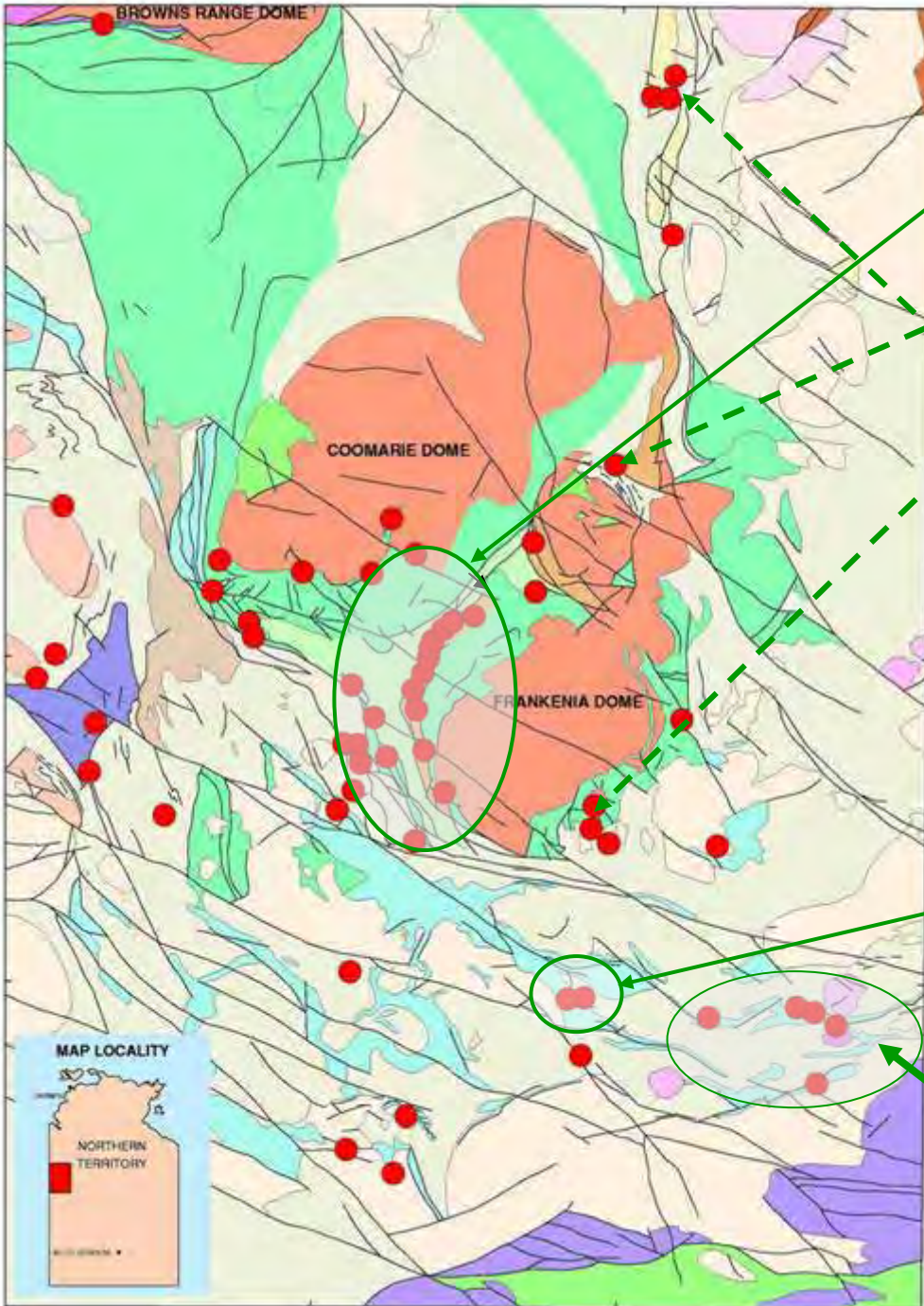
² Northern Territory Geological Survey



TALK OUTLINE

- Geological setting of gold deposits
- Overview of fluid inclusion data from the gold deposits
 - Composition of the ore fluids
 - Temperatures of mineralisation
 - Depths of formation
- Overview of isotopic data
 - Source of the fluids
- Possible depositional mechanisms for the gold deposits in the eastern Tanami region





TANAMI
1.63 Moz Au

Ground Rush: 0.73 Moz Au

Oberon: 0.41 Moz Au

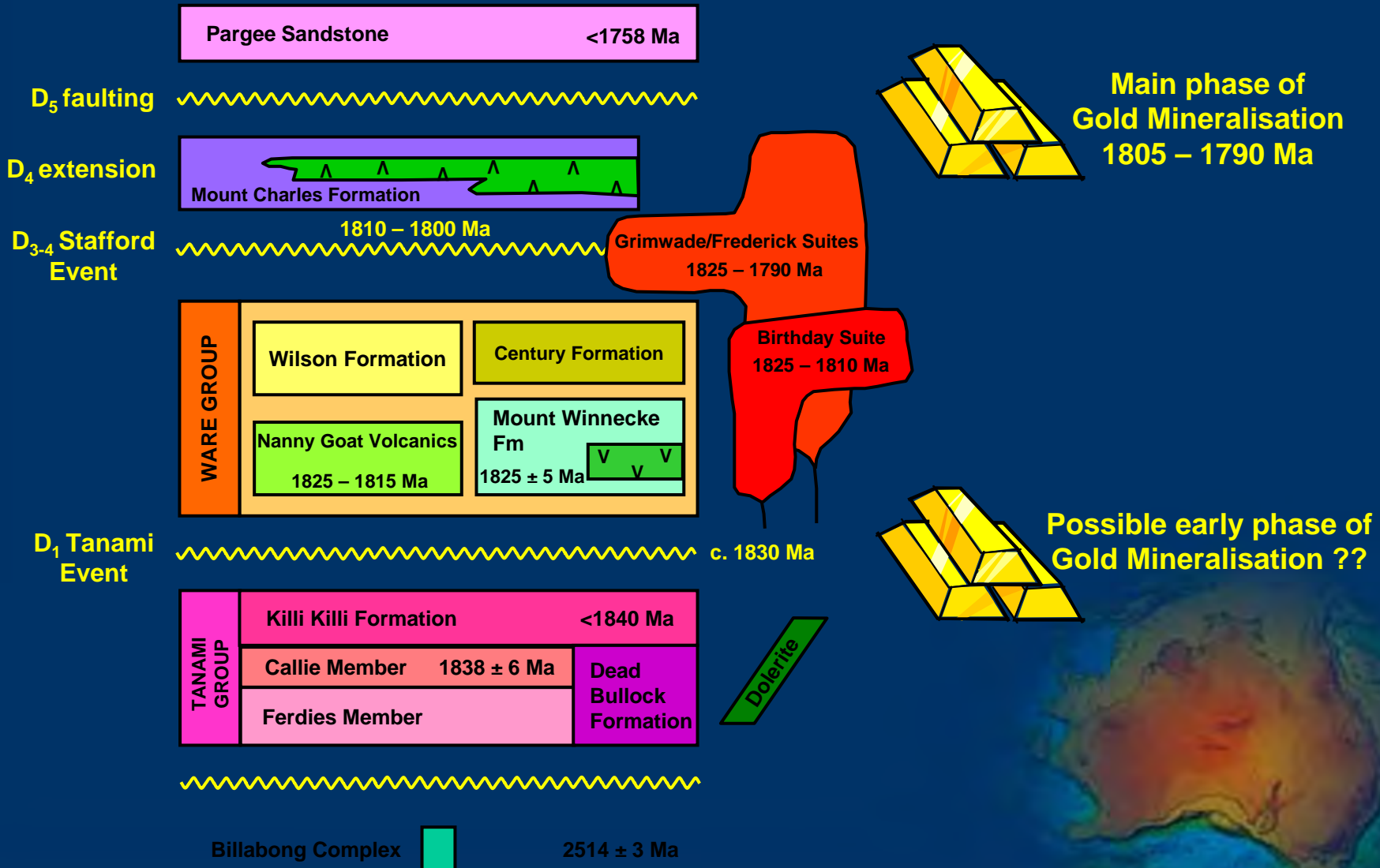
Crusade: 0.08 Moz Au

Eastern Tanami region
~11 Moz (342 t) Au

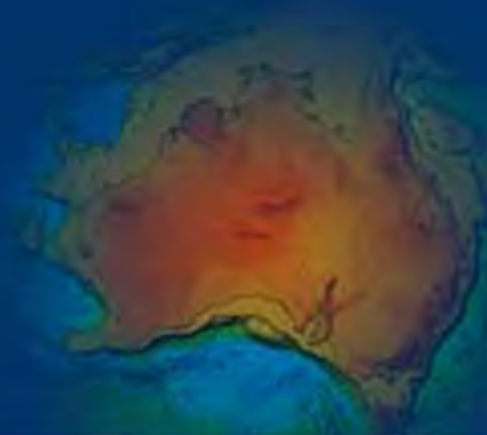
DEAD BULLOCK SOAK
7.6 Moz Au
(86% in Callie)

