Polyphased gold enrichment as a key process for high-grade gold formation: Insights from the 10 Moz Jundee-Bogada camp (Yilgarn Craton, Western Australia)

23 November 2023

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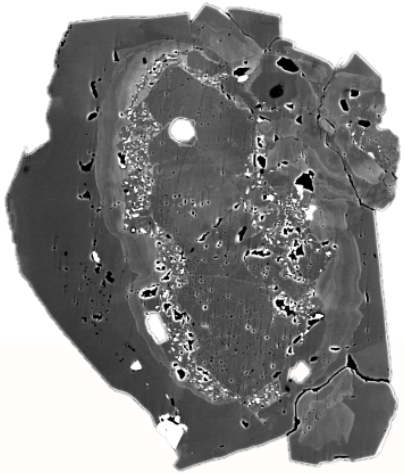
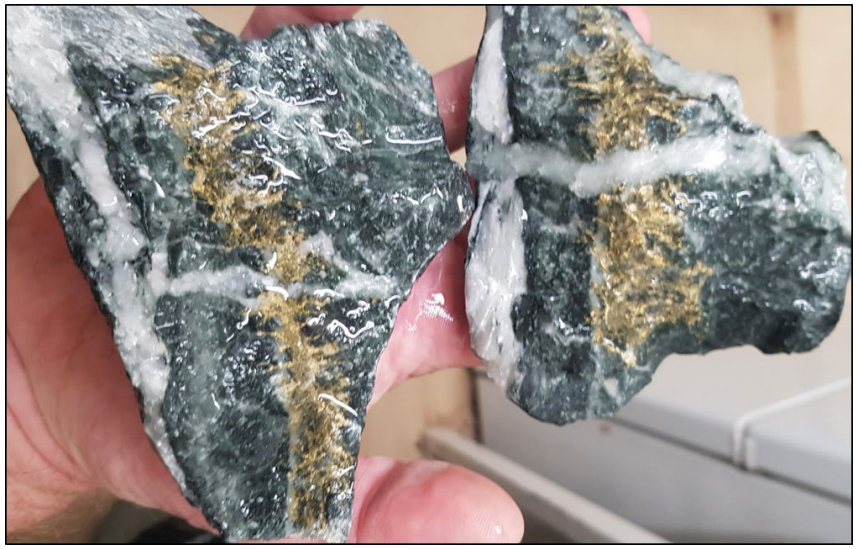
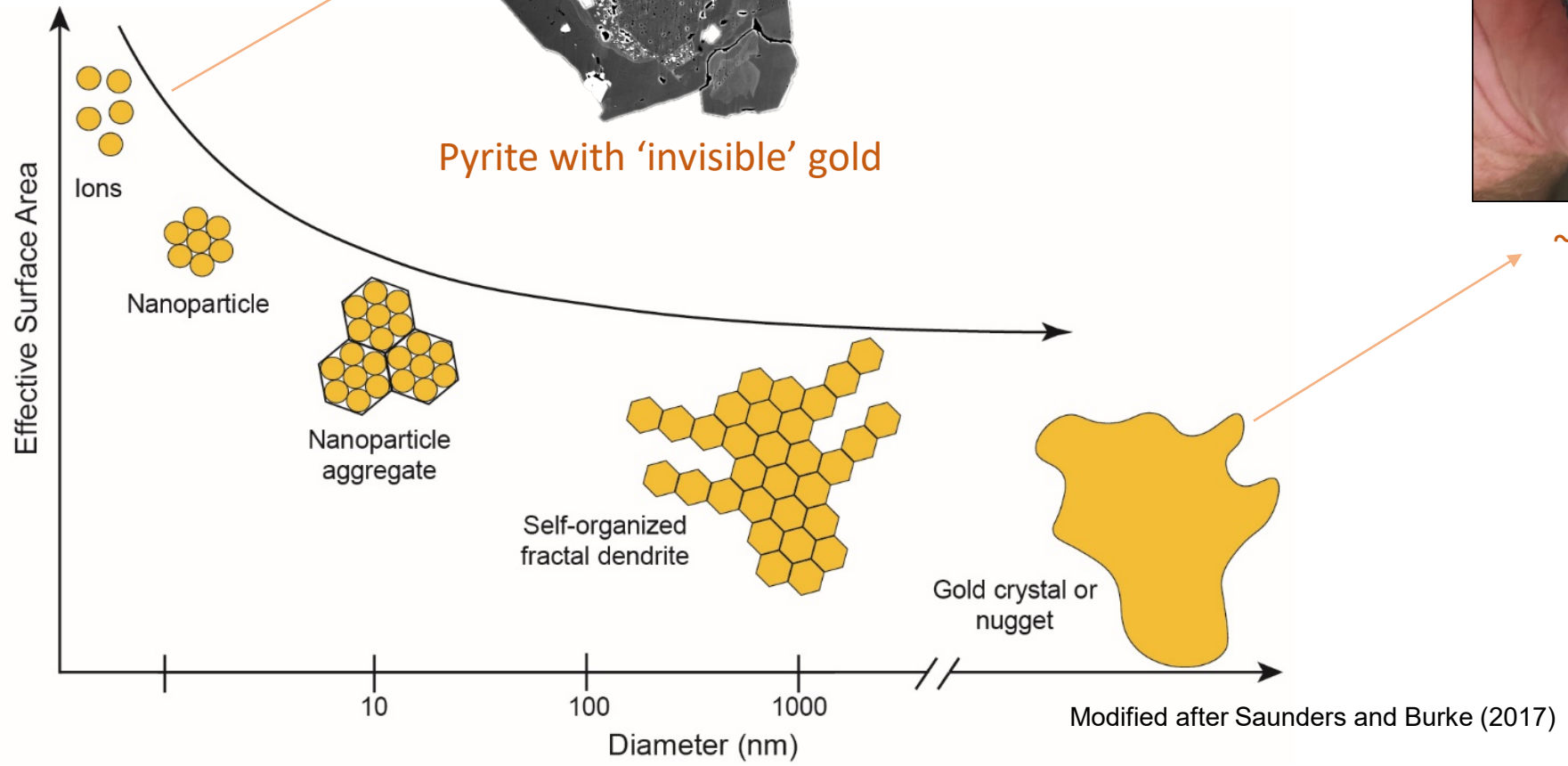
What forms high-grade gold?



Pyrite with ‘invisible’ gold



~15 wt. % Au; Jundee gold deposit



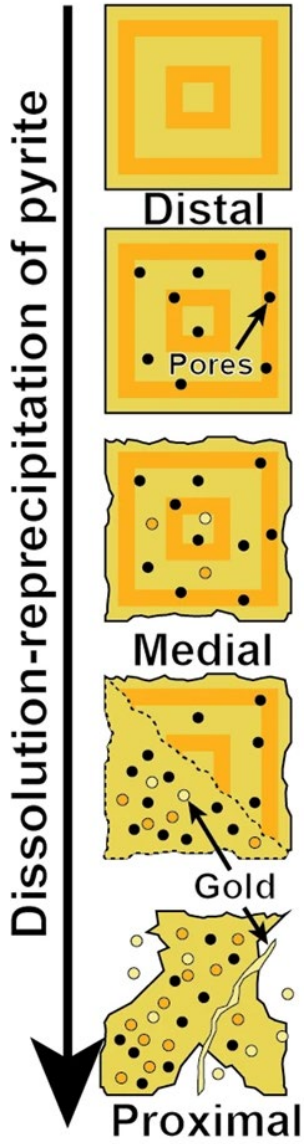
Modified after Saunders and Burke (2017)

Free-Gold

- Often higher grade
- Higher Au recoveries
- Lower processing costs
- Lower environmental footprint (50% less)

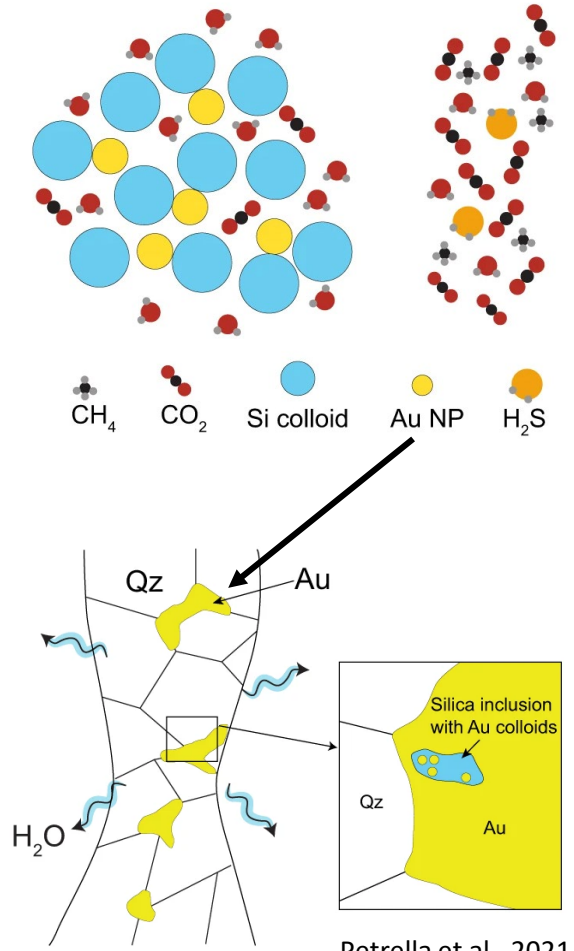
What forms high-grade gold?