THE GRANITES
1.3 Moz Au

Structure, Stratigraphy and Mineralisation



Geological Setting of the Major Gold Deposits



Dead Bullock Soak Goldfield



Triumph Hill

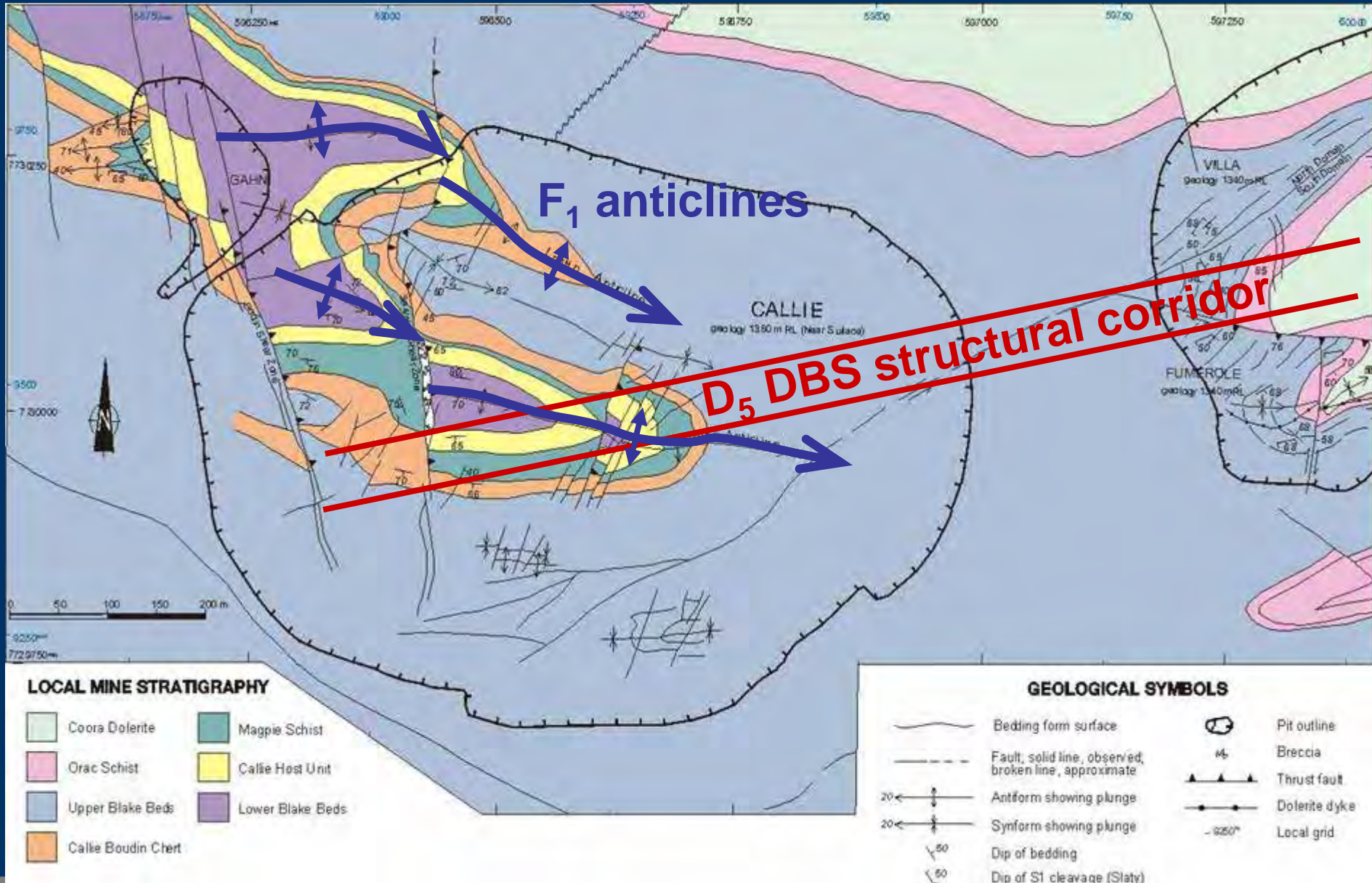
Colliwobble

Dead Bullock
Ridge

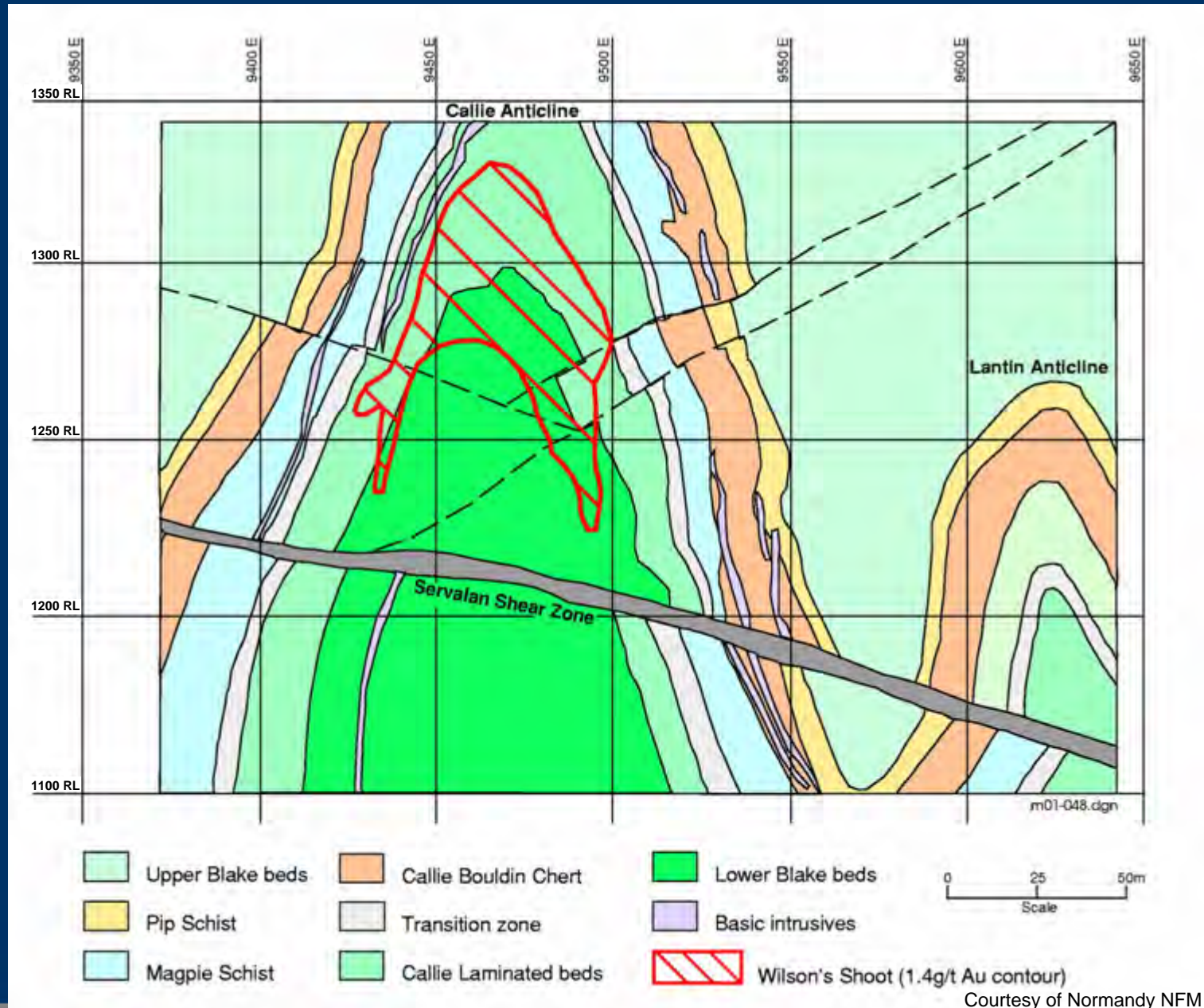
Villa

Callie

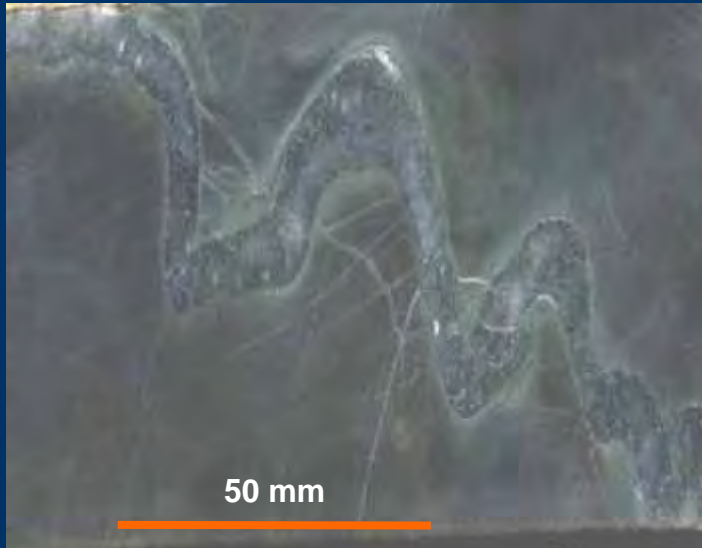
Callie Deposit



Cross Section of the Callie Deposit



Stages of veining at Callie



(a) Folded, pre-mineralisation vein



(b) Syn-mineralisation sheeted veins

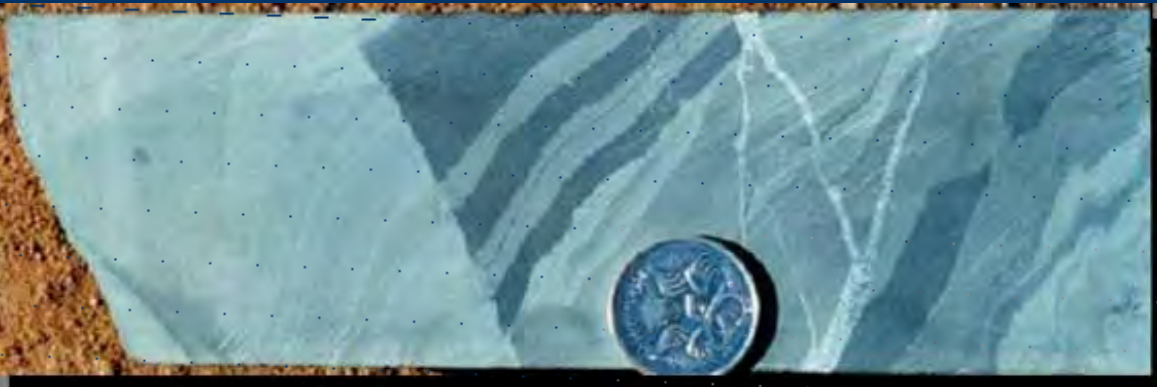


(c) Post-mineralisation buck quartz cutting ore-stage veins



(d) Post-mineralisation carbonate (ankerite) veins

The effect of carbon

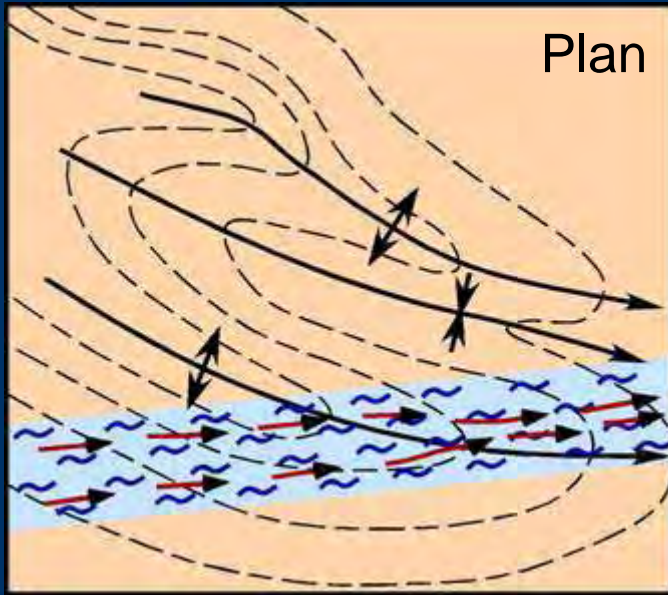


Decarbonisation front in siltstone from the Callie gold mine, Northern Territory (Photo courtesy Nick Williams)



Callie - Banding of Magpie Schist resulting from decarbonisation.

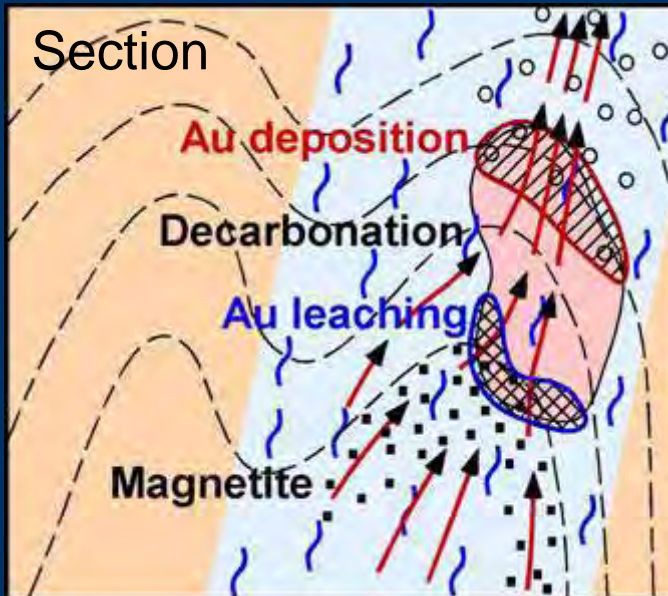
Controls on the Callie deposit



Structural control

Overprinting of F_1 anticlinorium by D_5 structural corridor

- D_5 corridor at small angle to F_1 axial plane
- Fluid funnelled into anticlinal closures



Chemical control

Moderately oxidised fluids + graphite \Rightarrow fluid reduction & CO_2 effervescence \Rightarrow gold deposition

Zone refining \Rightarrow enrichment at top of decarbonised zone

The Granites goldfield

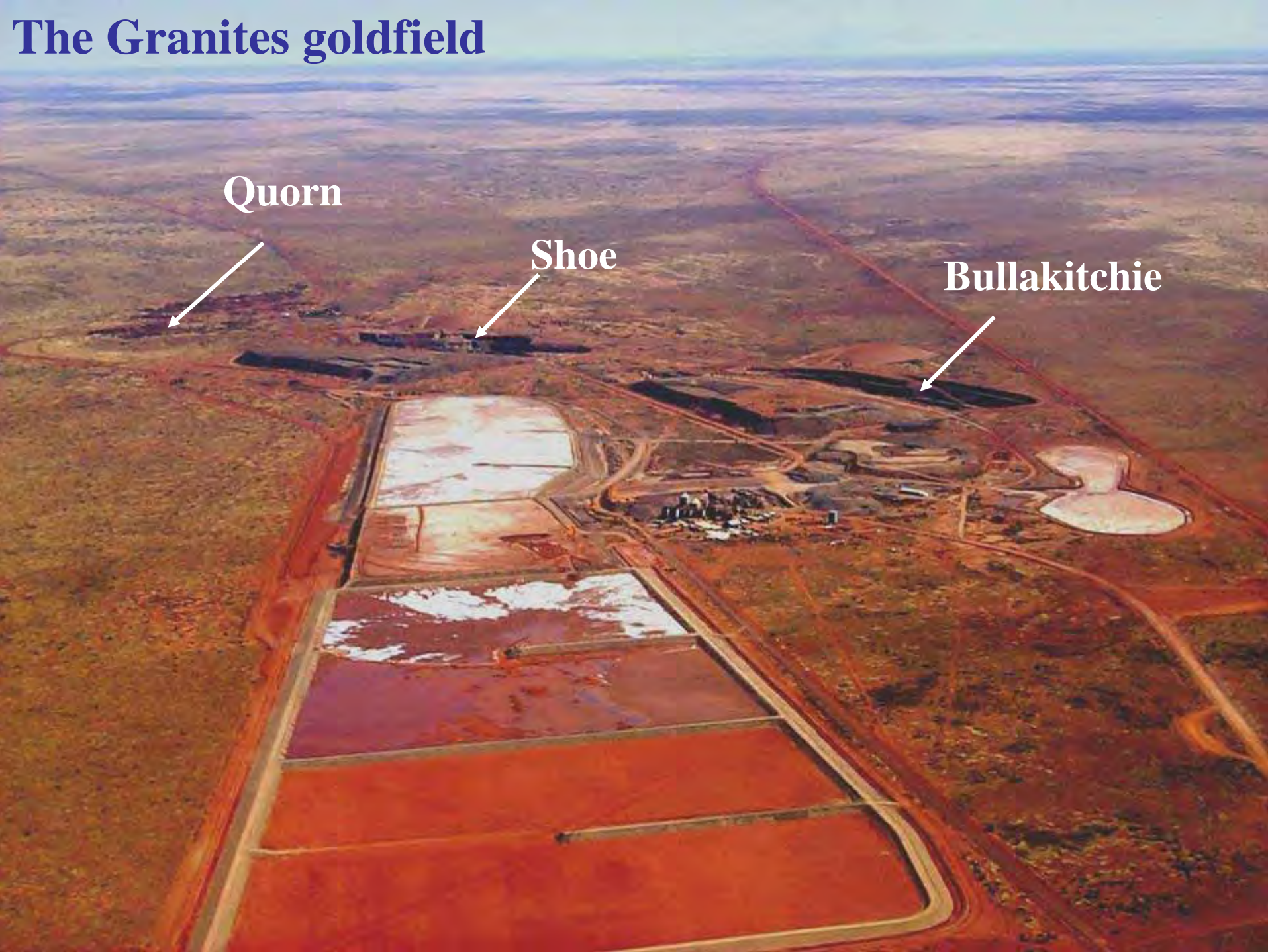
Quorn



Shoe

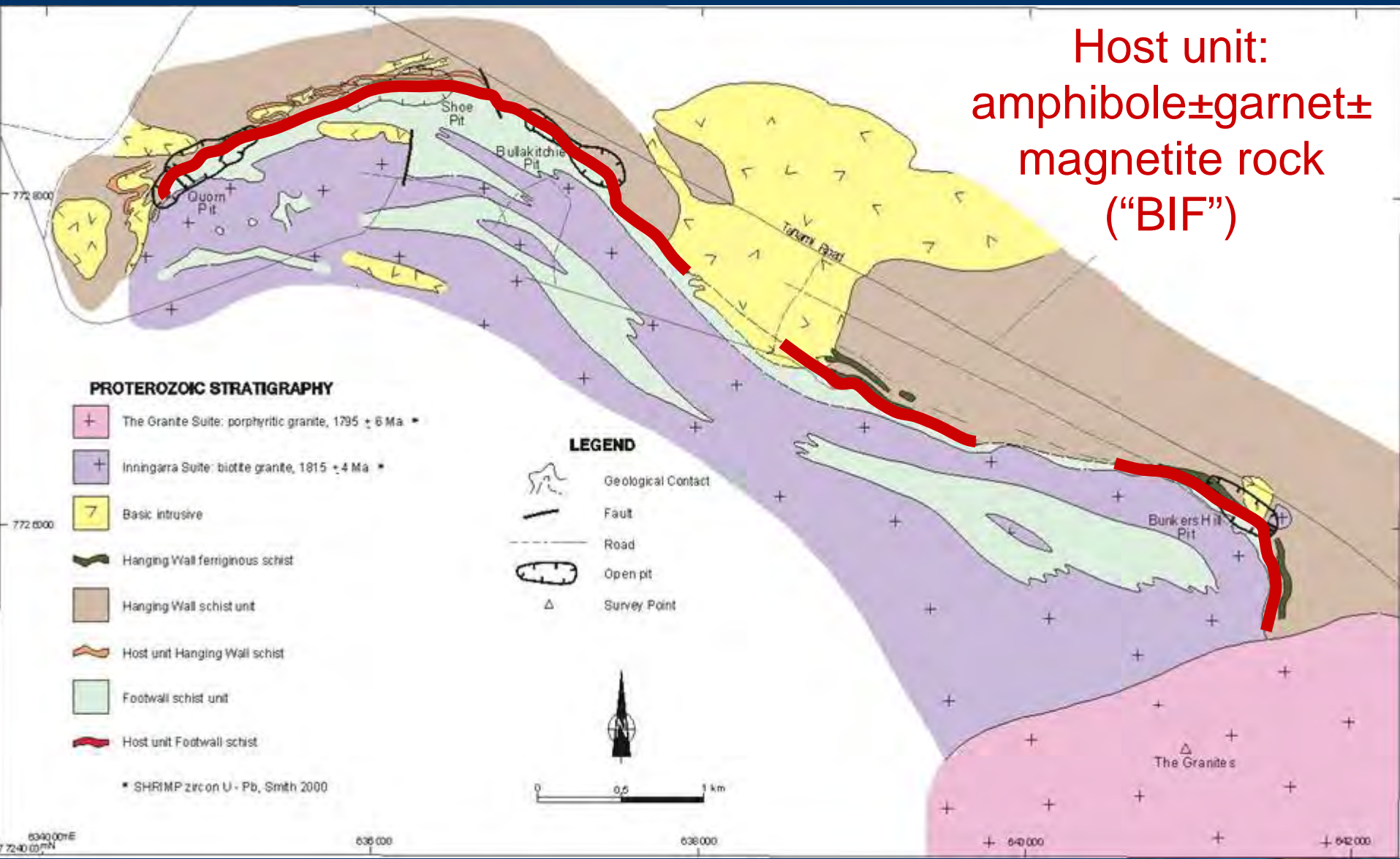


Bullakitchie



The Granites Goldfield

Host unit:
amphibole±garnet±
magnetite rock
("BIF")



Cross Section of East Bullakitchie Pit

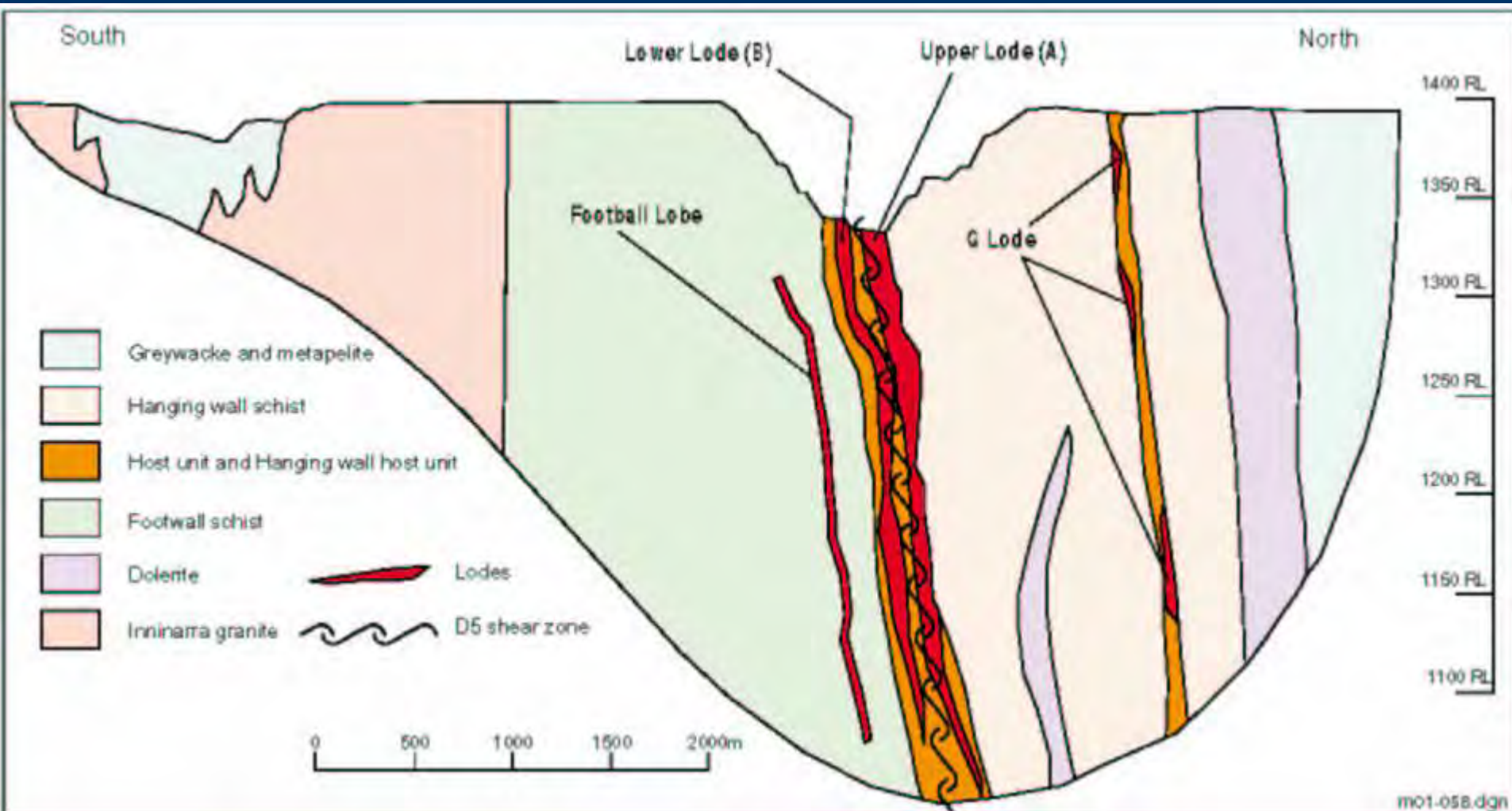


Figure 20. Cross section of East Bullakitchie deposit (North Flinders Mines, Annual Report 1990).

The Granites Goldfield



Arsenopyrite rich ore from the Shoe open pit – The Granites Goldfield.



The Quorn open pit at The Granites Goldfield

Tanami goldfield (looking N)

Hurricane

Carbine

Hadleys

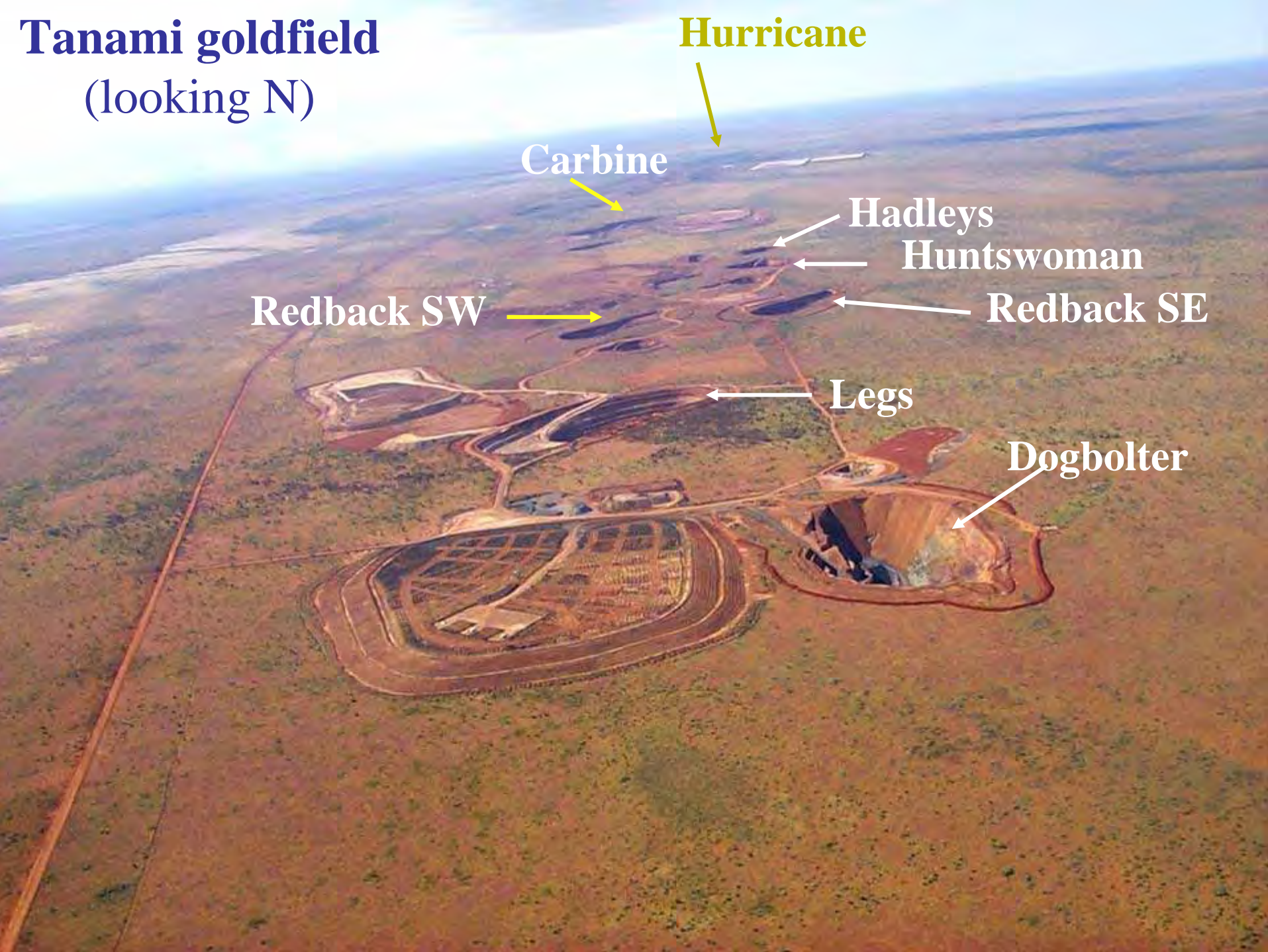
Huntswoman

Redback SW

Redback SE

Legs

Dogbolter



Tanami Goldfield

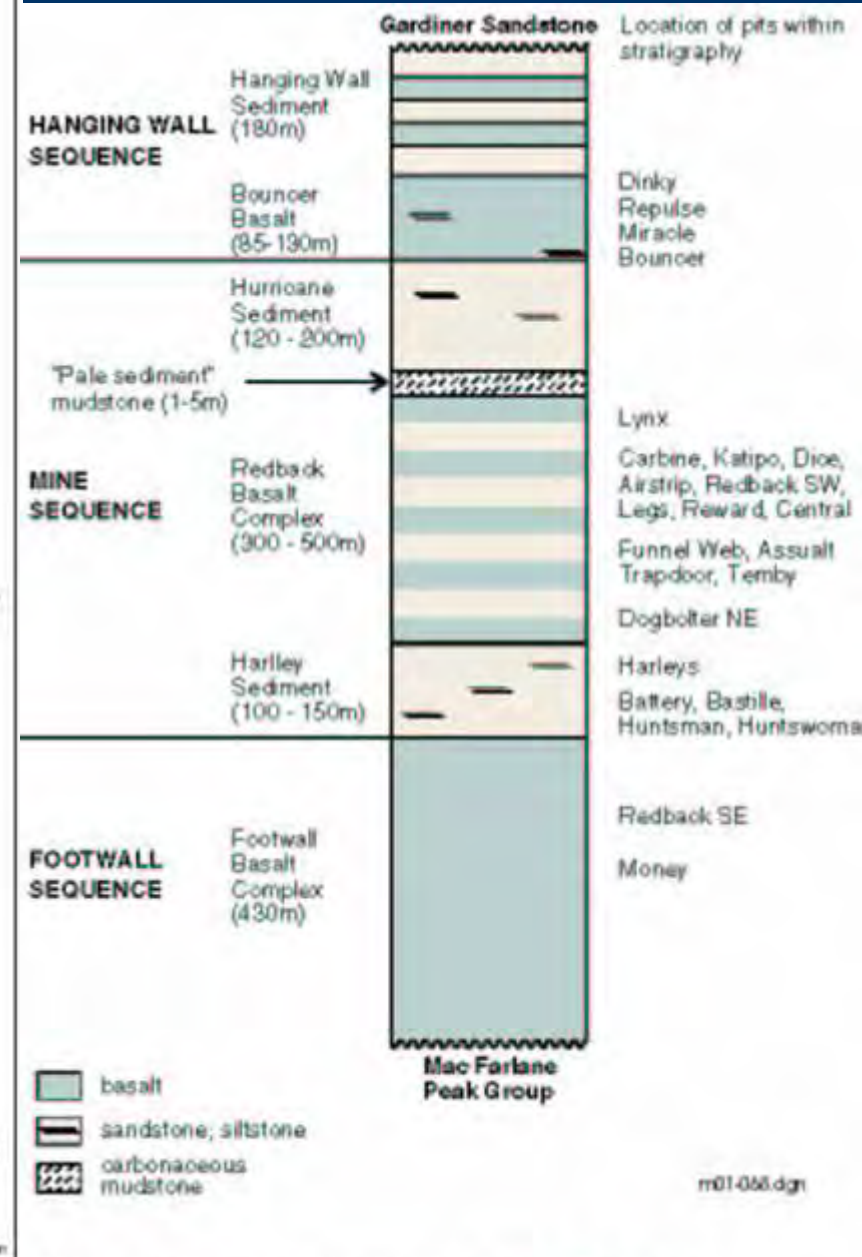


Figure 28. Regional geology of Tanami goldfield.