Gold remobilisation



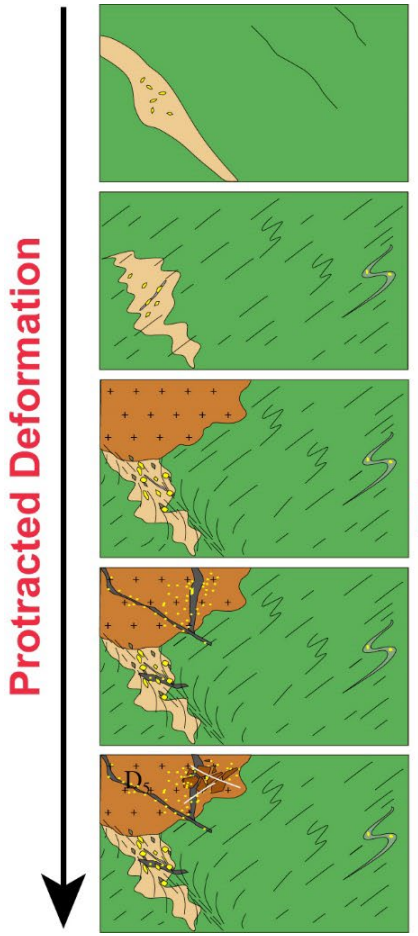
Hastie et al., 2021

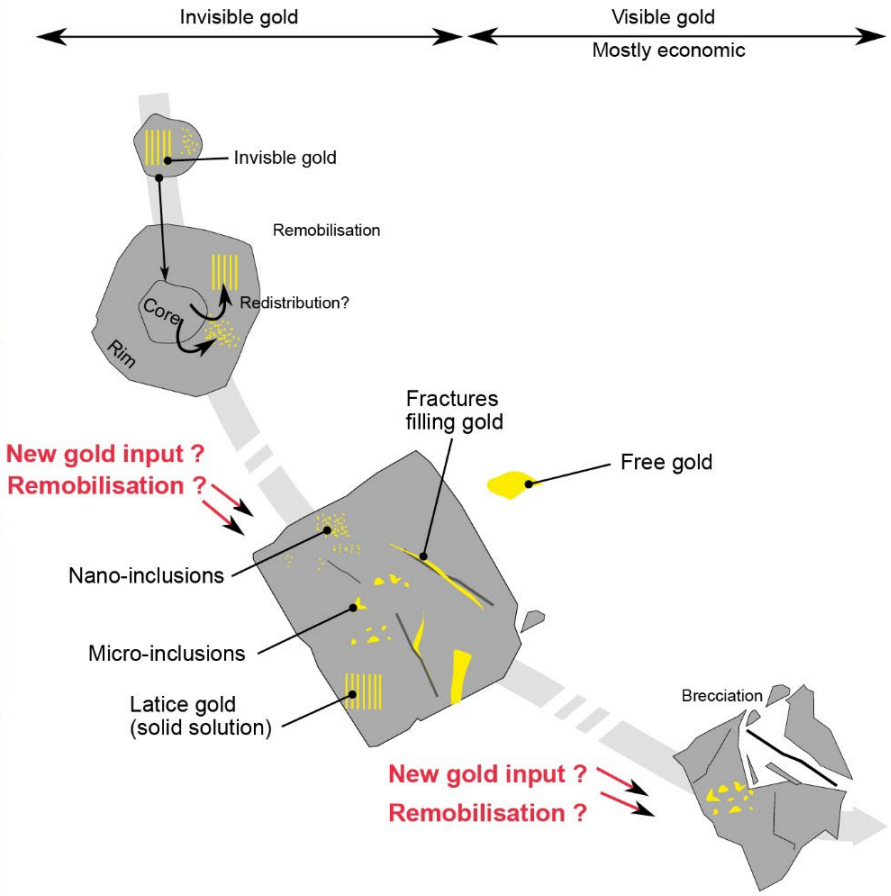
Gold nanoparticles



Petrella et al., 2021

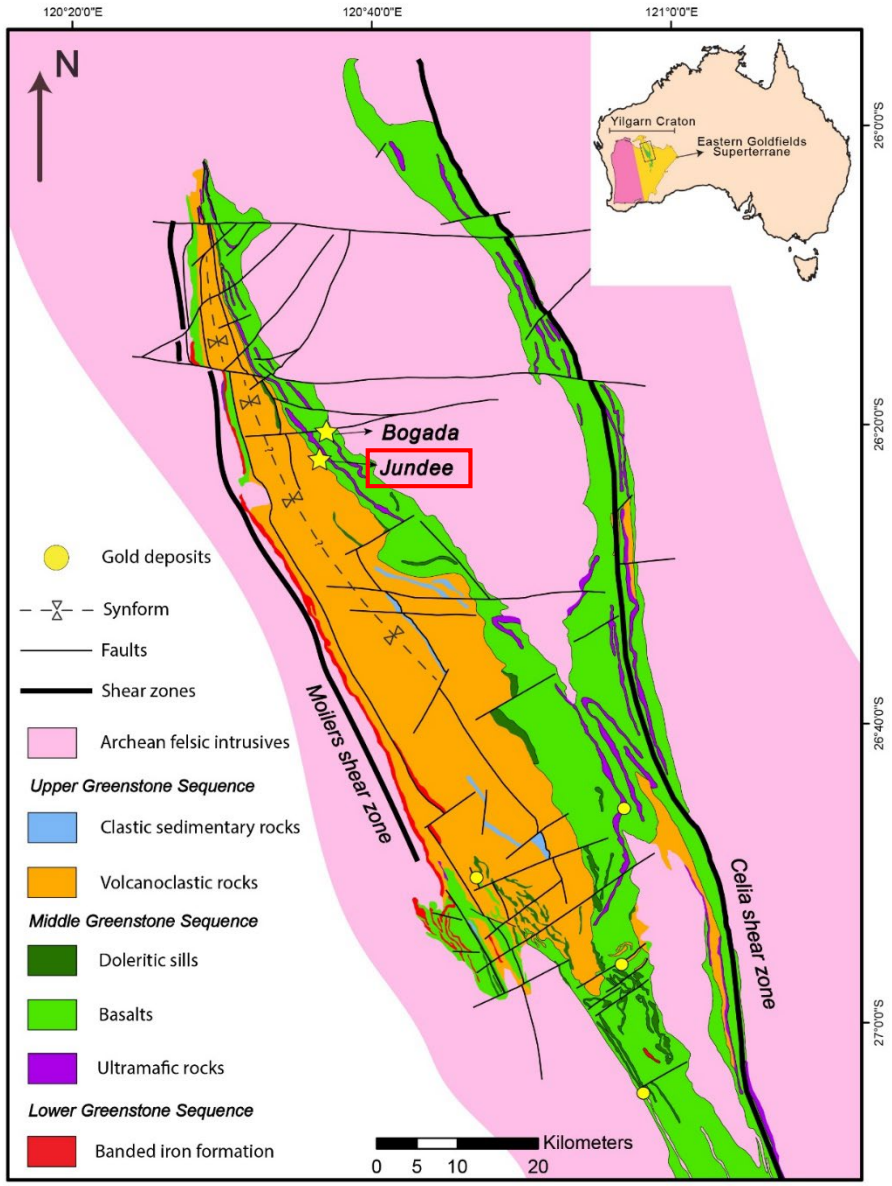
Polyphase enrichment



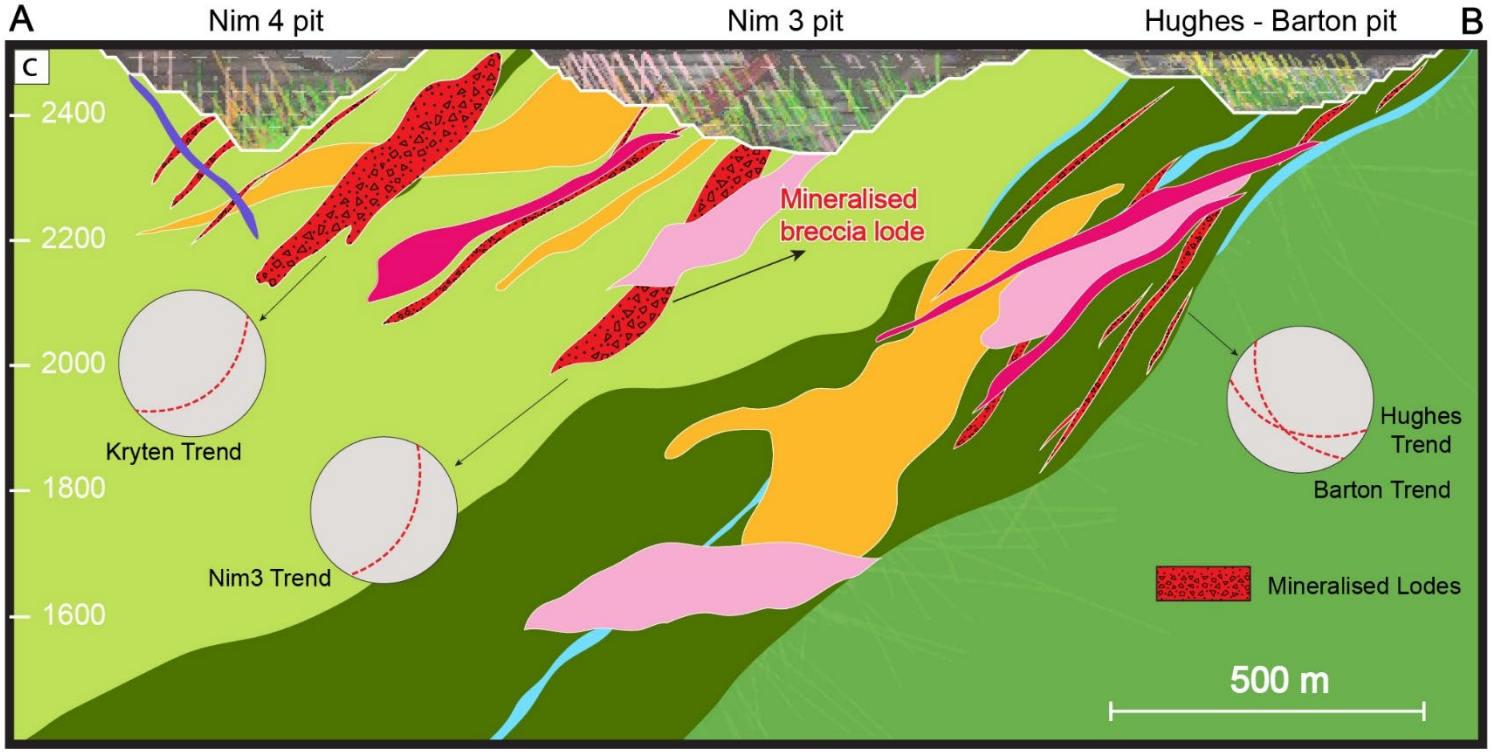


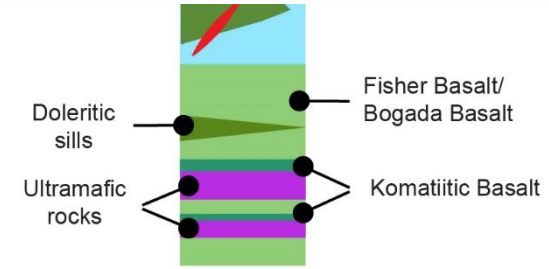
Combes et al., 2021

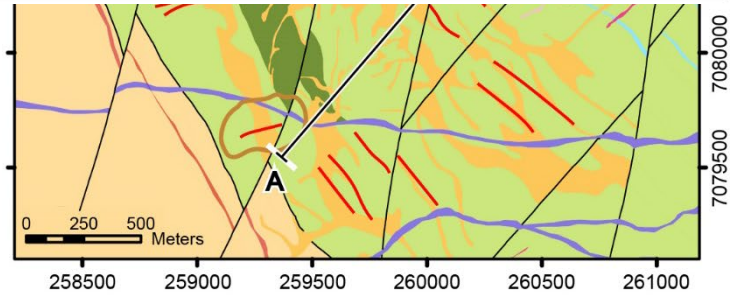
Jundee Gold Deposit



Jundee gold deposit (avg. >10 g/t)

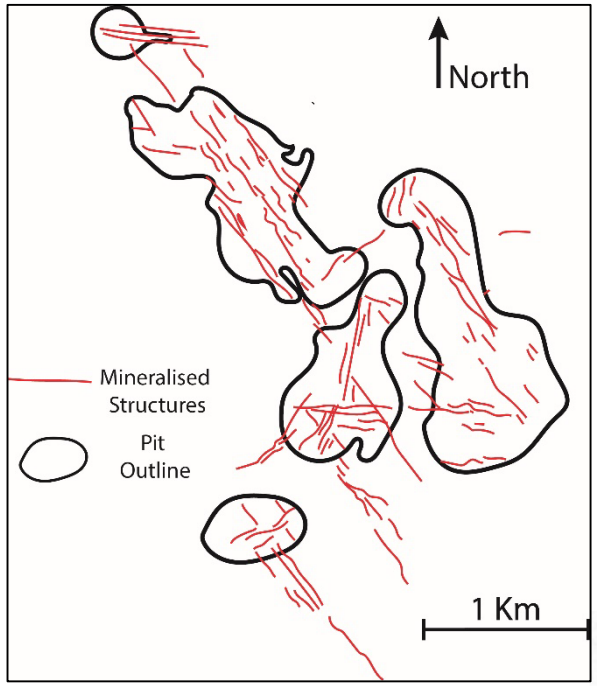




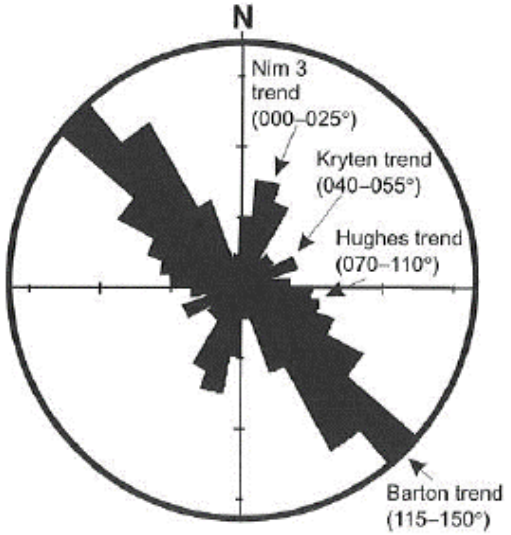


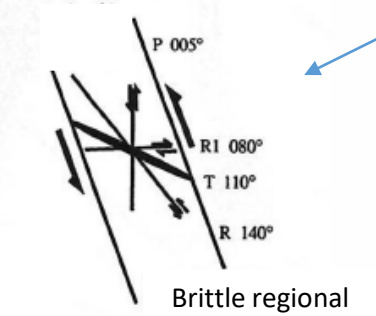
Modified after Northern Star Resources Limited

Research Motive

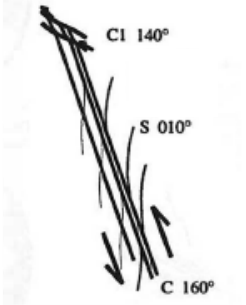


Complex structural geometry at Jundee, outlined by lode orientations



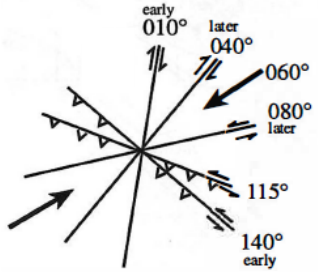


Brittle regional sinistral shearing

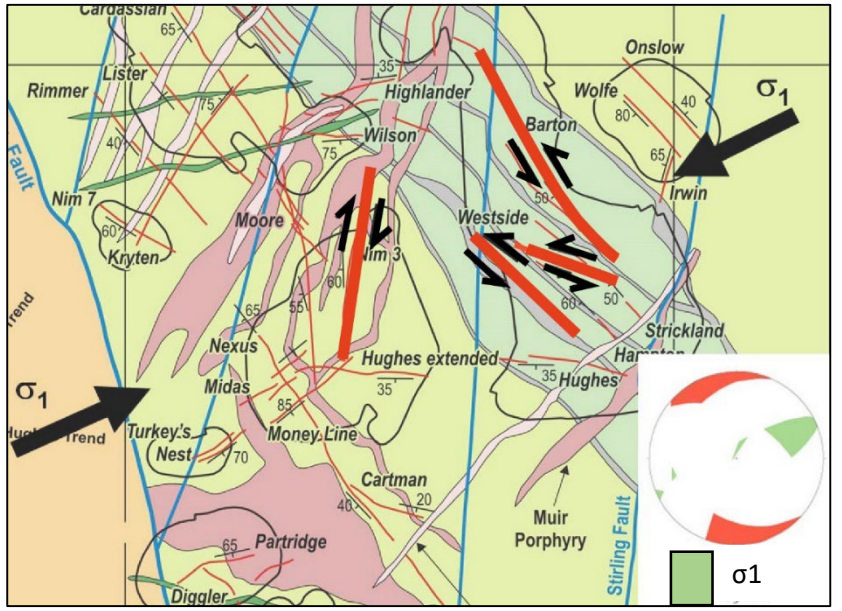


Ductile regional sinistral shearing

(Vearncombe et al., 2000)



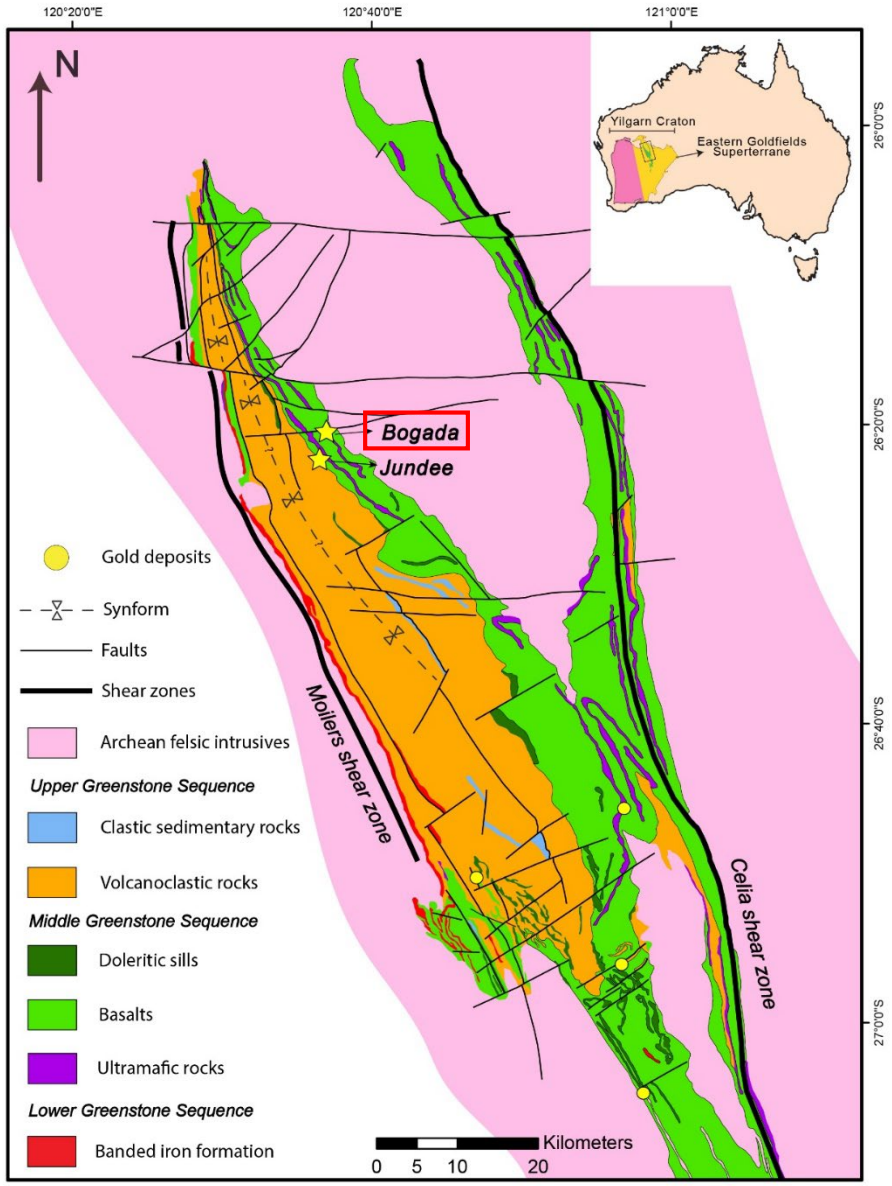
Complex conjugate compression.