Figure 29. Local stratigraphy of Tanami goldfield.

Types of quartz in the Tanami Goldfield



'Triple-point quartz in basalt



Light grey and white ore-stage quartz



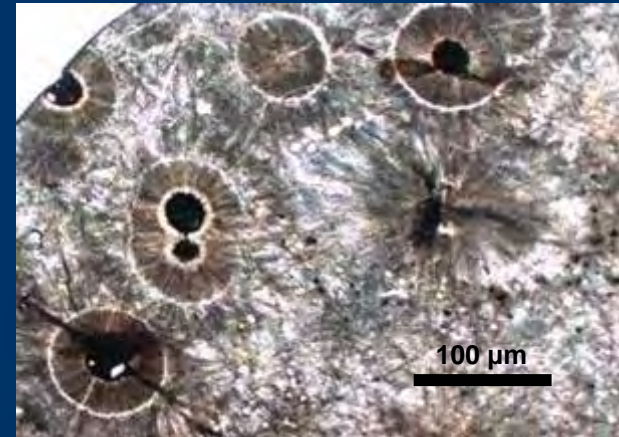
Chalcedonic quartz



Comb textured quartz



Saccharoidal quartz

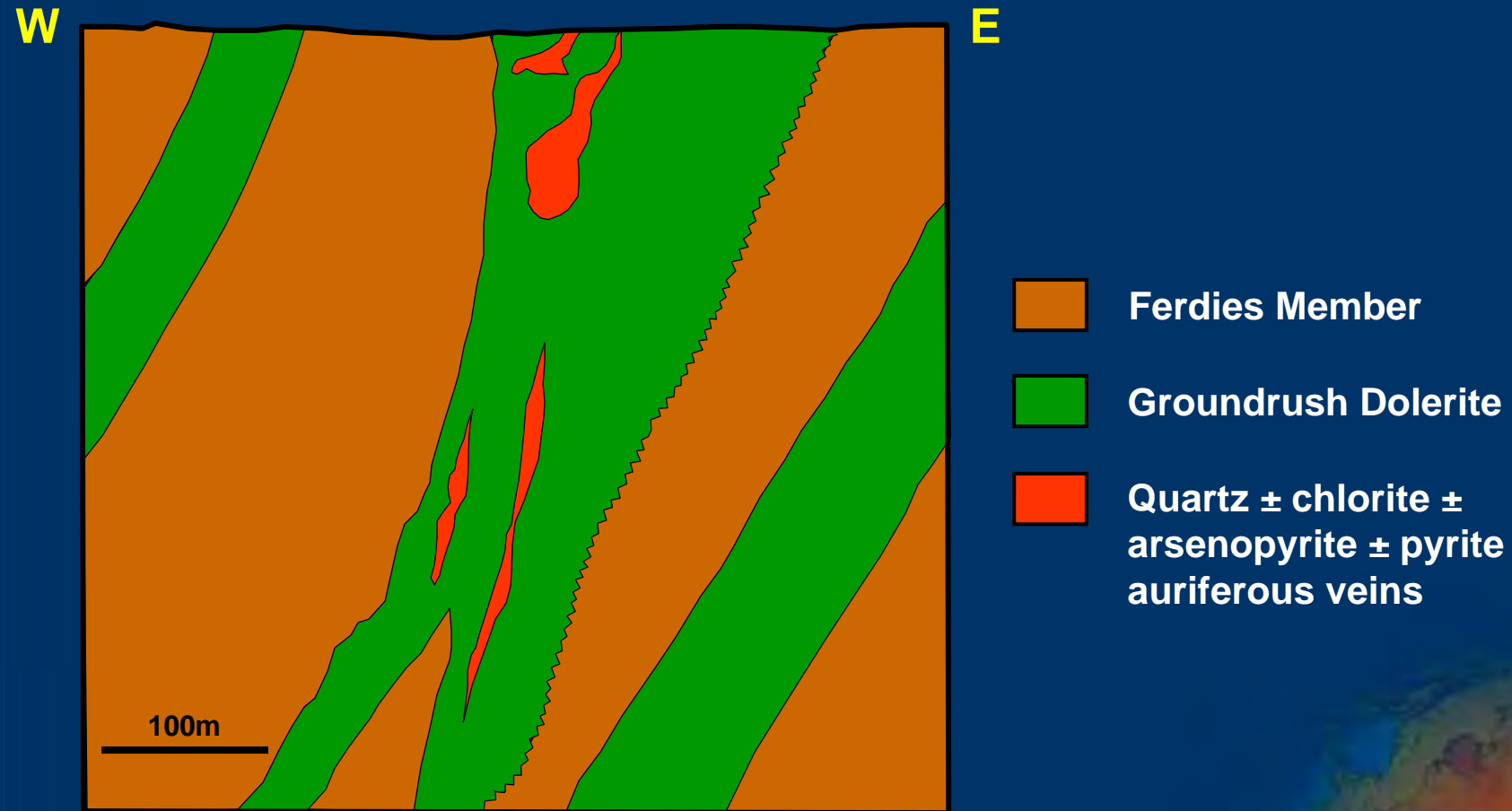


Ghost spheres in quartz vein

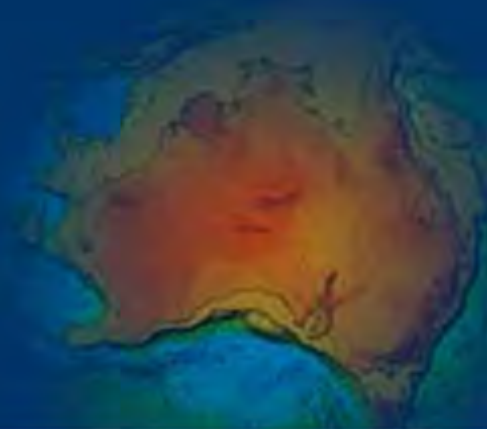
Groundrush Deposit



Cross section of the Groundrush Deposit



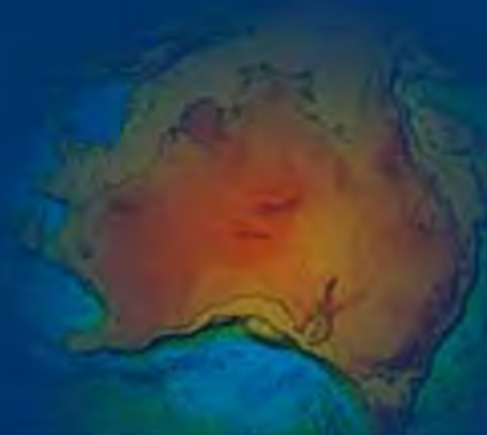
Cross section 25000N modified after Newmont Australia (2003)



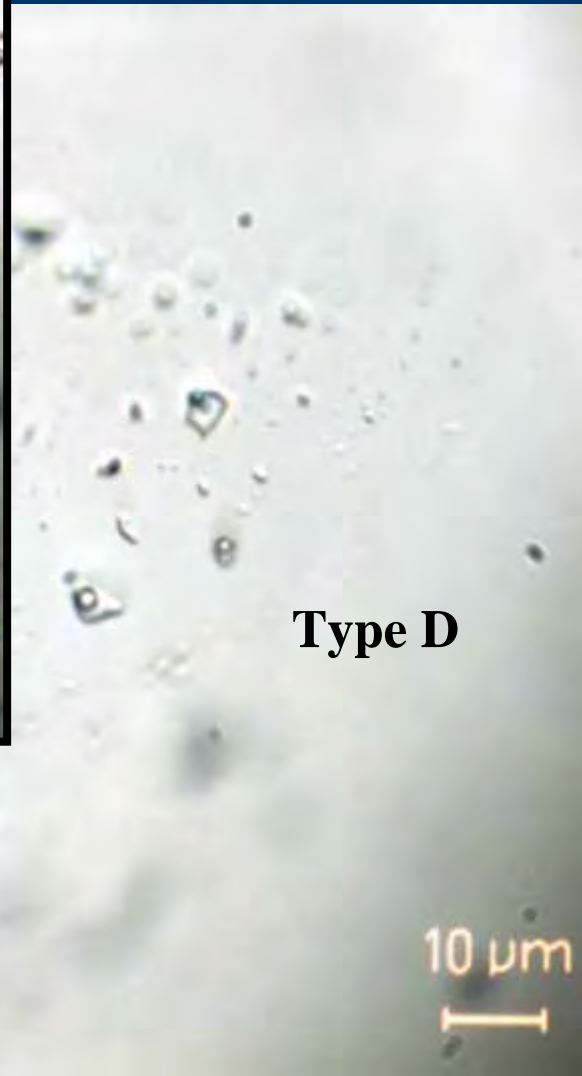
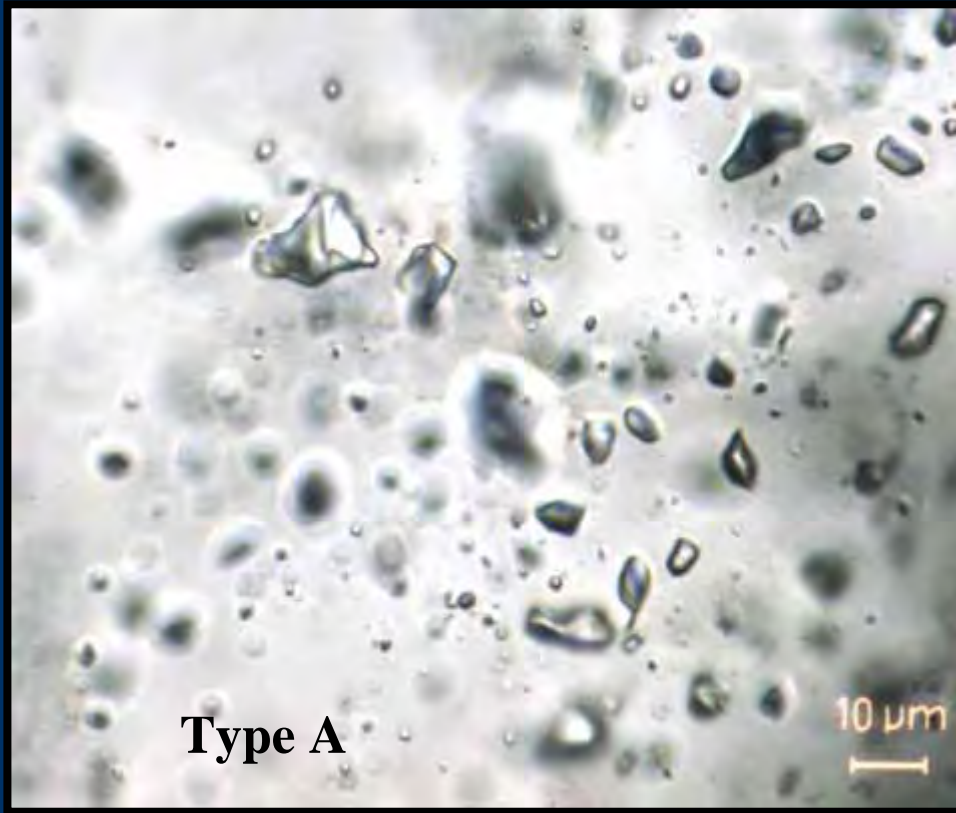
Groundrush