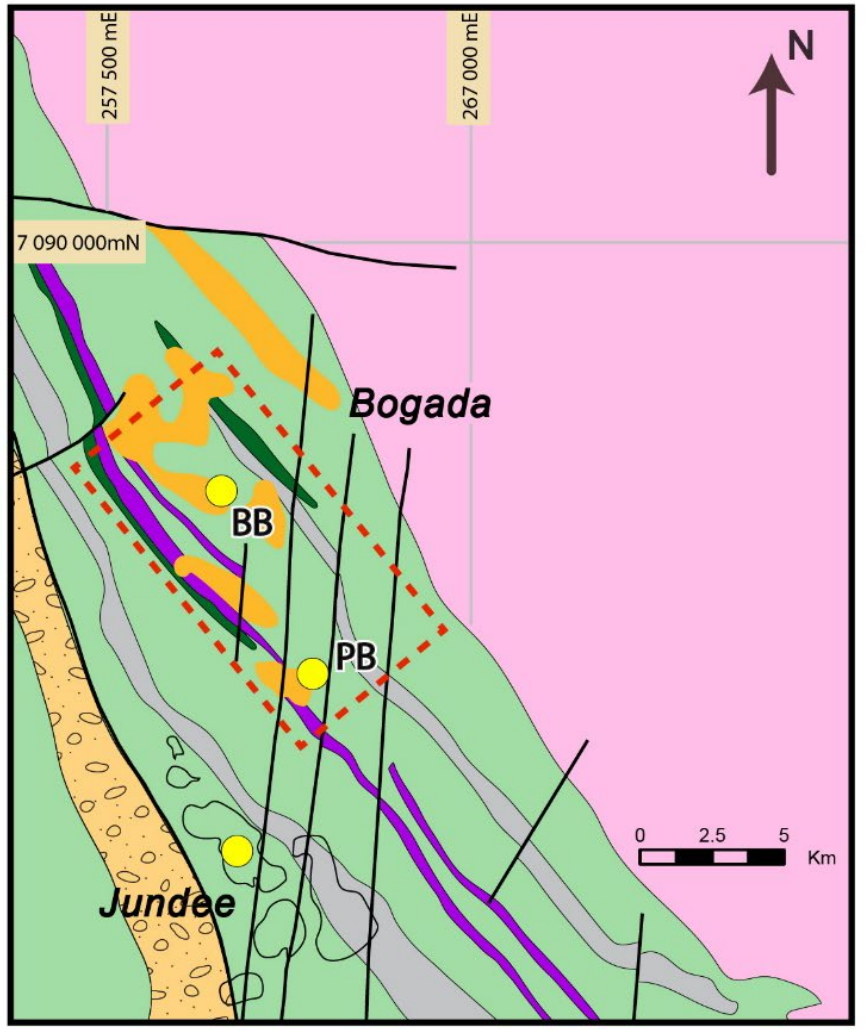
(Miller, 2008)

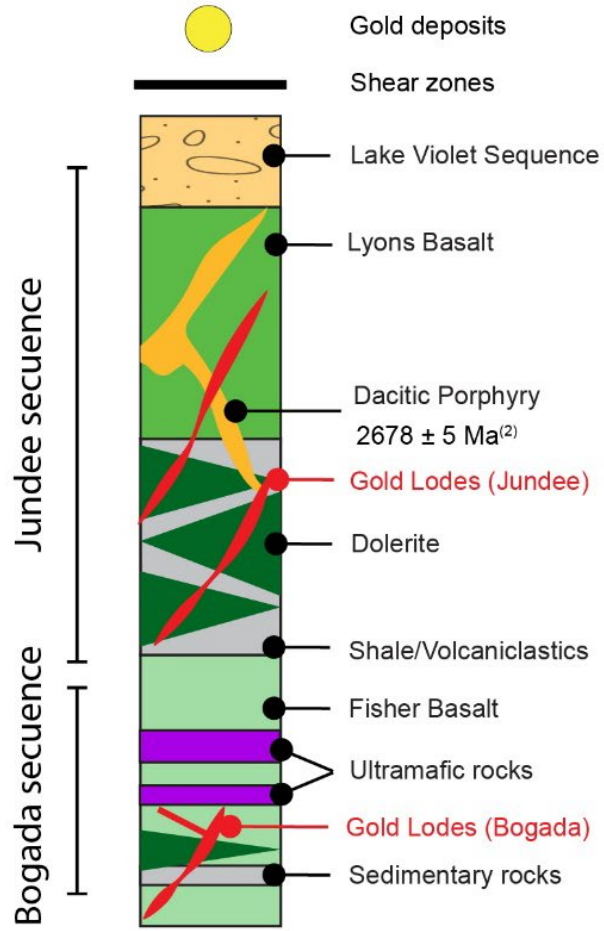
- **How do you explain the complex structural framework at Jundee?**
- **Single Au event Vs polyphased gold enrichment**

Bogada Gold Deposit



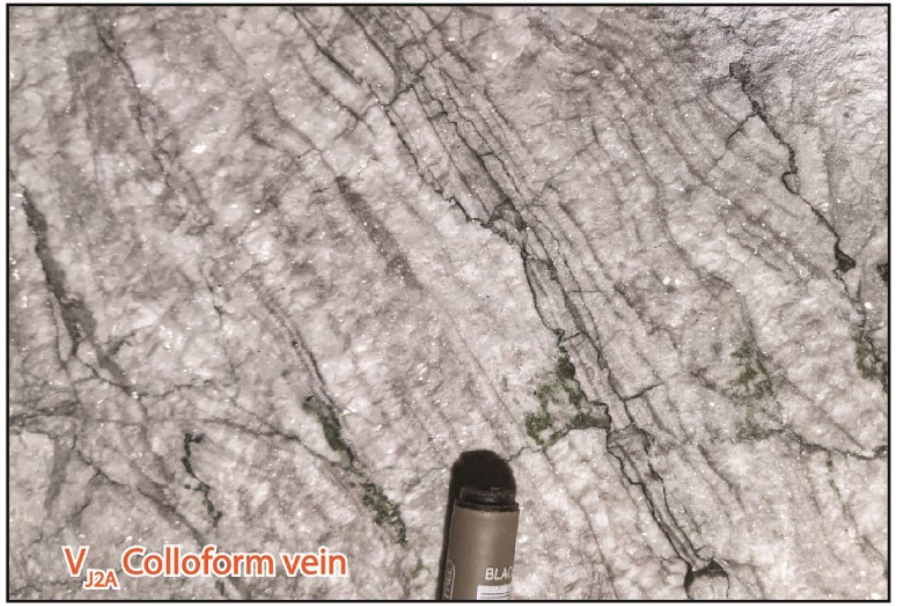
Bogada gold deposit (avg. <3 g/t)





Modified after Cooper et al. (2005)

V_{J2A}: Colloform-crustiform veins and cockade breccia



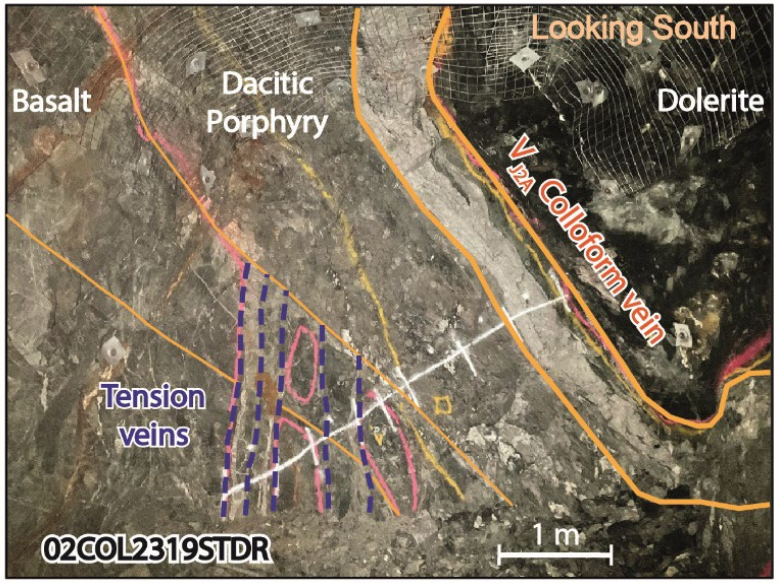
(1st Au-event; Low-grade <2 g/t)

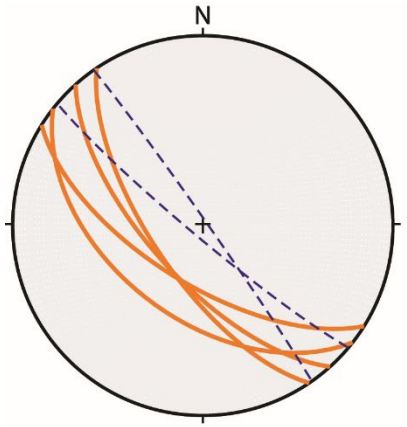
- Colloform-crustiform and cockade veins show open-space growth textures that suggest formation in shallow crustal environments and are associated with **1st introduction of gold** in the system

- Compositionally dominated by Fe-rich dolomite

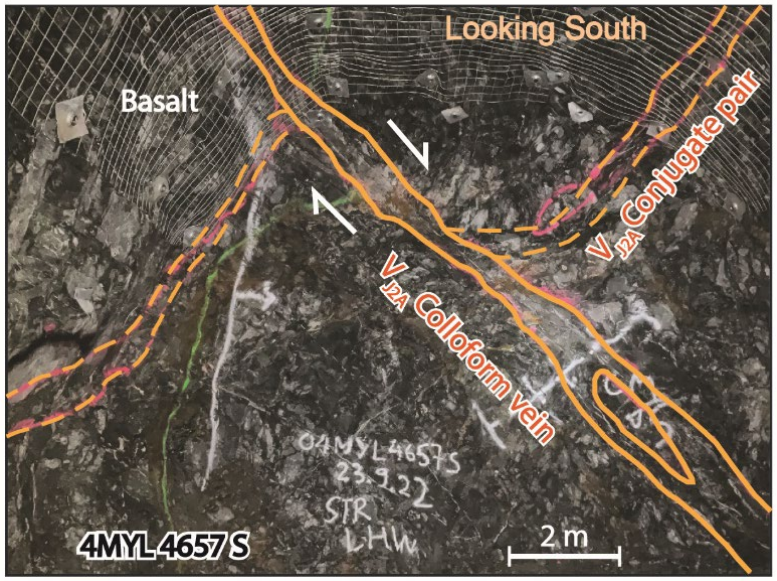
- Other 'orogenic' examples include Golden Mile, Kanowna Belle, Red Lake, and Dome

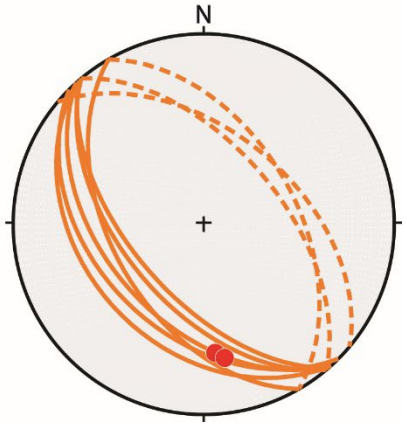
V_{J2A}: Colloform-crustiform veins and cockade breccia



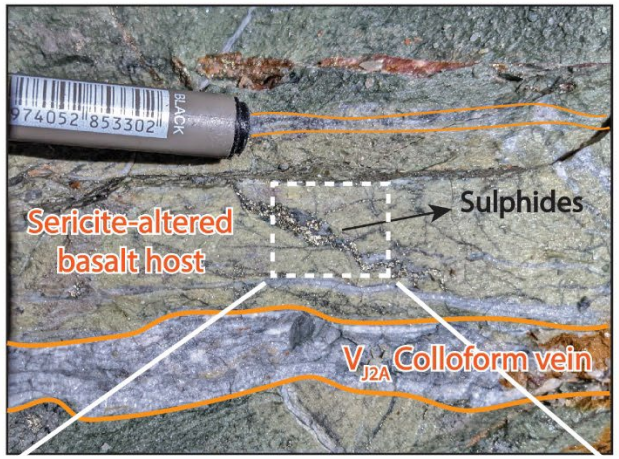


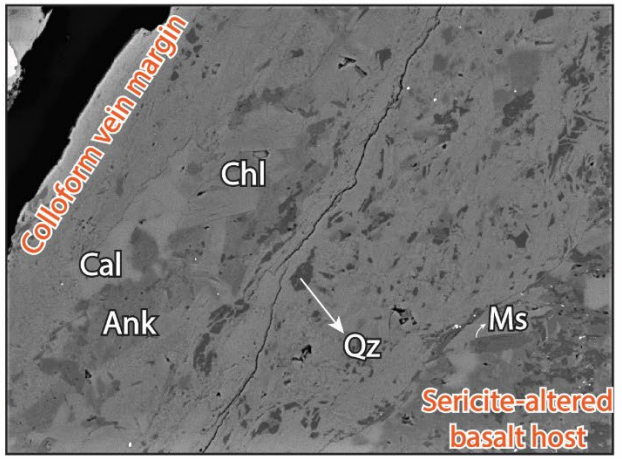
Colloform veins (**thick**)
Tension veins (**dashed**)

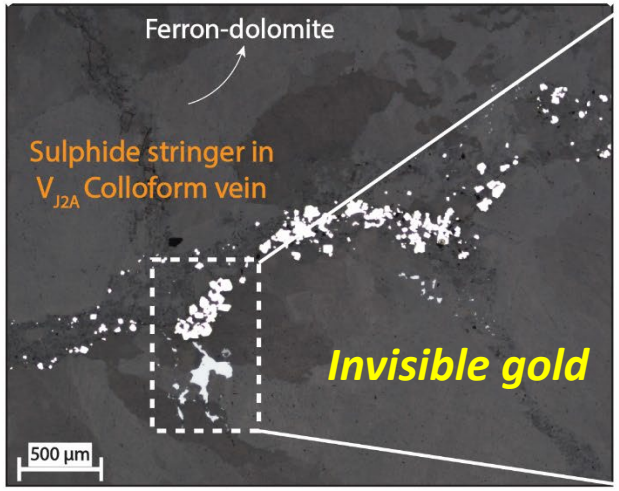


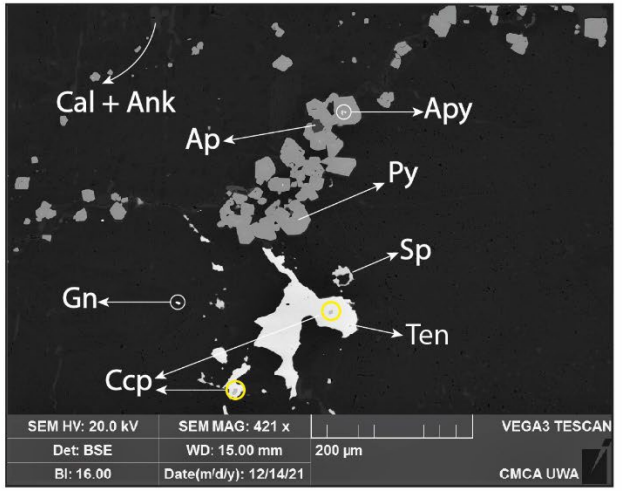


Colloform vein main (**thick**)
Conjugate colloform veins (**dashed**)
lineation





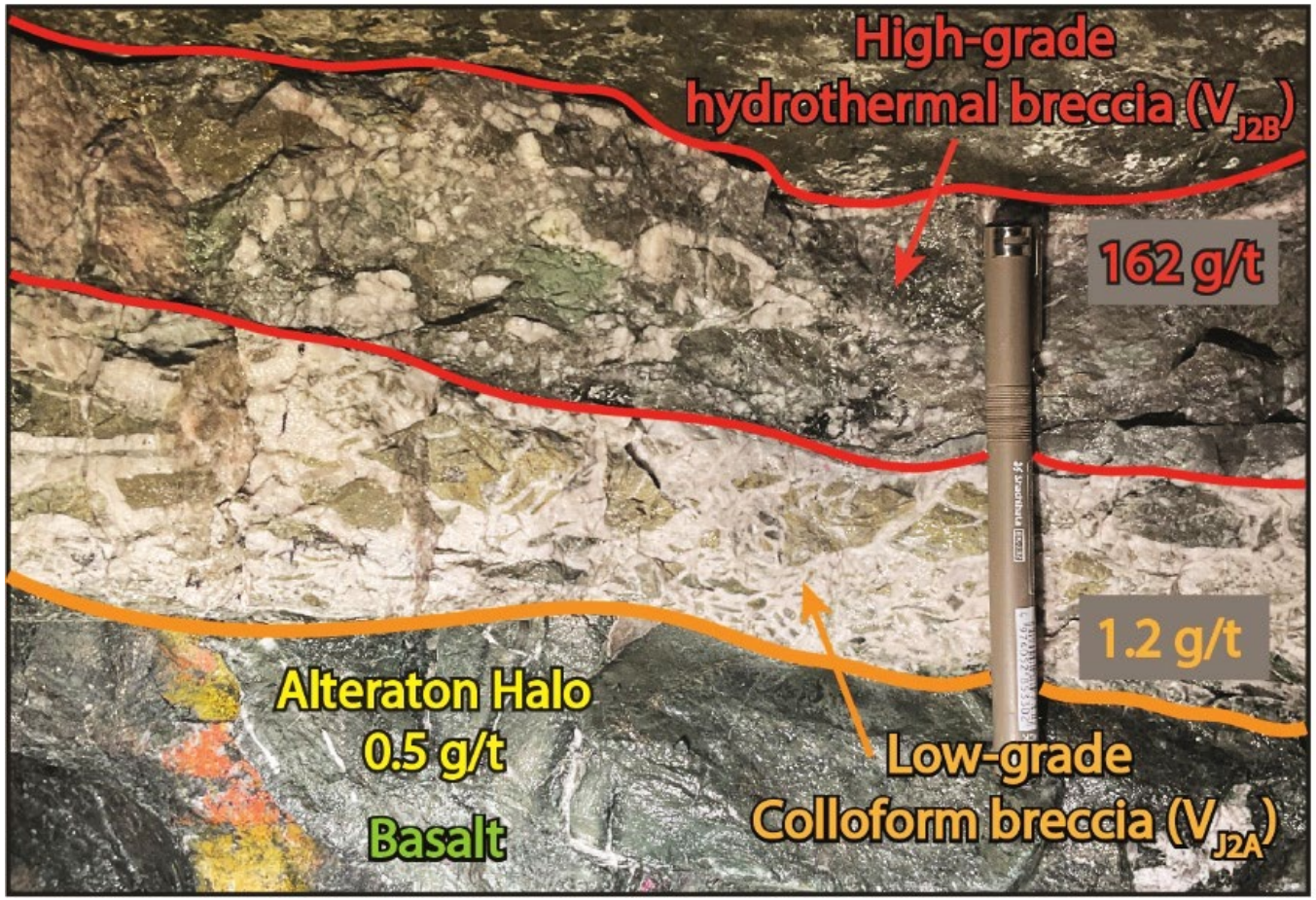


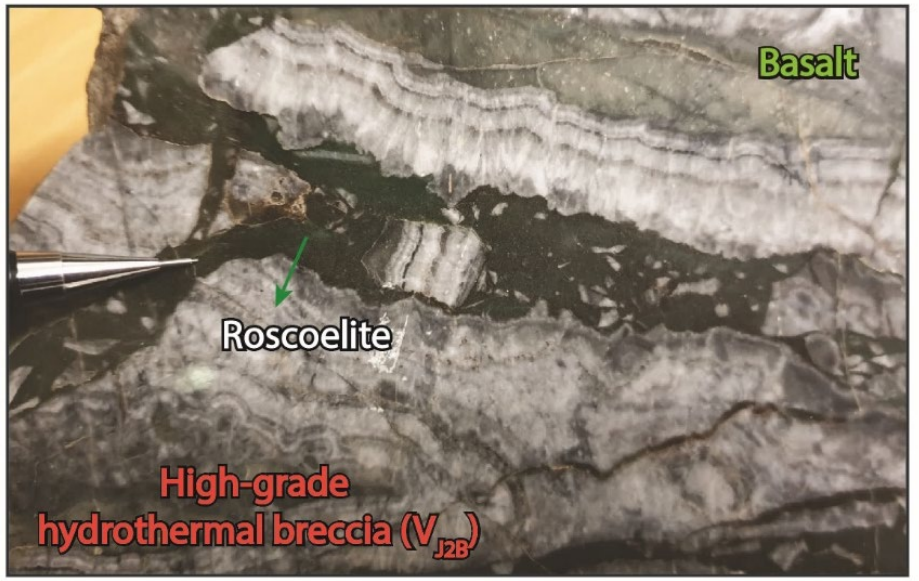


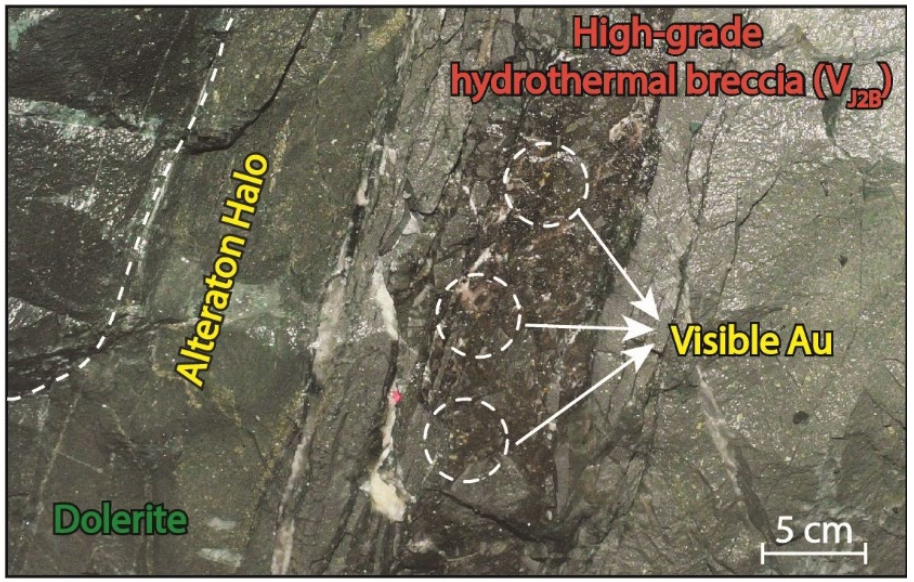
Early low-grade (<2 g/t) mineralisation

V_{J2B}: Hydrothermal breccia and laminated veins

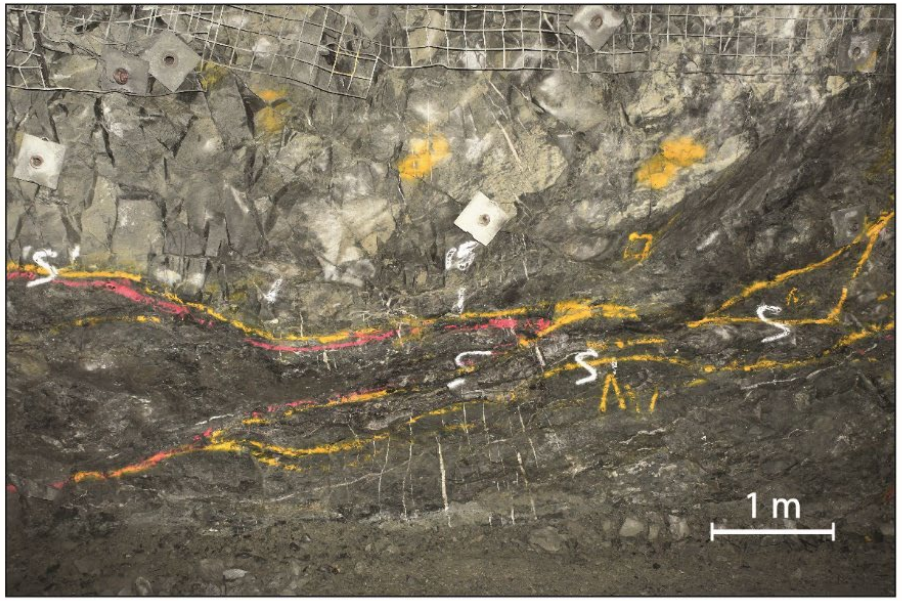
★ *(2nd Au-event; Native gold; >10g/t)*

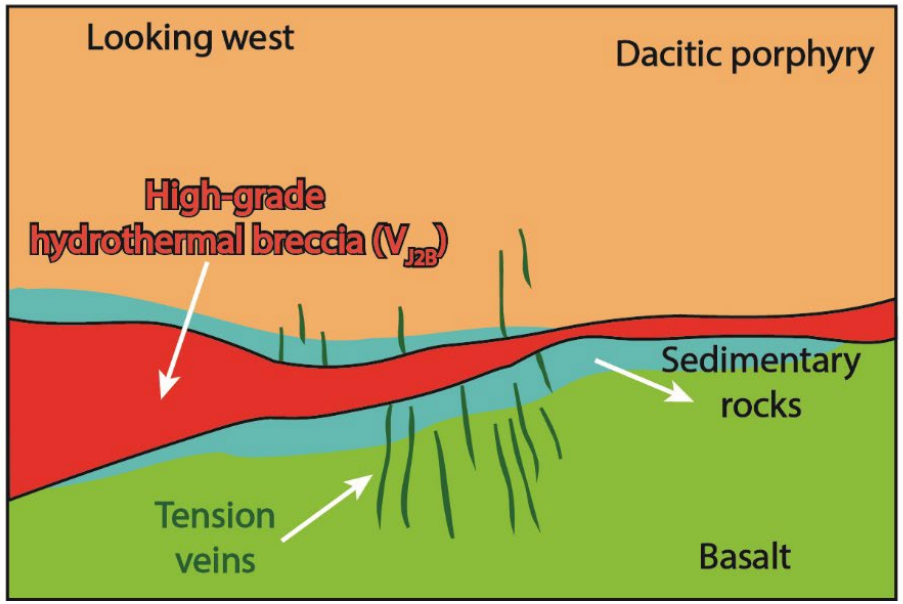


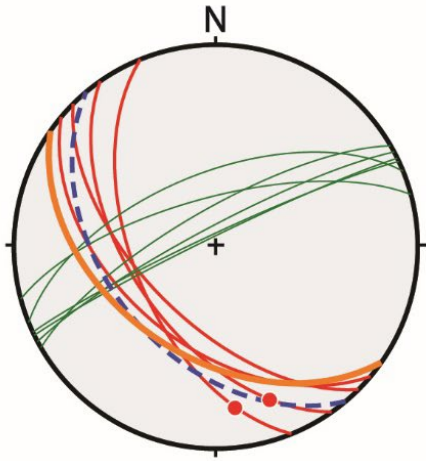




V_{J2B}: Hydrothermal breccia and laminated veins







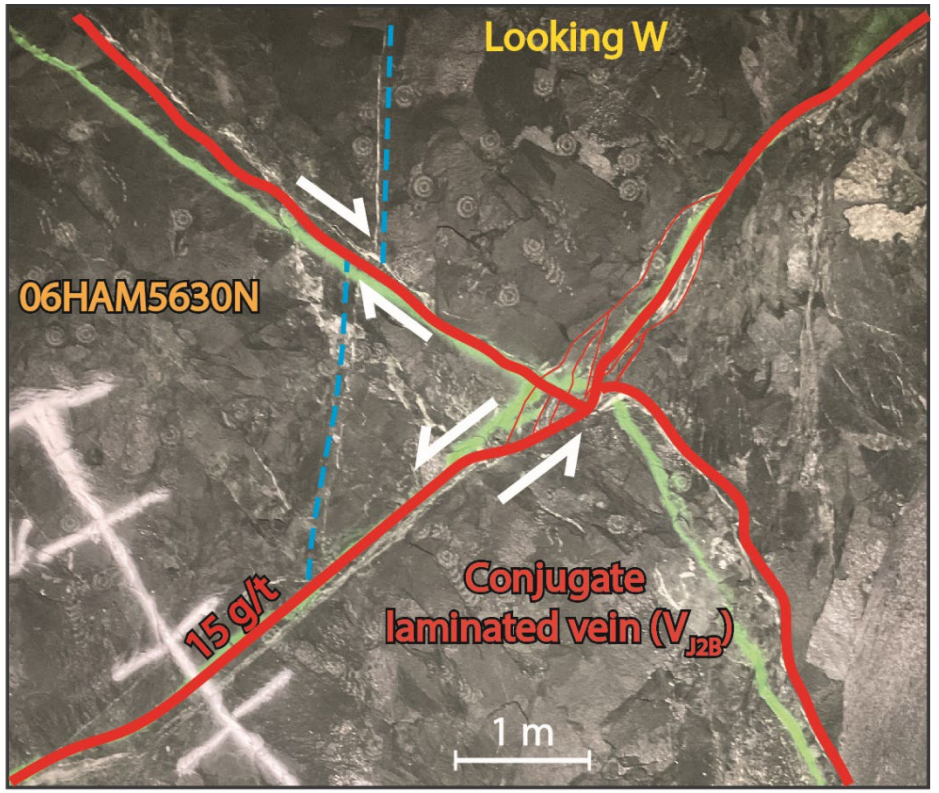
V_{J2B} high-grade structures (red-thick)

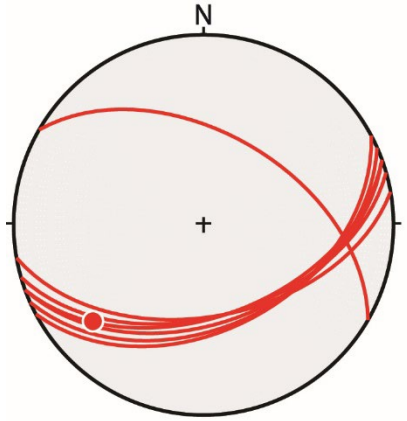
Lineation

Tension veins (green)