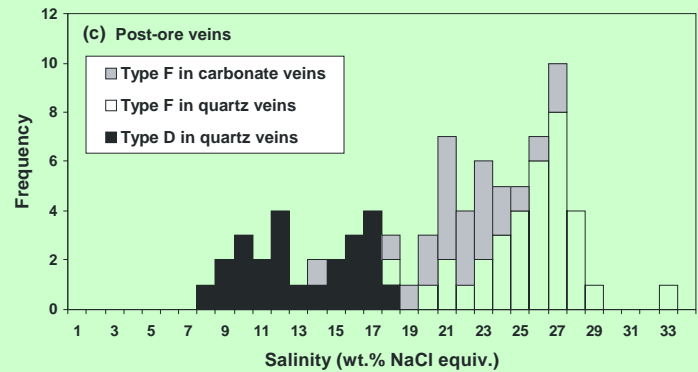
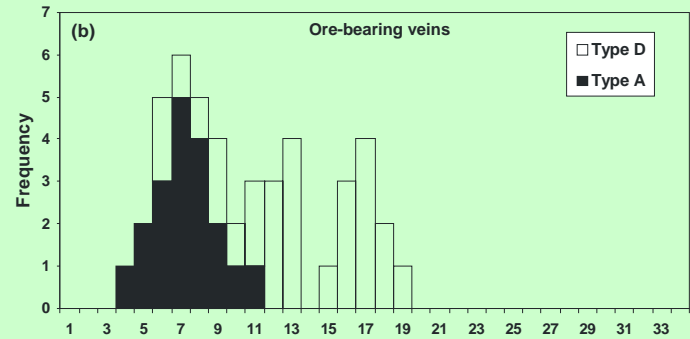
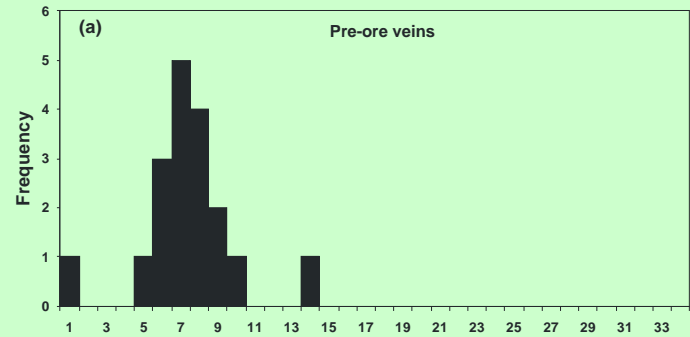
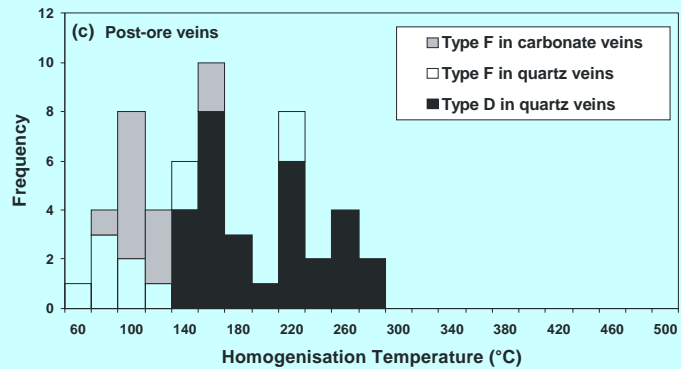
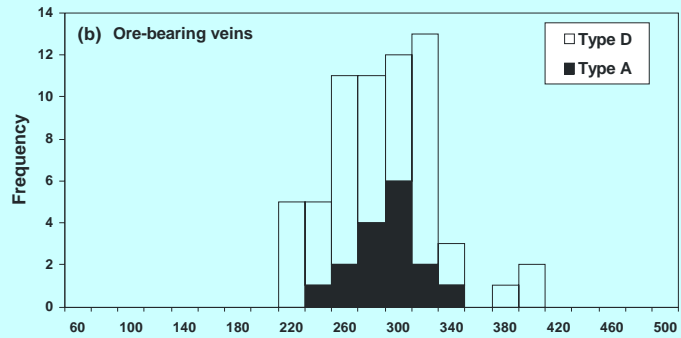
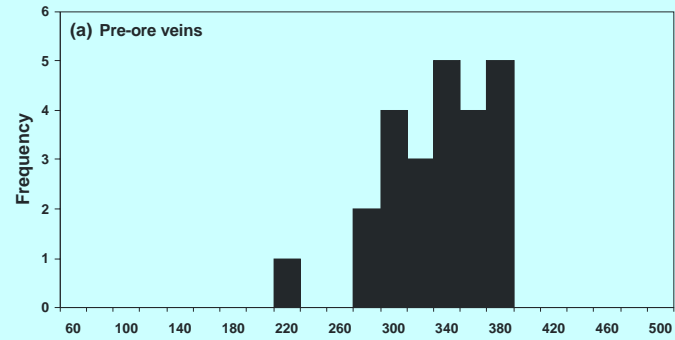
Fluid Inclusion Studies



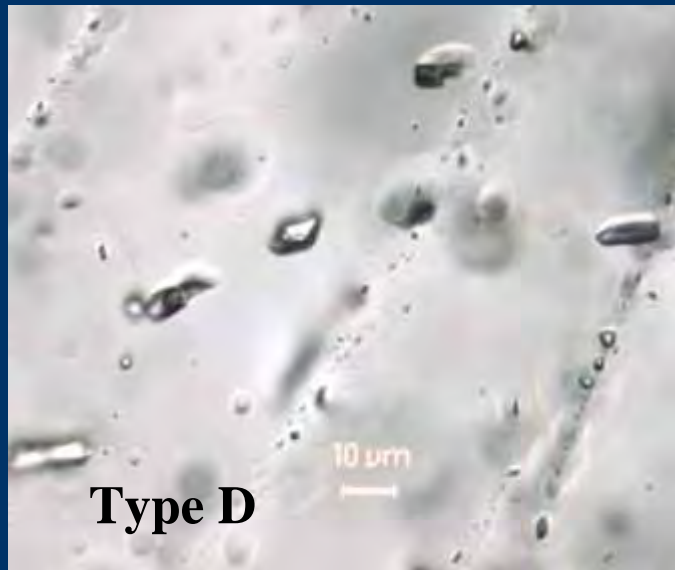
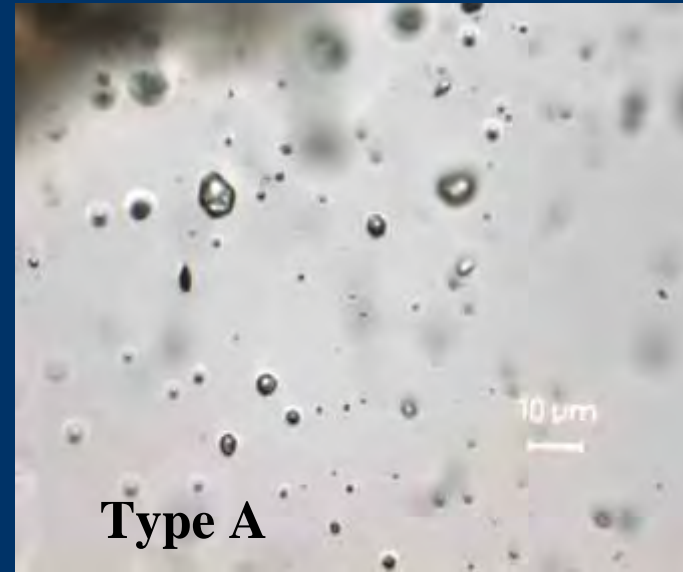
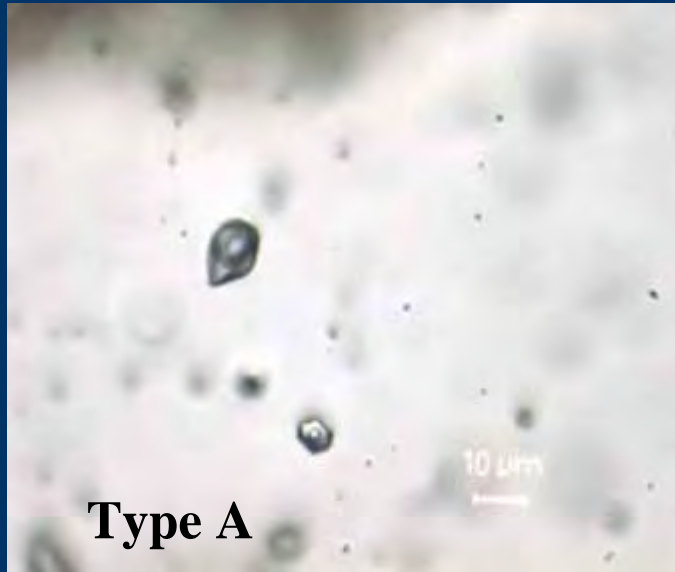
Callie Gold Mine



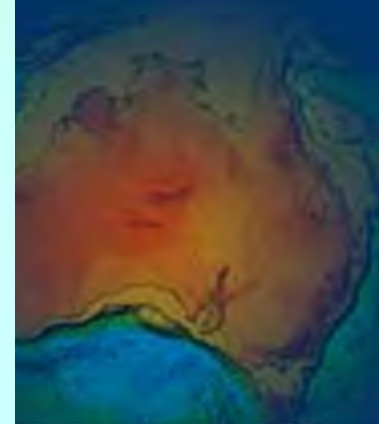
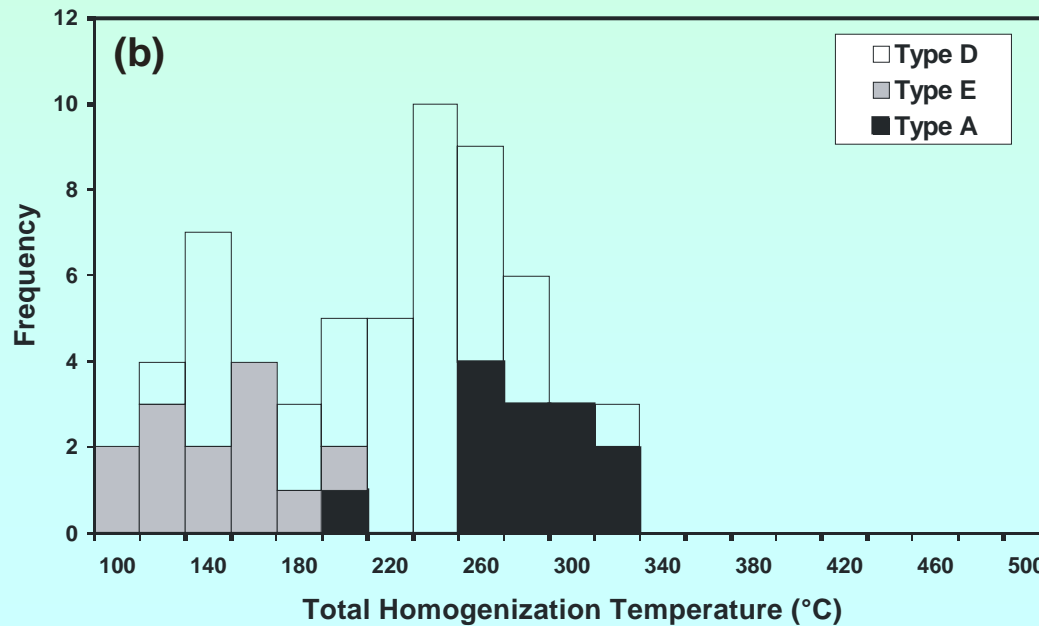
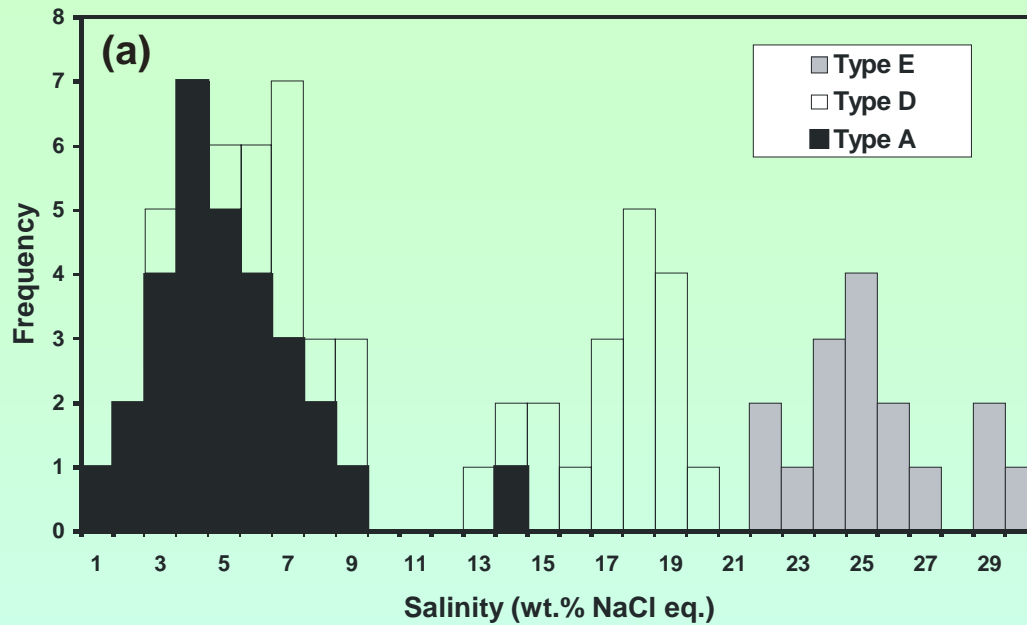
Callie Fluids