Intrusive contact (orange-thick)

Bedding (blue-dashed)

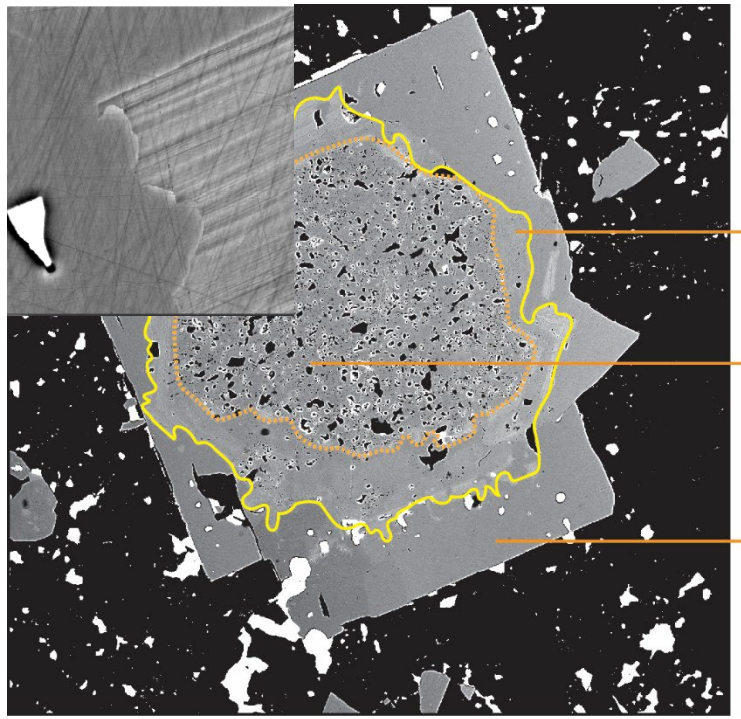




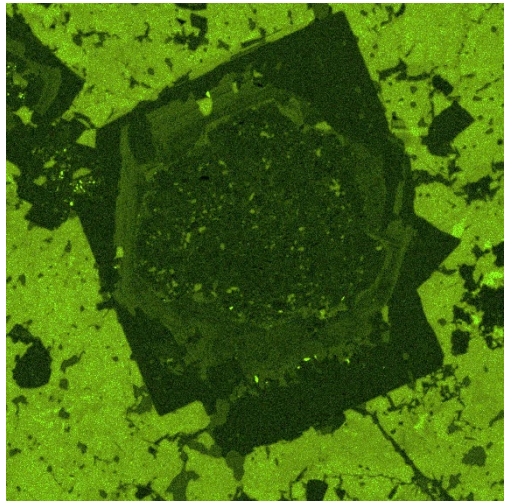
V_{J2B} conjugate laminated veins (red-thick)

Lineation

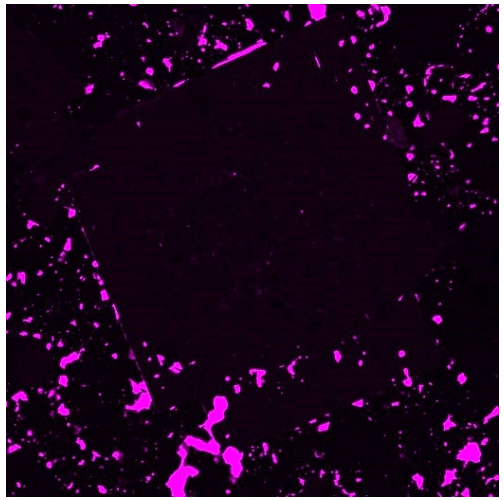
V_{J2B}: Hydrothermal breccia and laminated veins

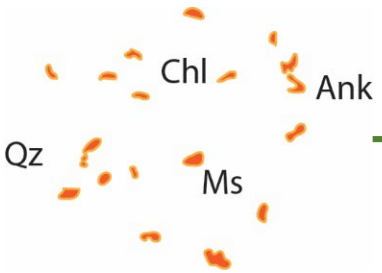


As map

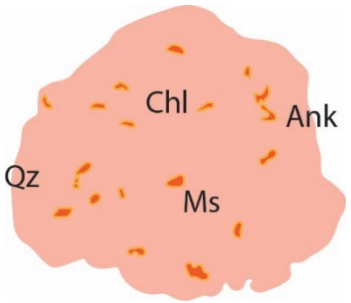


Au map

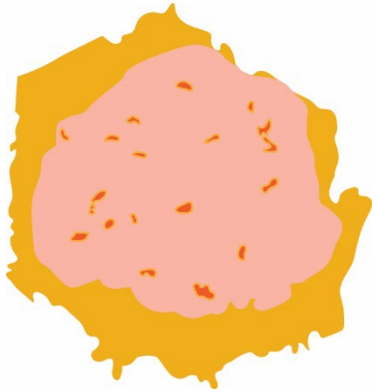




Alteration associated with V_{J2A} Colloform veins



Py core

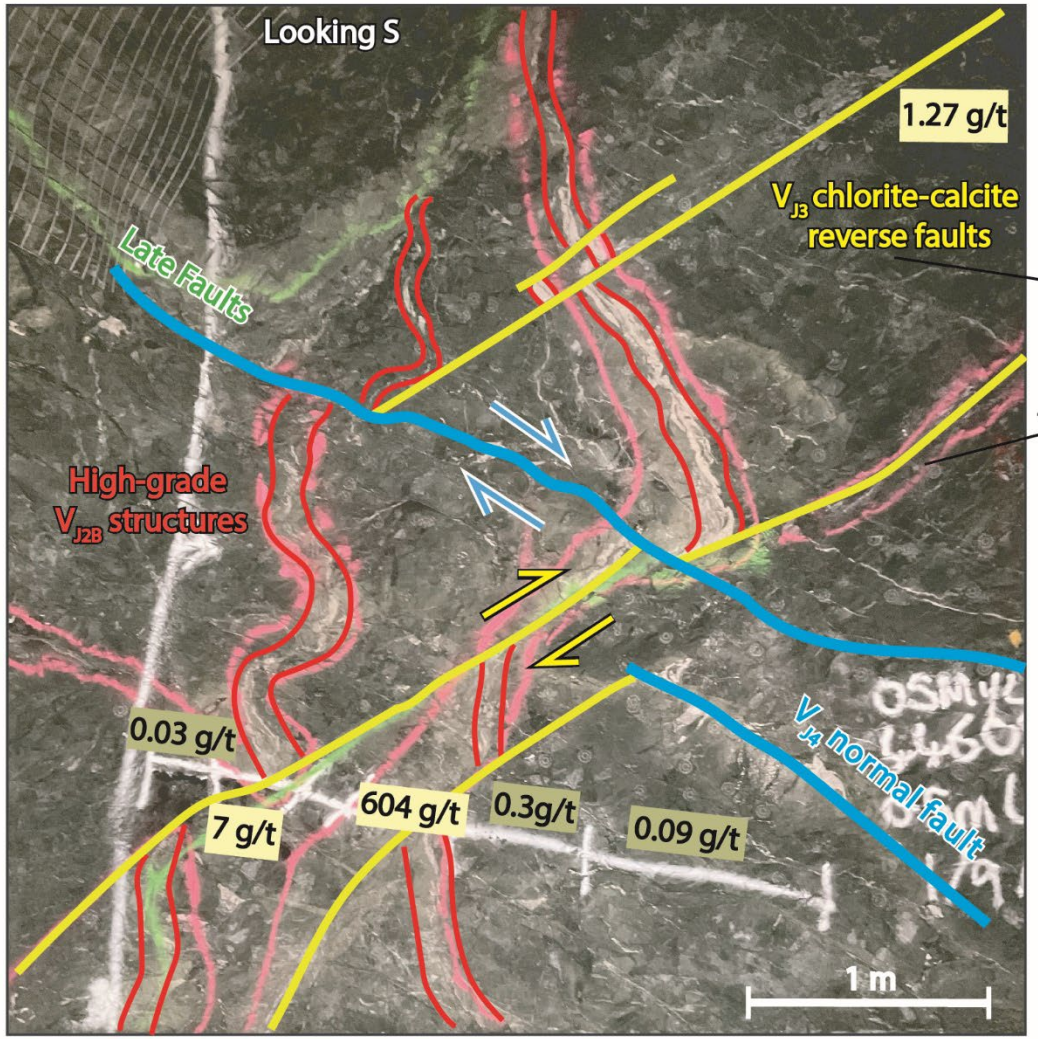


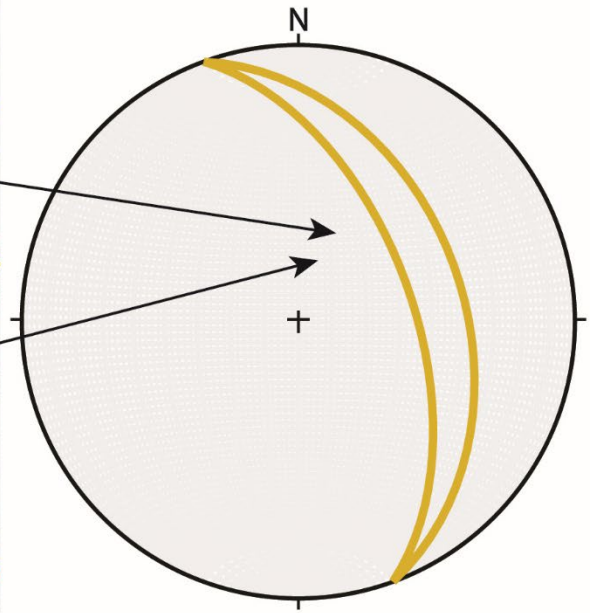
Py mantle

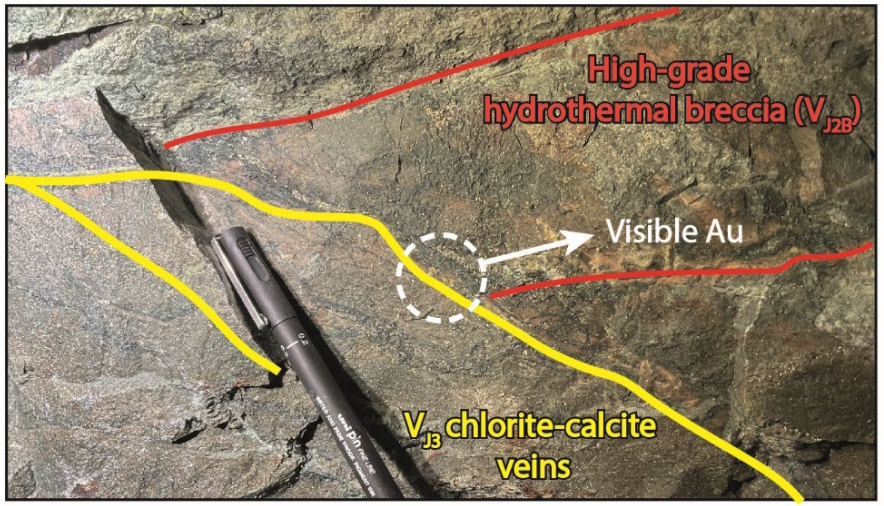
Py rim + free-Au

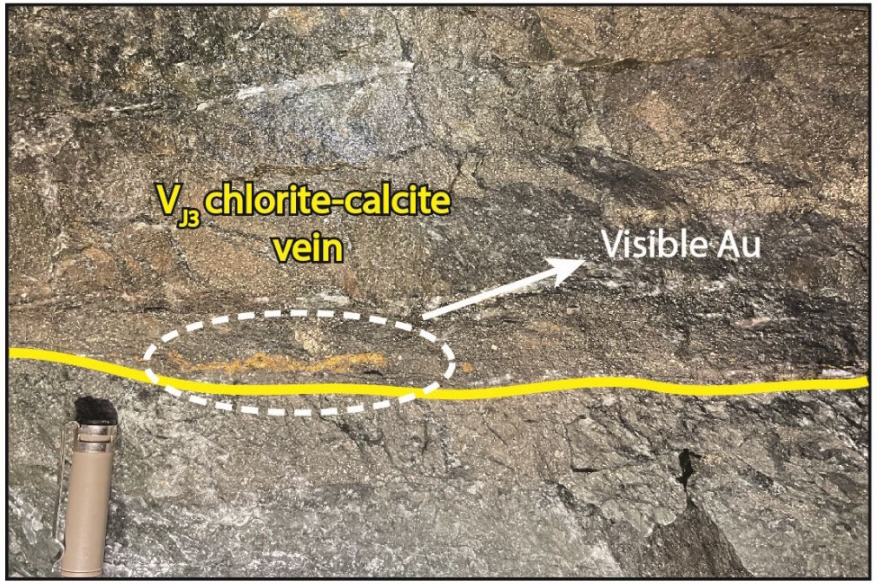
V_{J3}: Gold-rich veins

★ ***(Final Au-event; local ultra-high-grade gold; >100 g/t)***



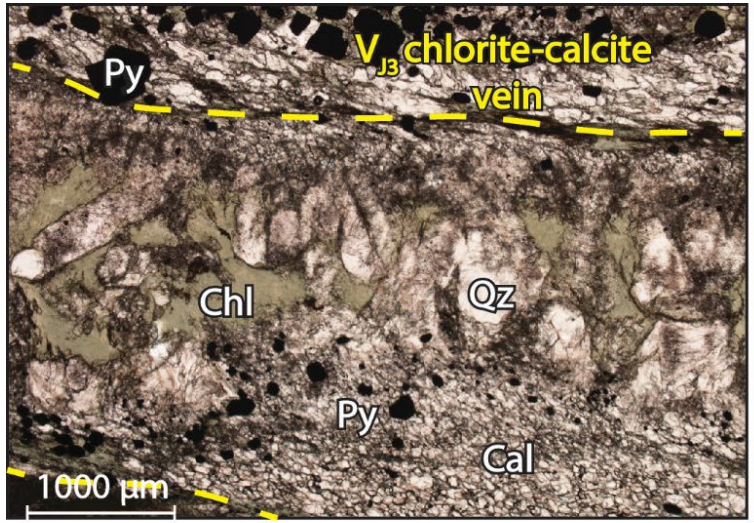


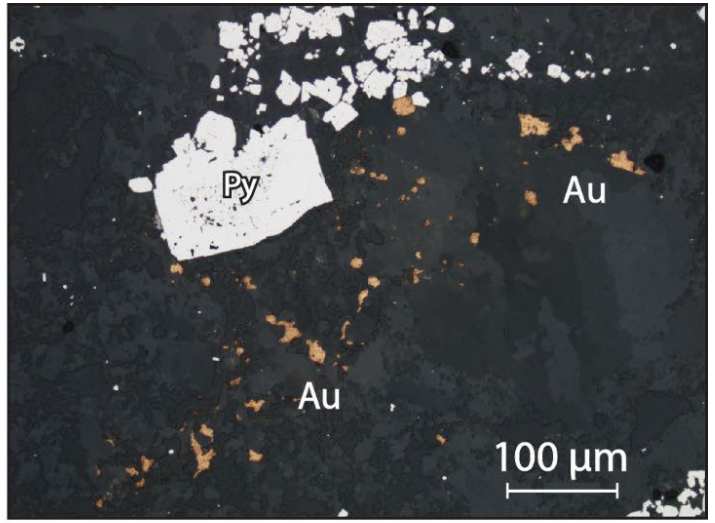


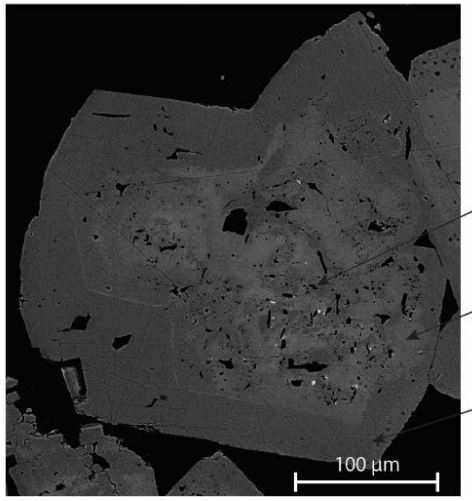


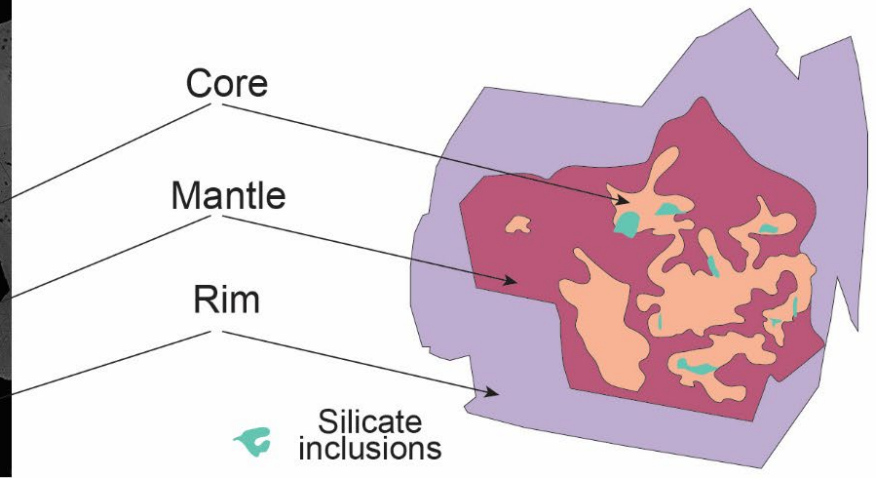
V_{J3}: Gold-rich veins

(Final Au-event; local ultra-high-grade gold; >100 g/t)



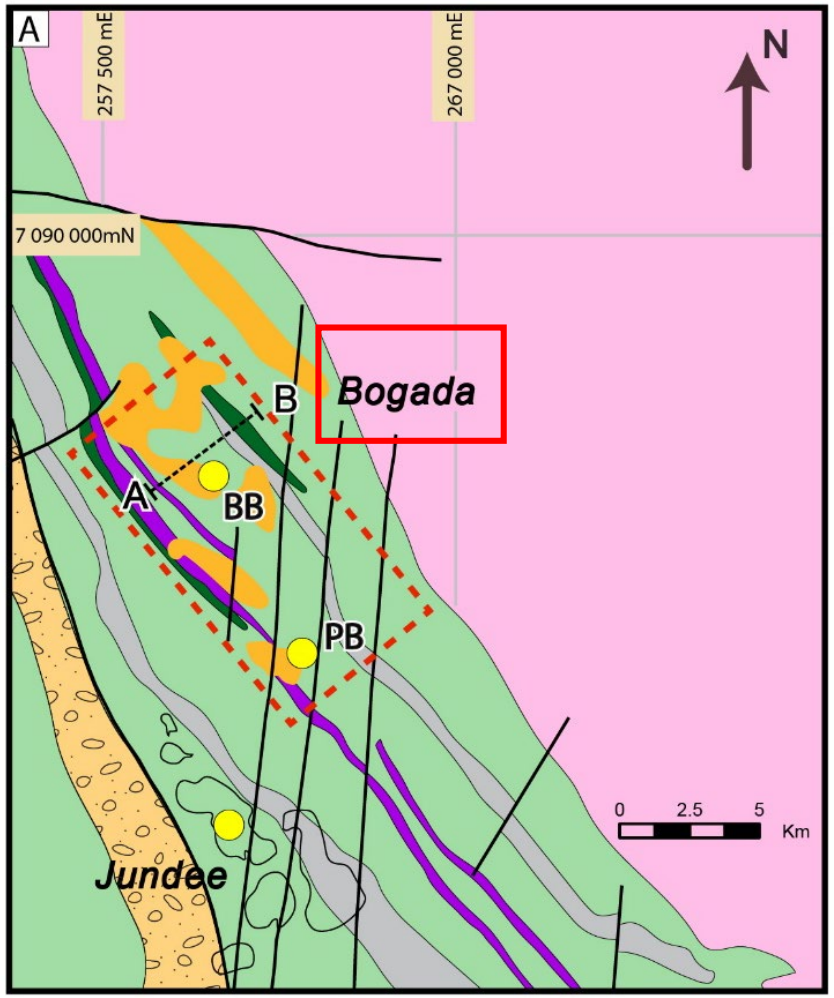




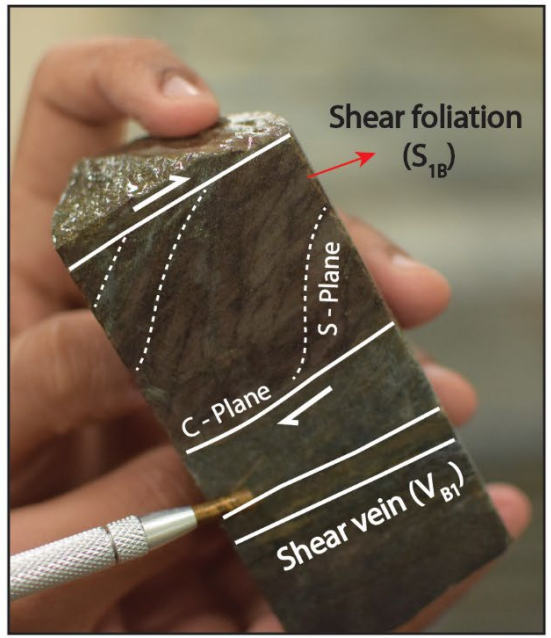


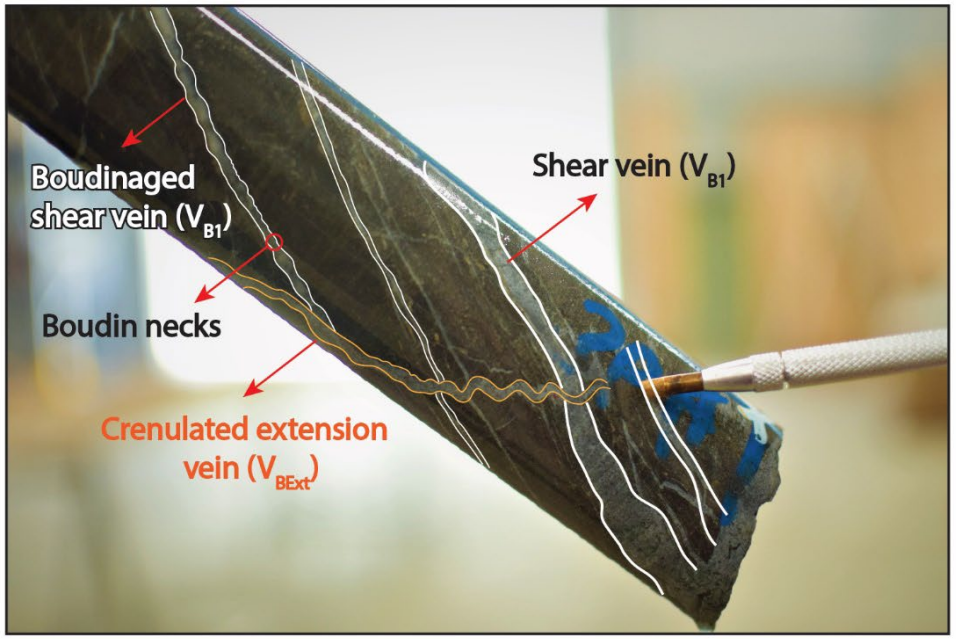
V_{B1}: Shear veins and shear foliation

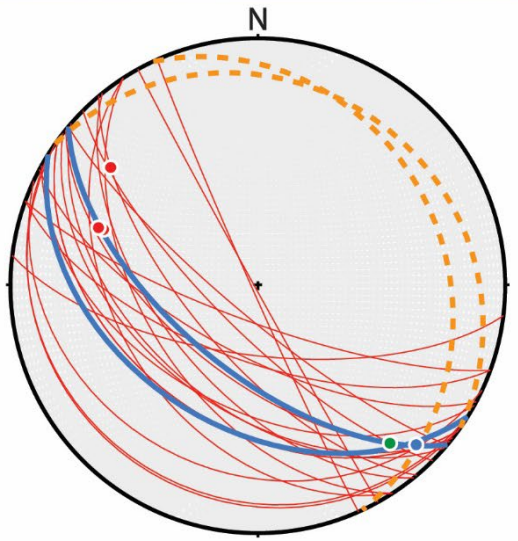
★ ***(Bogada Au-event; Low-grade; <2 g/t)***



Modified after Cooper et al. (2005)







Shear vein 'V_{B1}' and shear foliation 'S_{1B}' (red-thin)

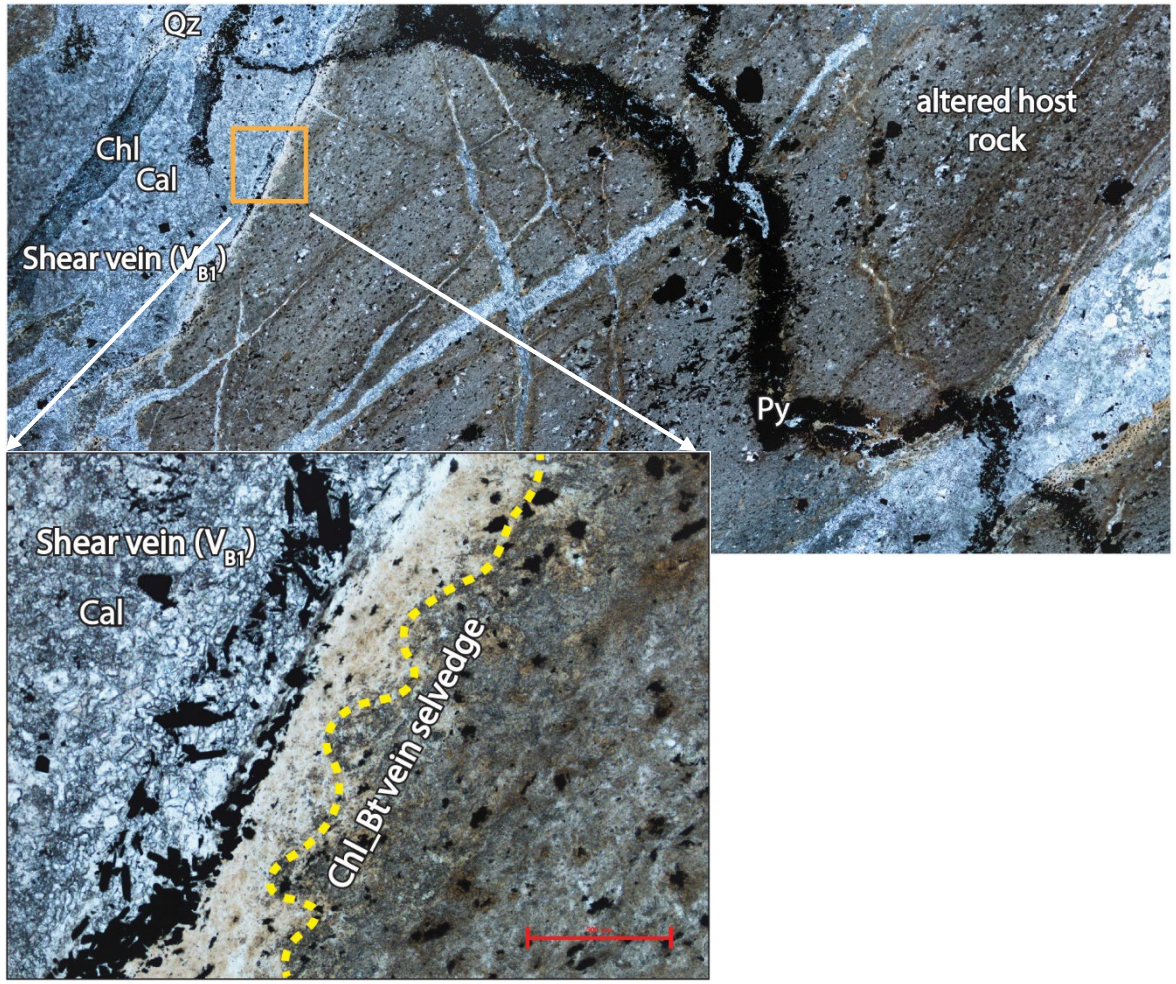
Crenulated extension vein 'V_{BExt}' (orange-dashed)