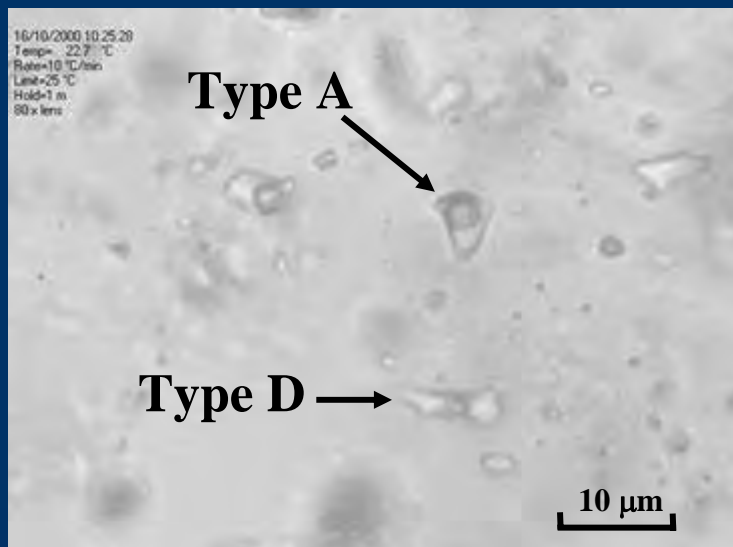
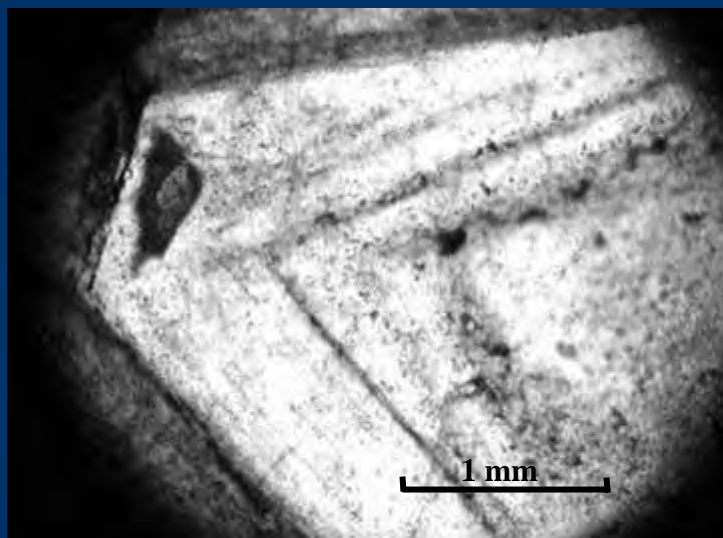
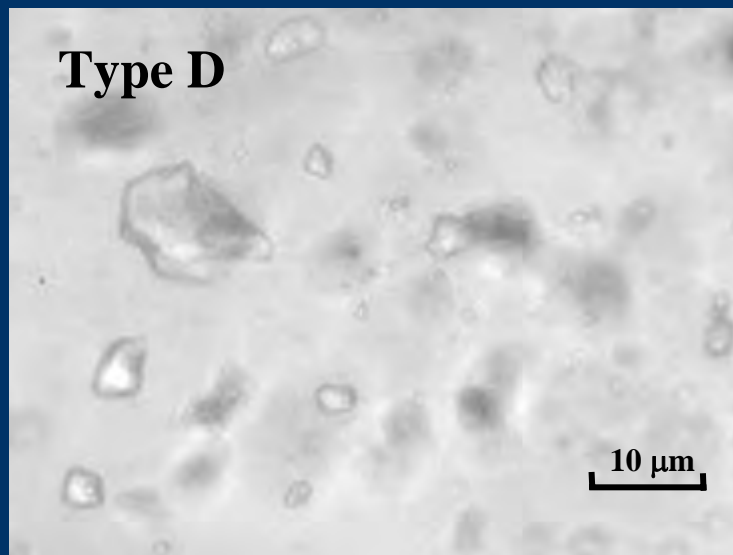
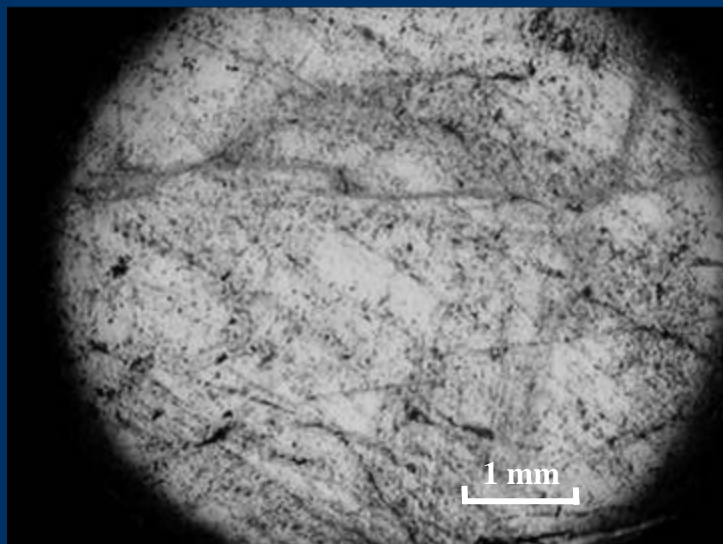
The Granites Gold Mine



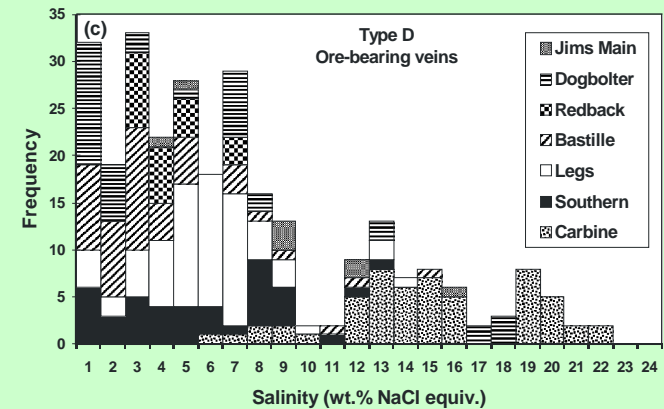
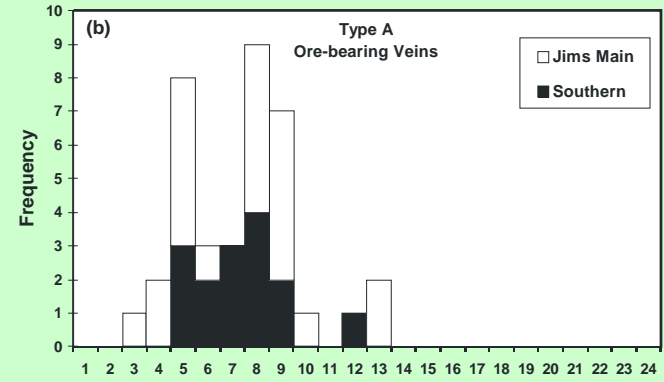
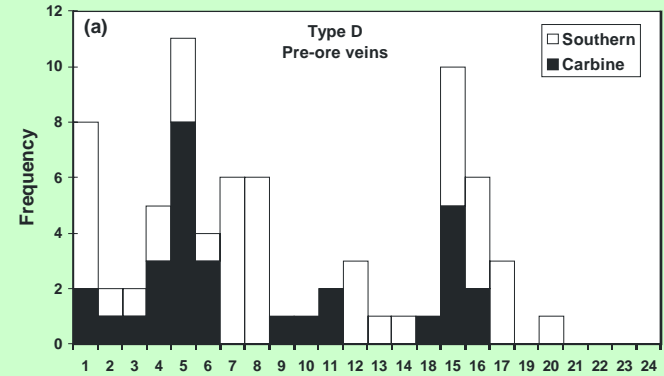
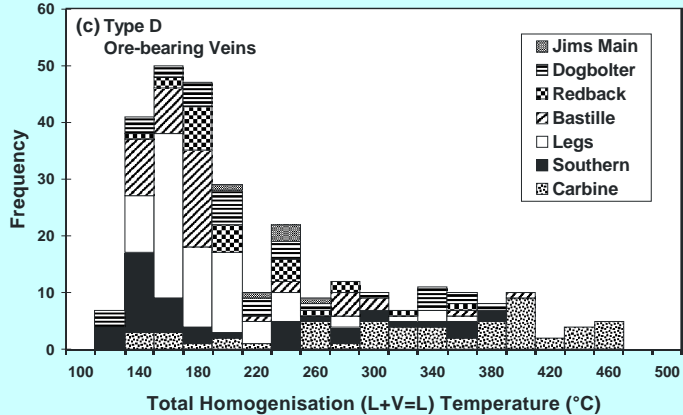
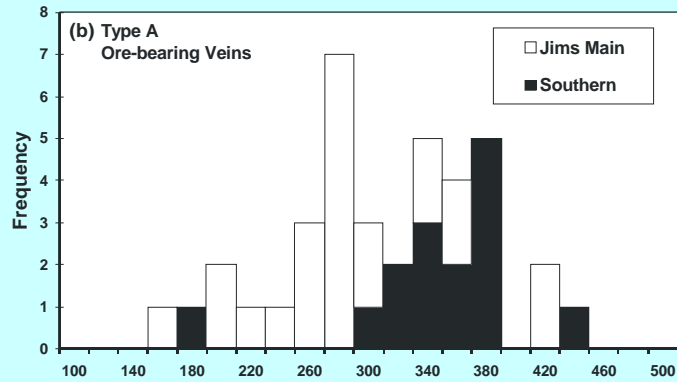
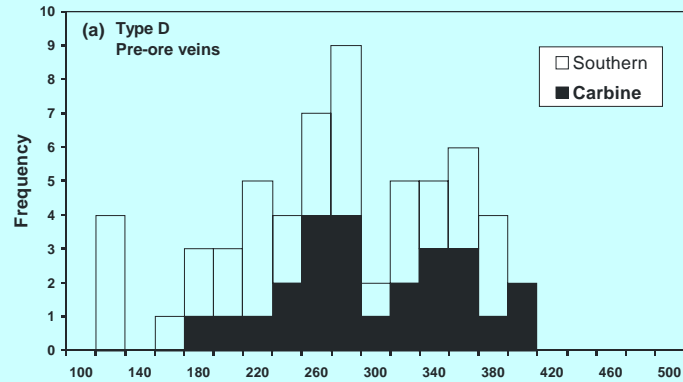
Ore Fluids at The Granites Goldfield



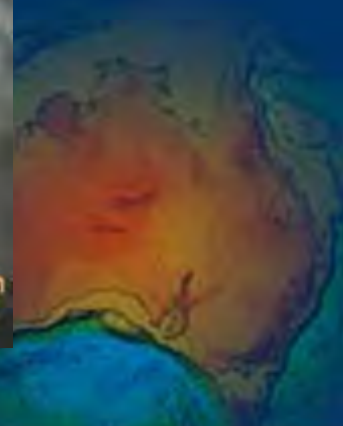
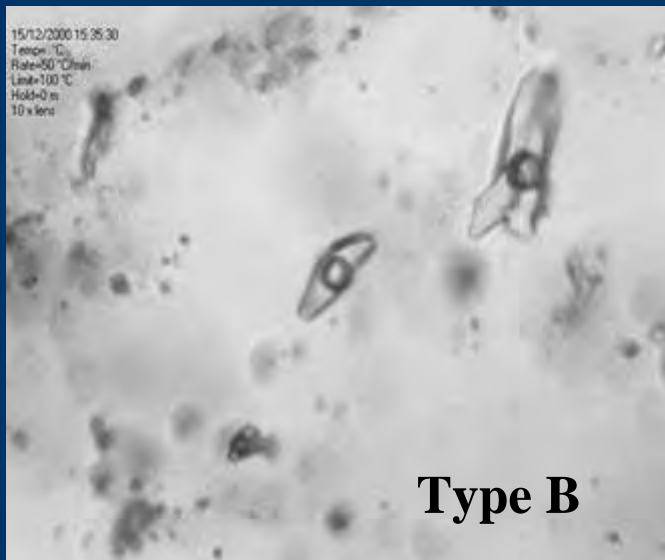
Fluid inclusions from the Tanami goldfield



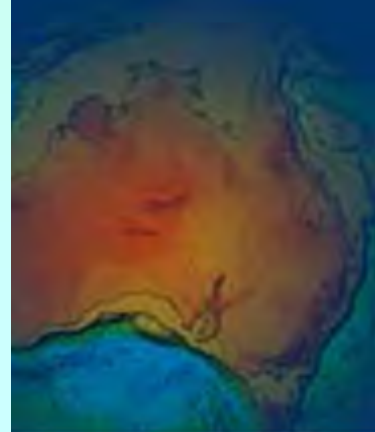
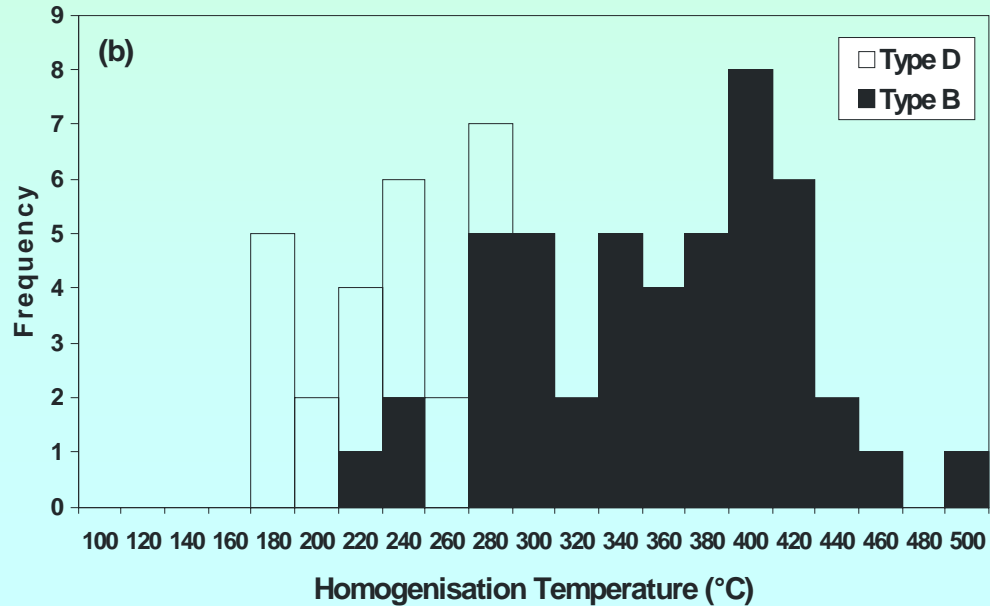
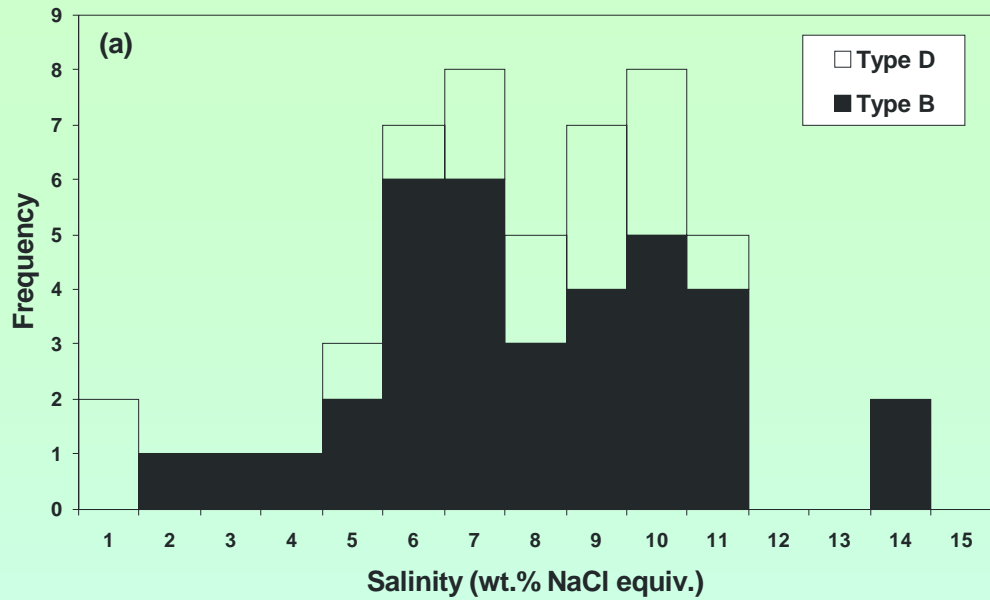
Tanami Fluids



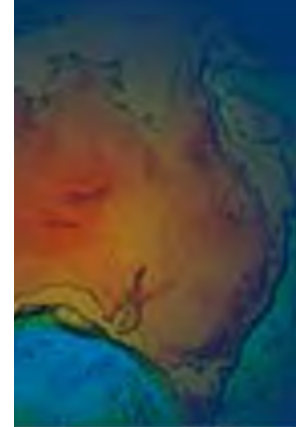
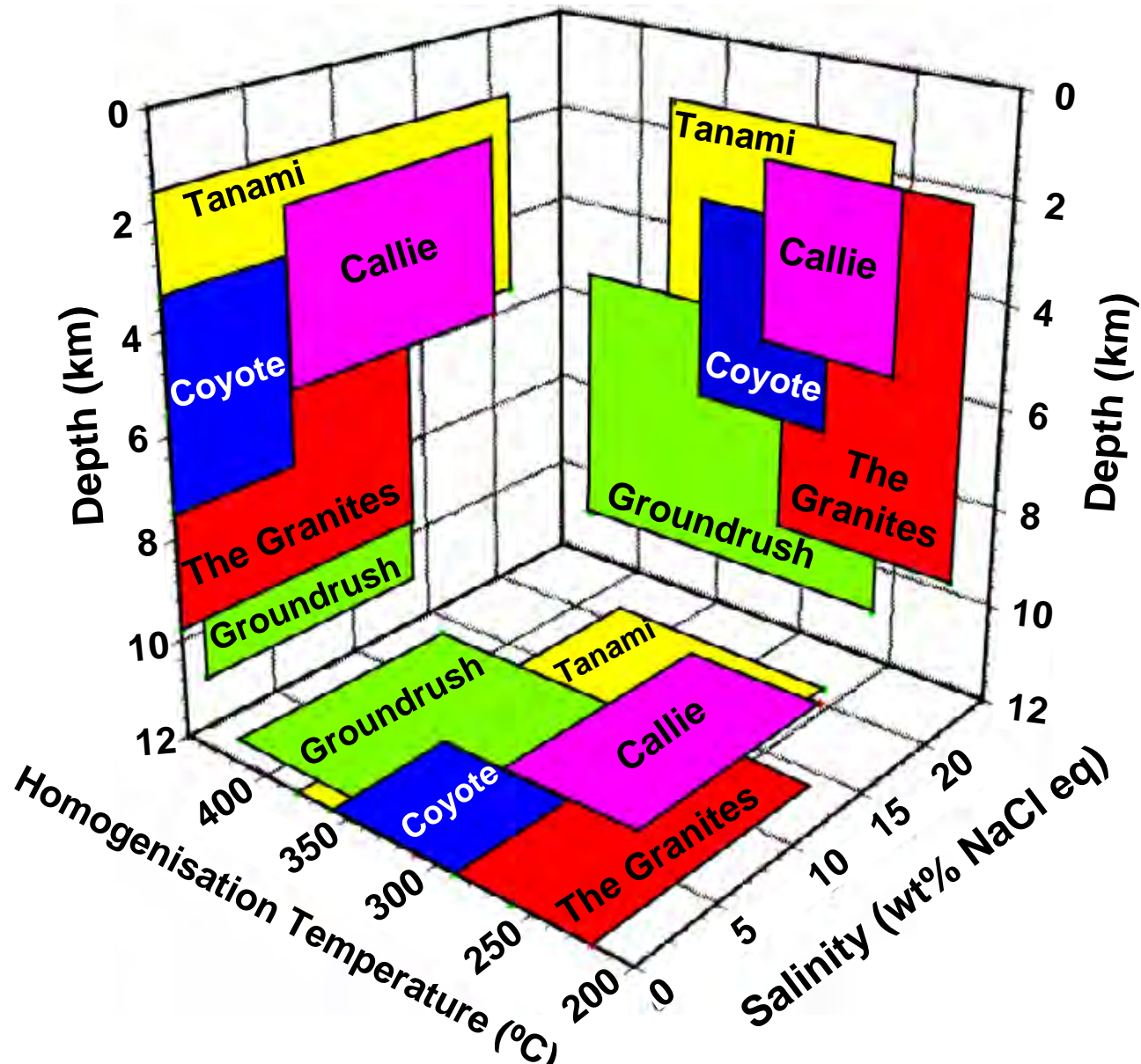
Groundrush Fluid Inclusions



Ore Fluids at the Groundrush Deposit



Summary of Fluid Inclusion Data



Depth, fluid chemistry and depositional controls— some speculations

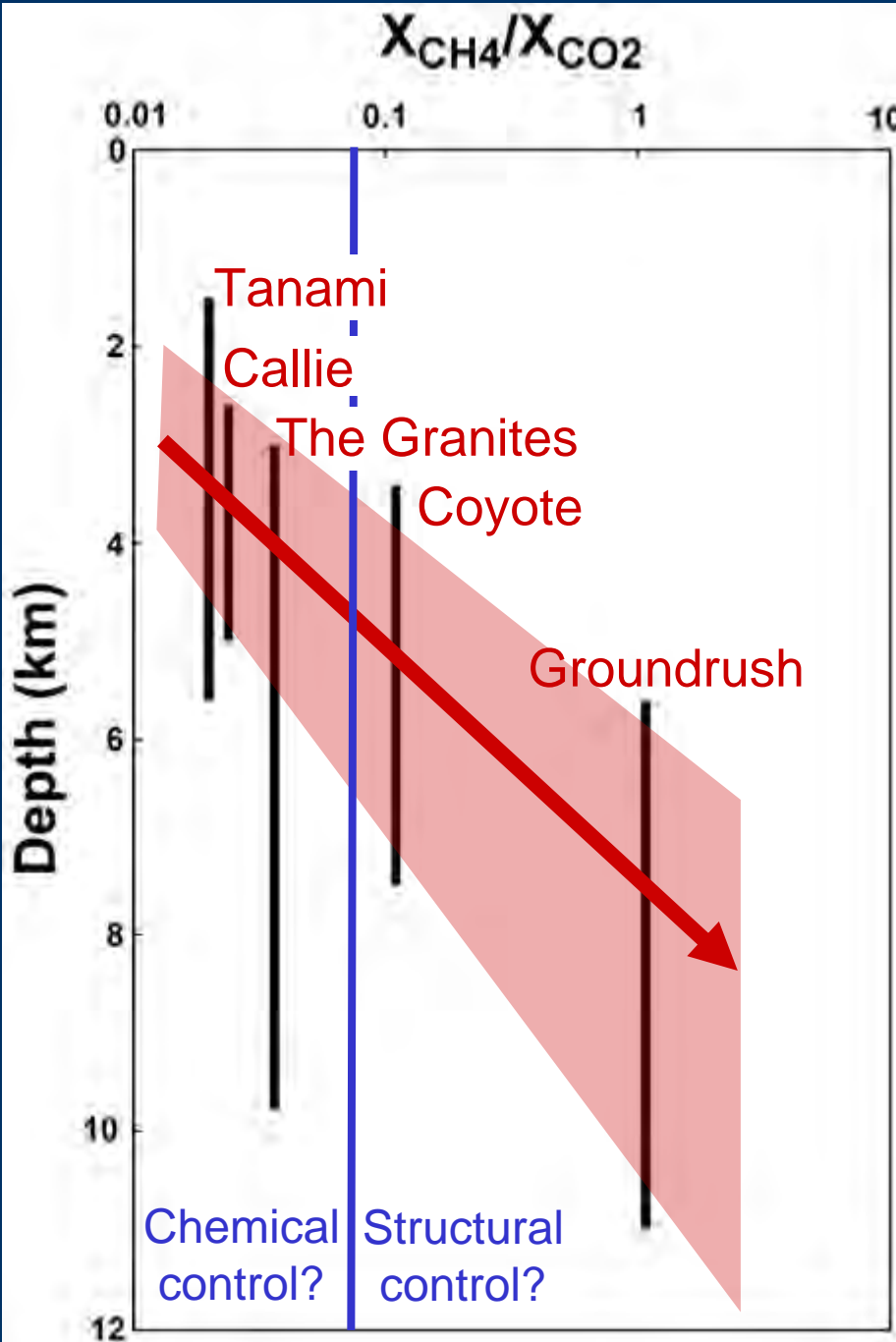
General increase in CH_4/CO_2 with depth

High CH_4 contents amenable to immiscibility at high pressure (Naden & Shepherd, 1989)

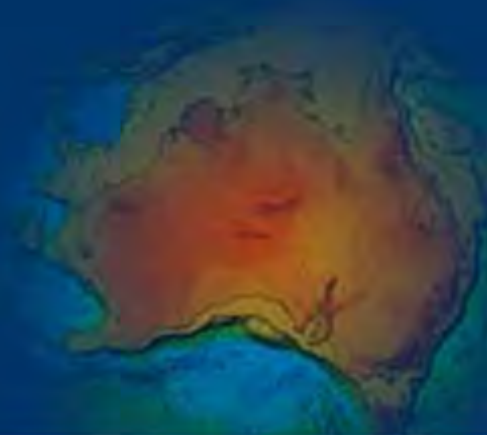
Deeper deposits have strong structural control, but shallower deposits have strong chemical control

CH_4 -rich fluids deposit gold at depth as a consequence of immiscibility and H_2S partitioning in dilatant zones