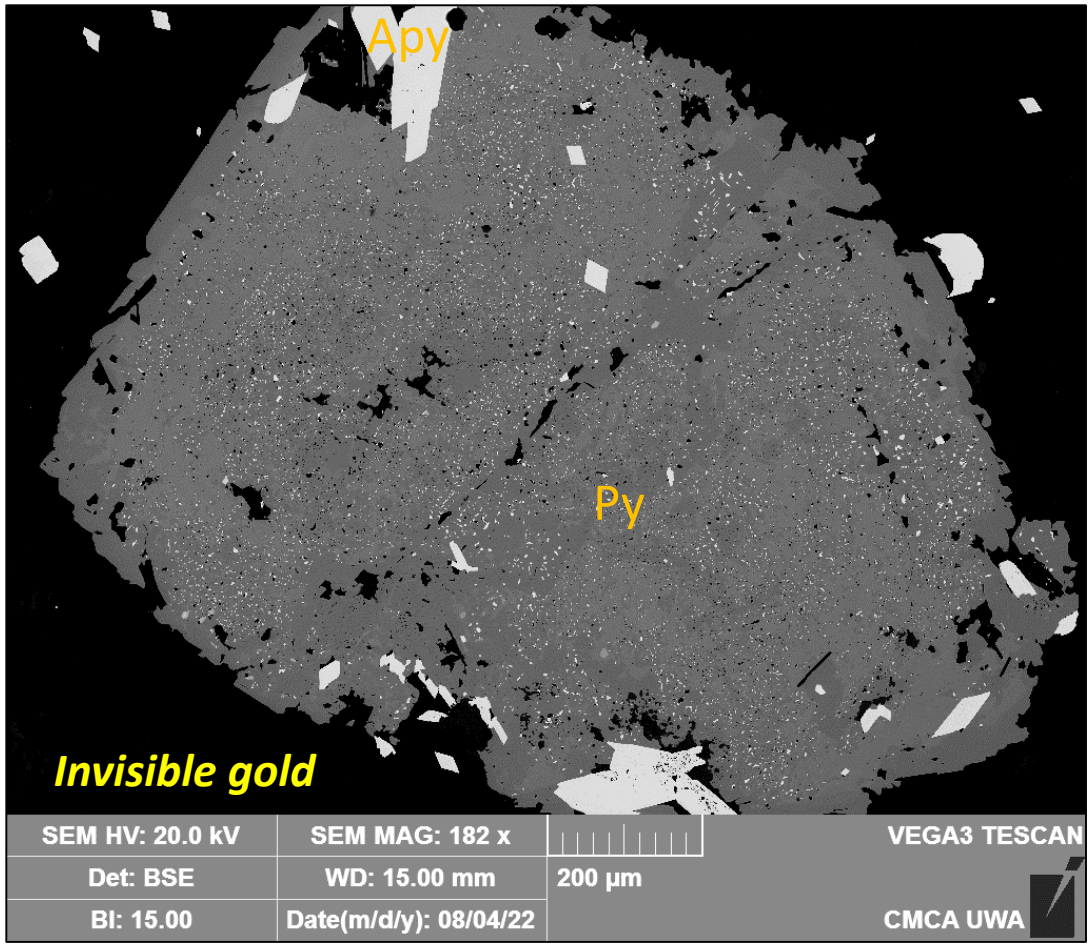
Axial plane for 'V_{BExt}' veins (blue-thick)

- Lineation
- Crenulation axis
- Boudin neck

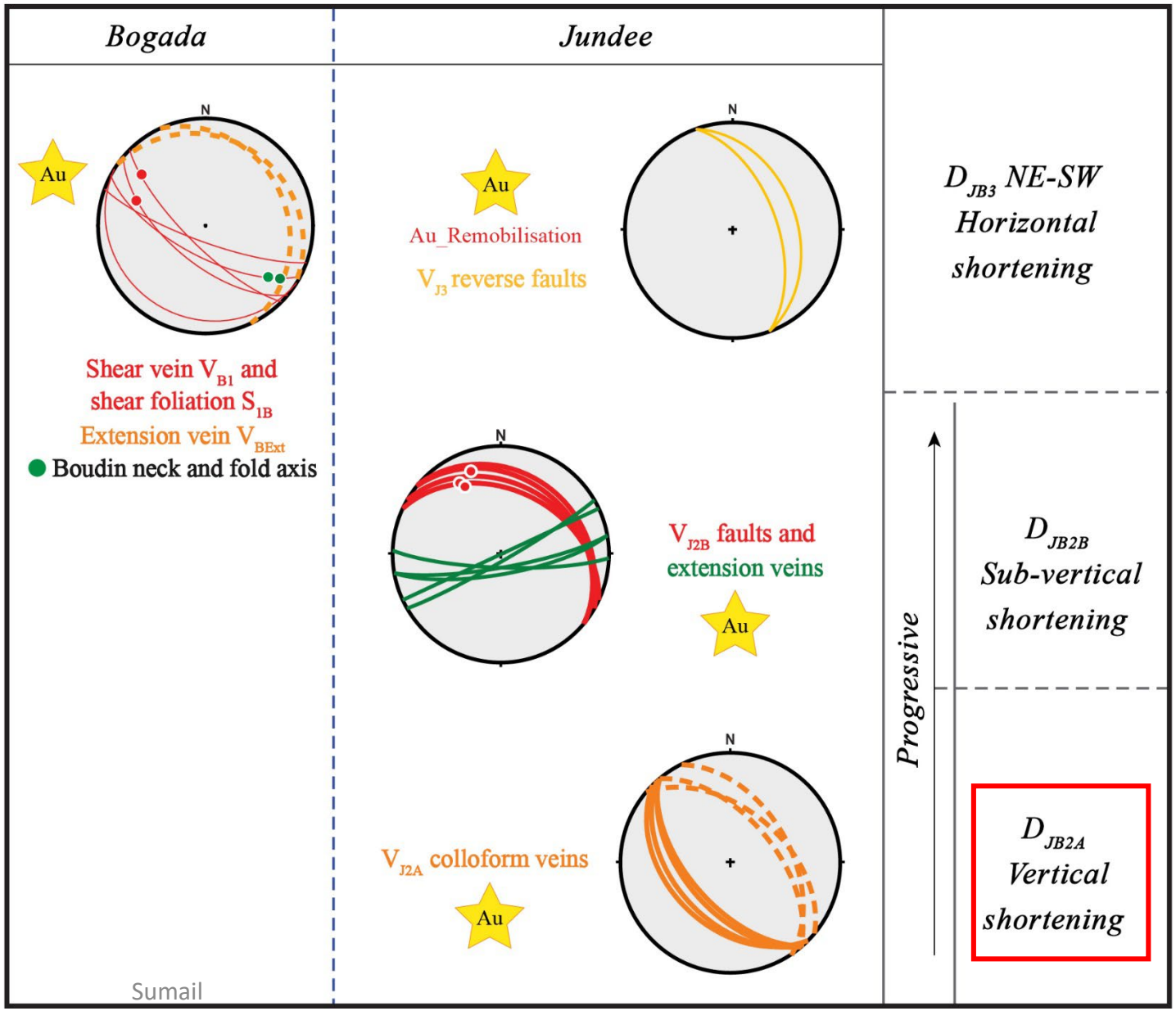
V_{B1}: Shear veins and shear foliation

(Bogada Au-event; Low-grade; <2 g/t)



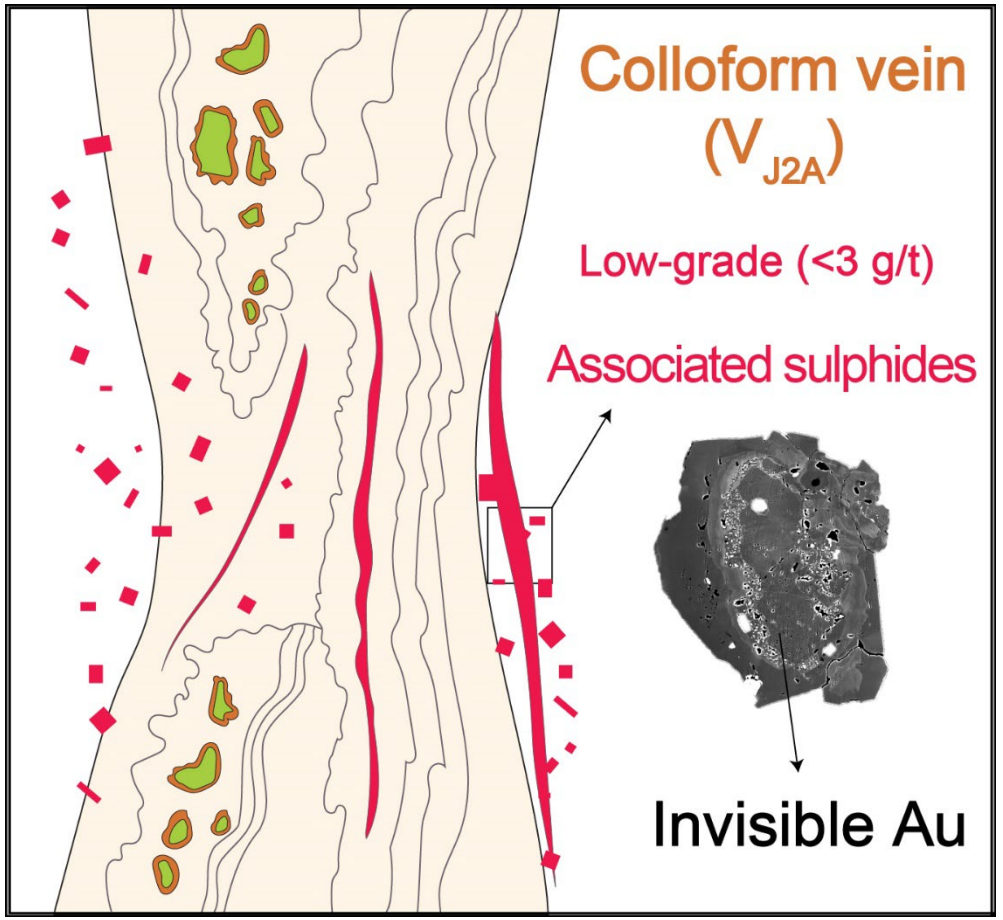


Polyphased gold enrichment

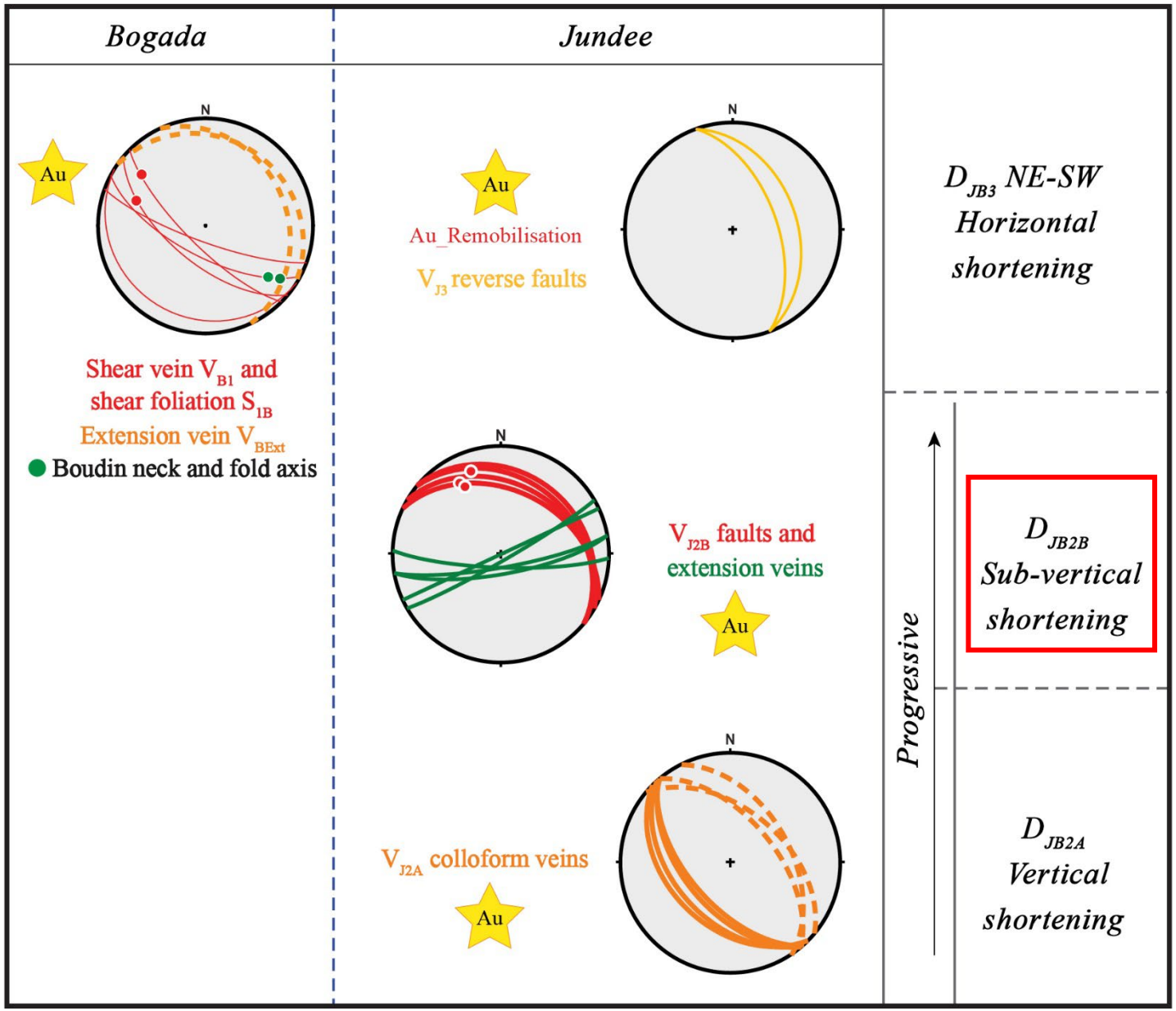


Sumail

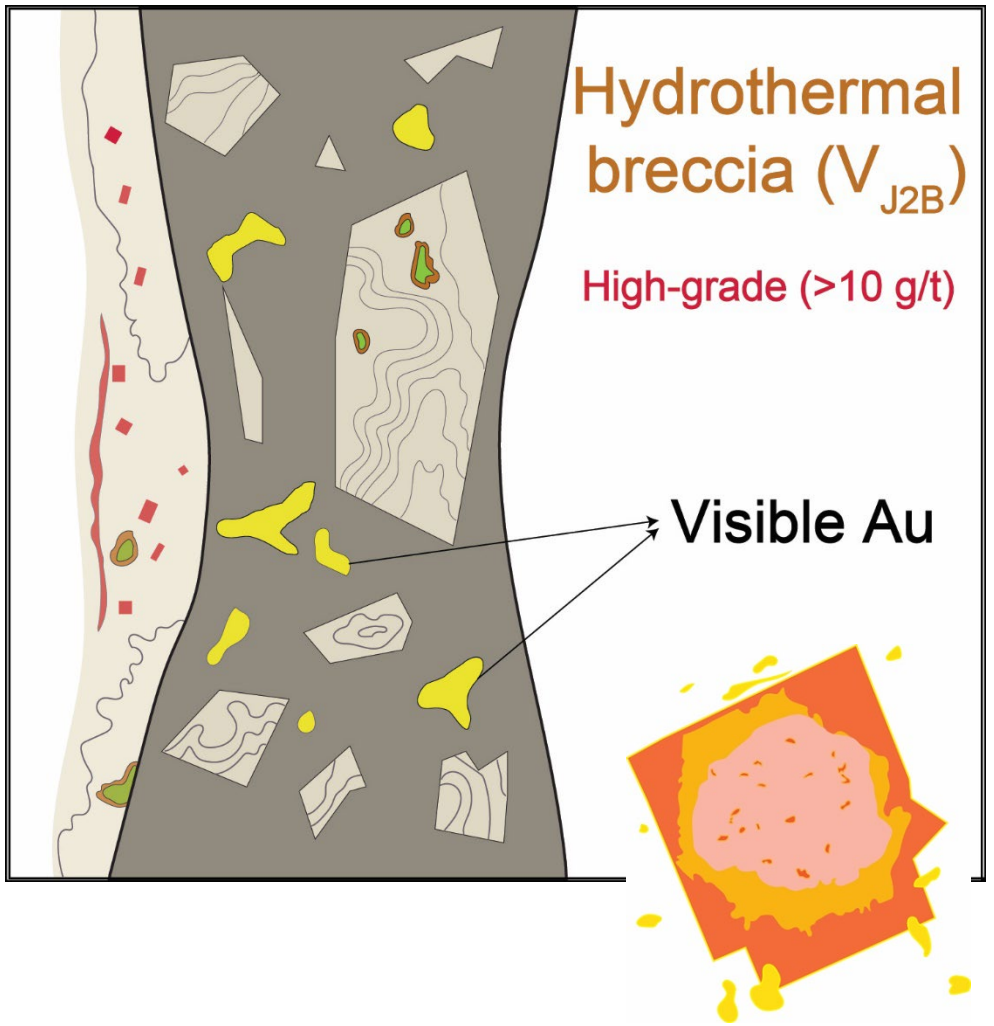
Early low-grade (<2 g/t) gold mineralisation