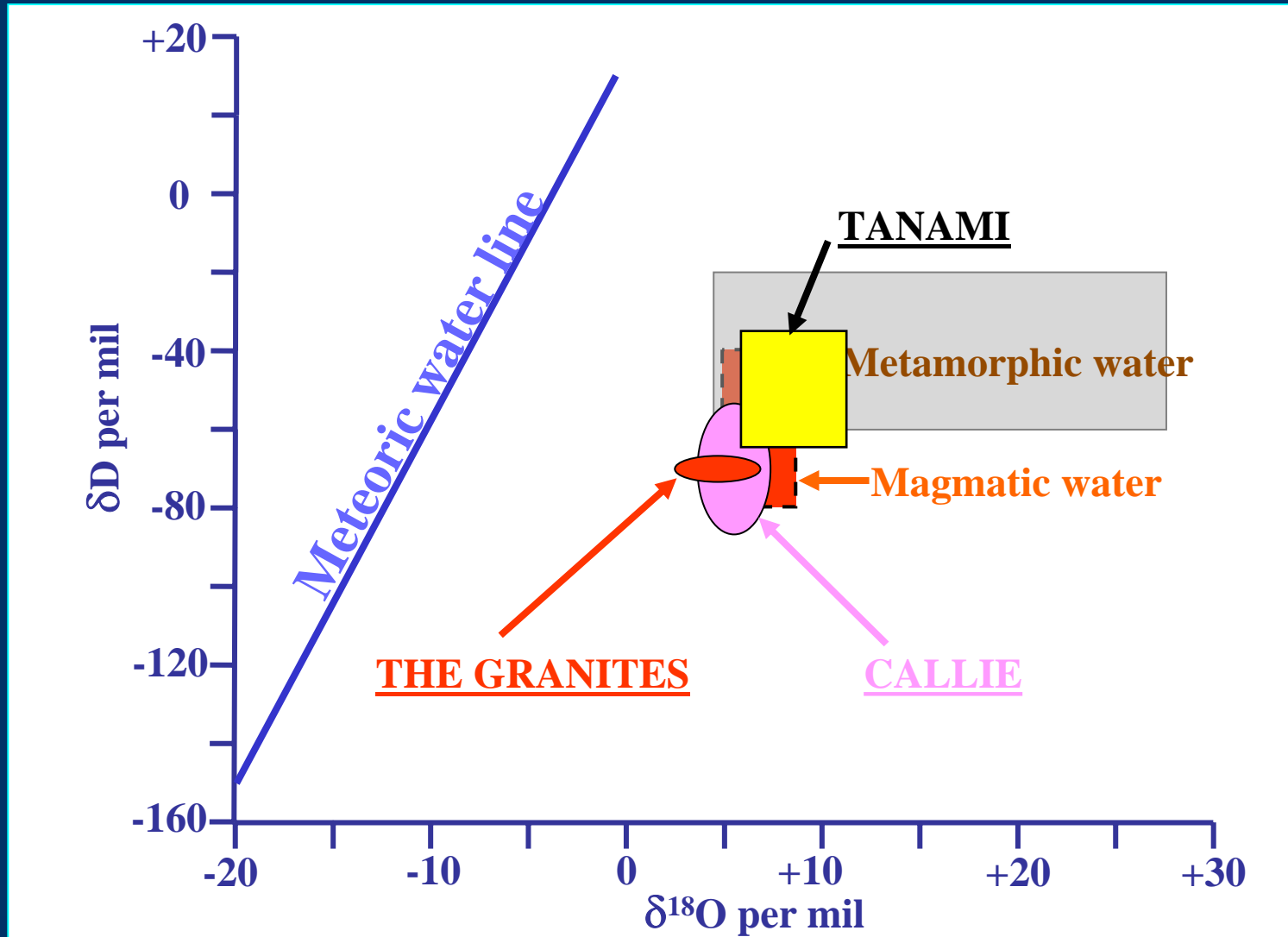
CO_2 -rich fluids may deposit gold at shallower depths due to wall rock reactions



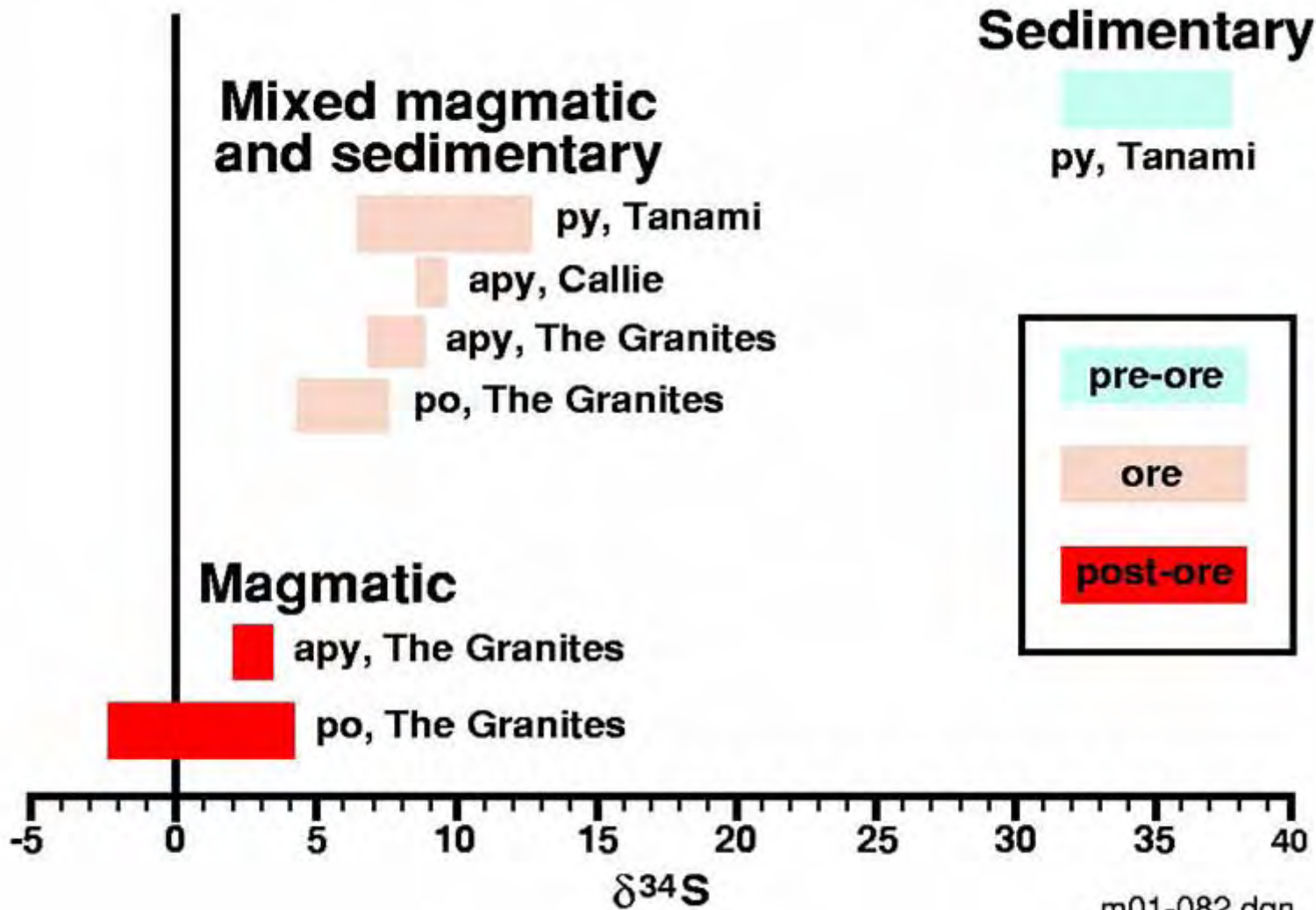
ISOTOPIC DATA



OXYGEN AND HYDROGEN ISOTOPES



Sulphur Isotopes



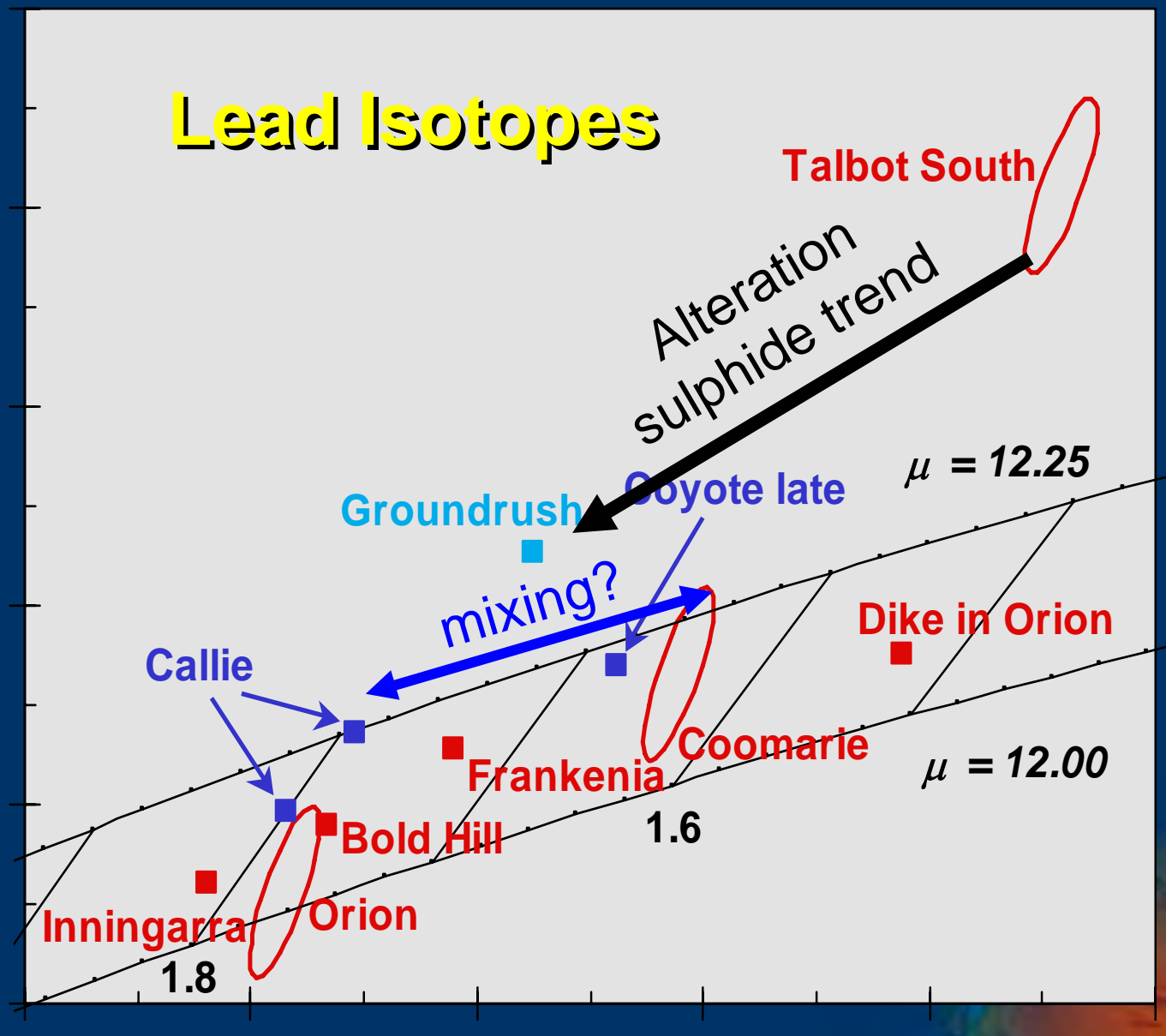
Lead Isotopes

$^{207}\text{Pb}/^{204}\text{Pb}$

15.8
15.7
15.6
15.5
15.4
15.3

15.5 15.7 15.9 16.1 16.3 16.5

$^{206}\text{Pb}/^{204}\text{Pb}$



Alteration sulphide trend

Talbot South

$\mu = 12.25$

Coyote late

Groundrush

mixing?

Callie

Dike in Orion

$\mu = 12.00$

Coomarlie

Frankenia

Bold Hill

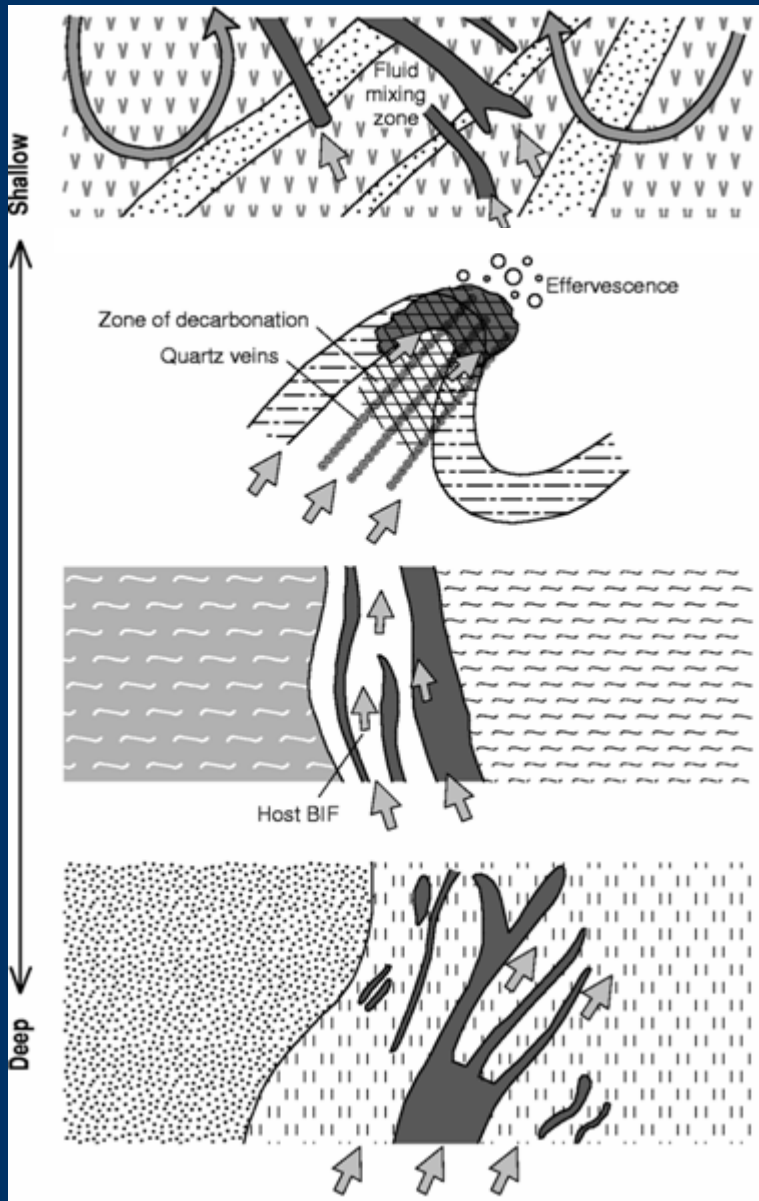
Inningarra

Orion

1.8

1.6

Tanami region – Depositional Mechanisms



Tanami: Boiling accompanied by fluid mixing

Callie: Reaction with graphite producing effervescence and/or reduction of ore fluid

The Granites: Desulphidation of fluid by reaction with BIF

Groundrush: Boiling/phase separation of a CH₄-rich fluid due to pressure fluctuations



Take a Camel
out to dinner

BOOK HERE FOR A
GOOD LOOKING ONE

THANK YOU