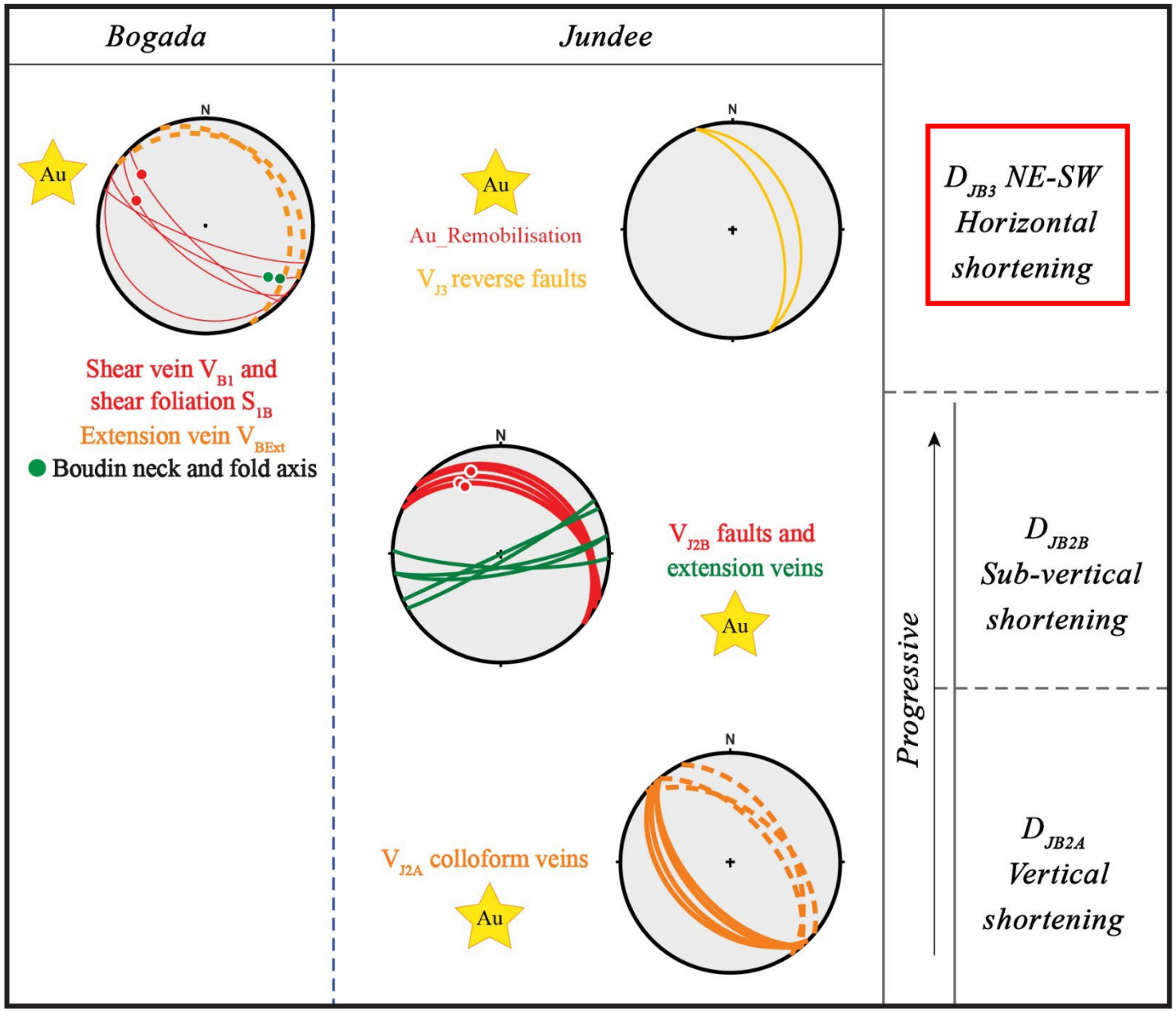
Polyphased gold enrichment



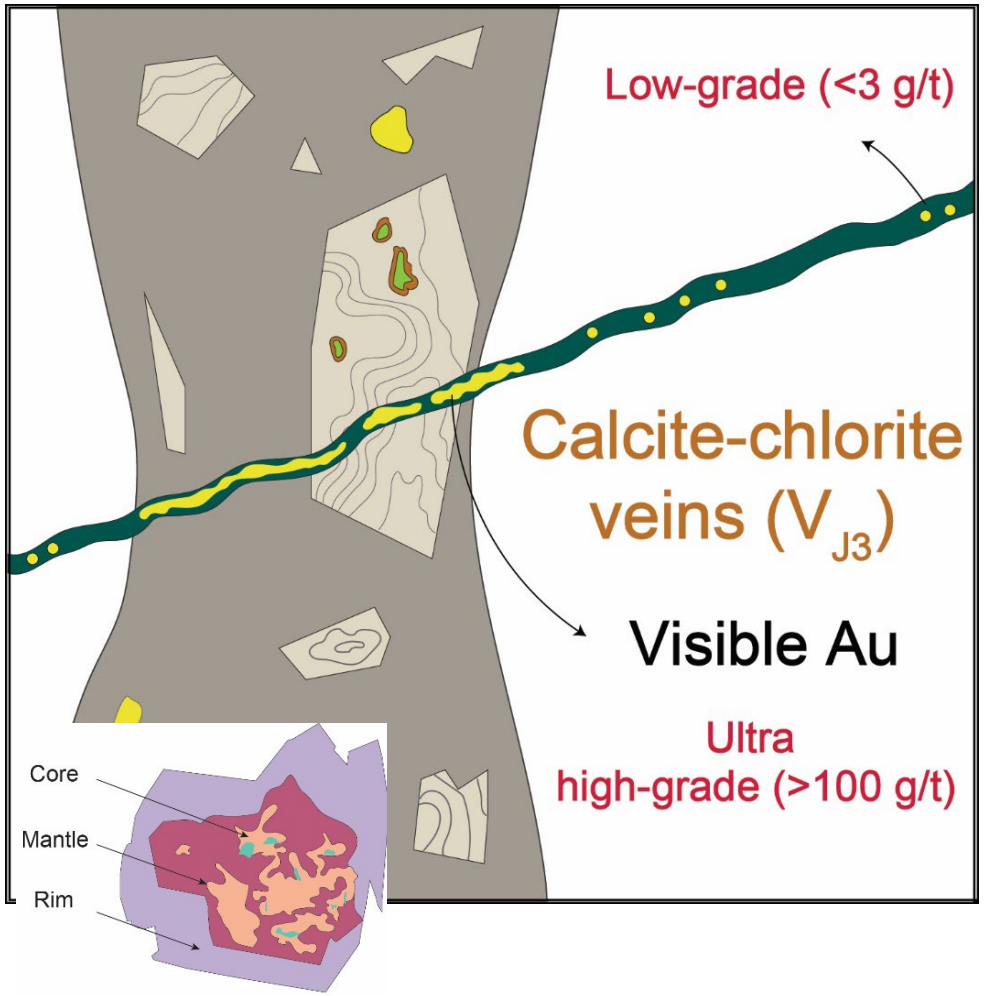
High-grade (> 10 g/t) native gold mineralisation



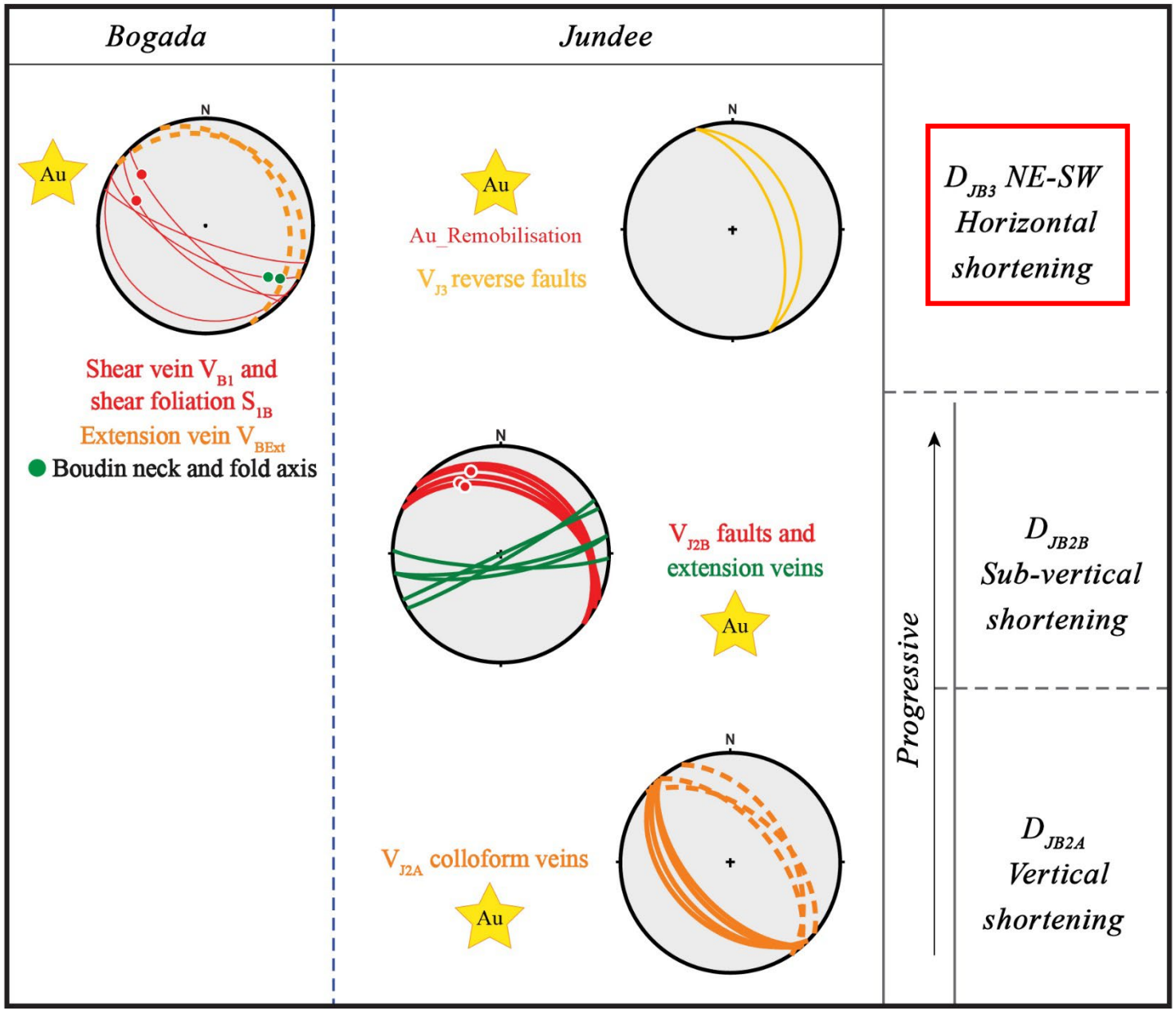
Polyphased gold enrichment

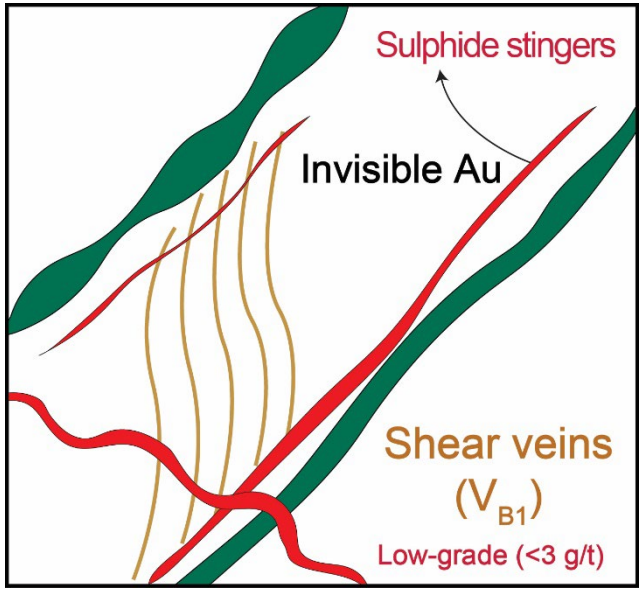


Low-grade (<2 g/t) +
Local ultra-high-grade (>100 g/t; remobilisation?)
gold mineralisation



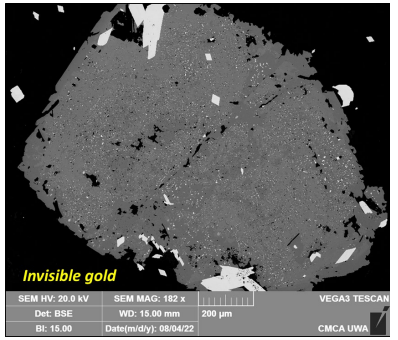
Polyphased gold enrichment

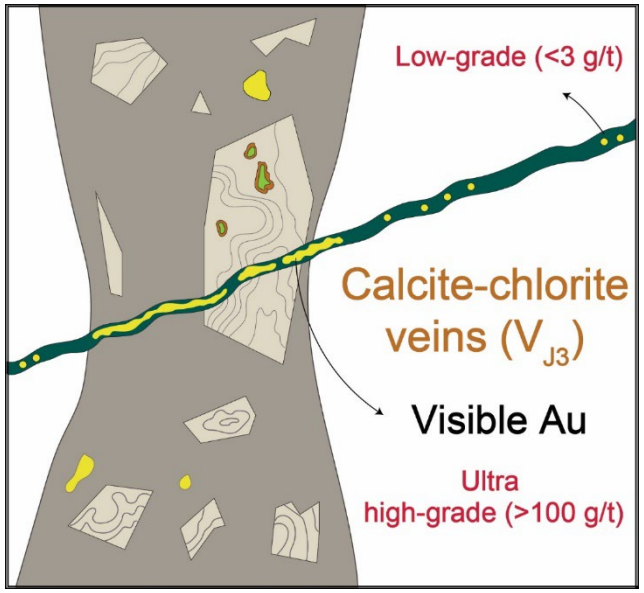




Bogada

Low-grade (<2 g/t) gold mineralisation





Jundee

Thank You!