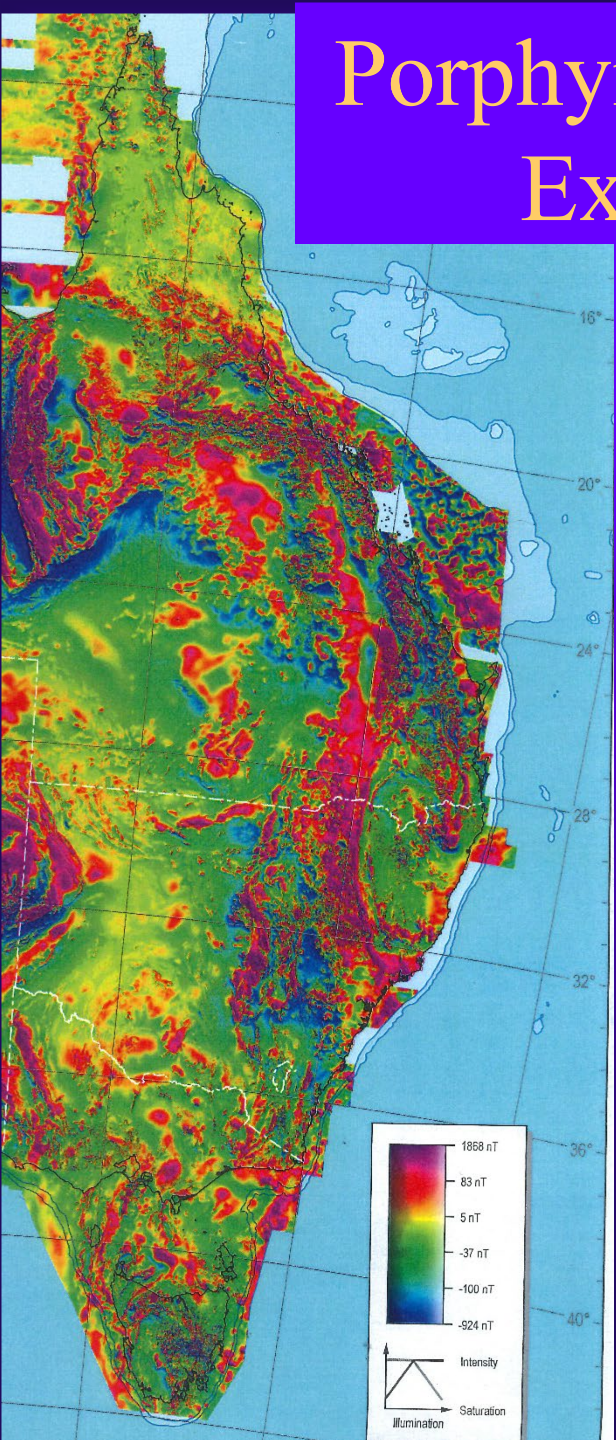
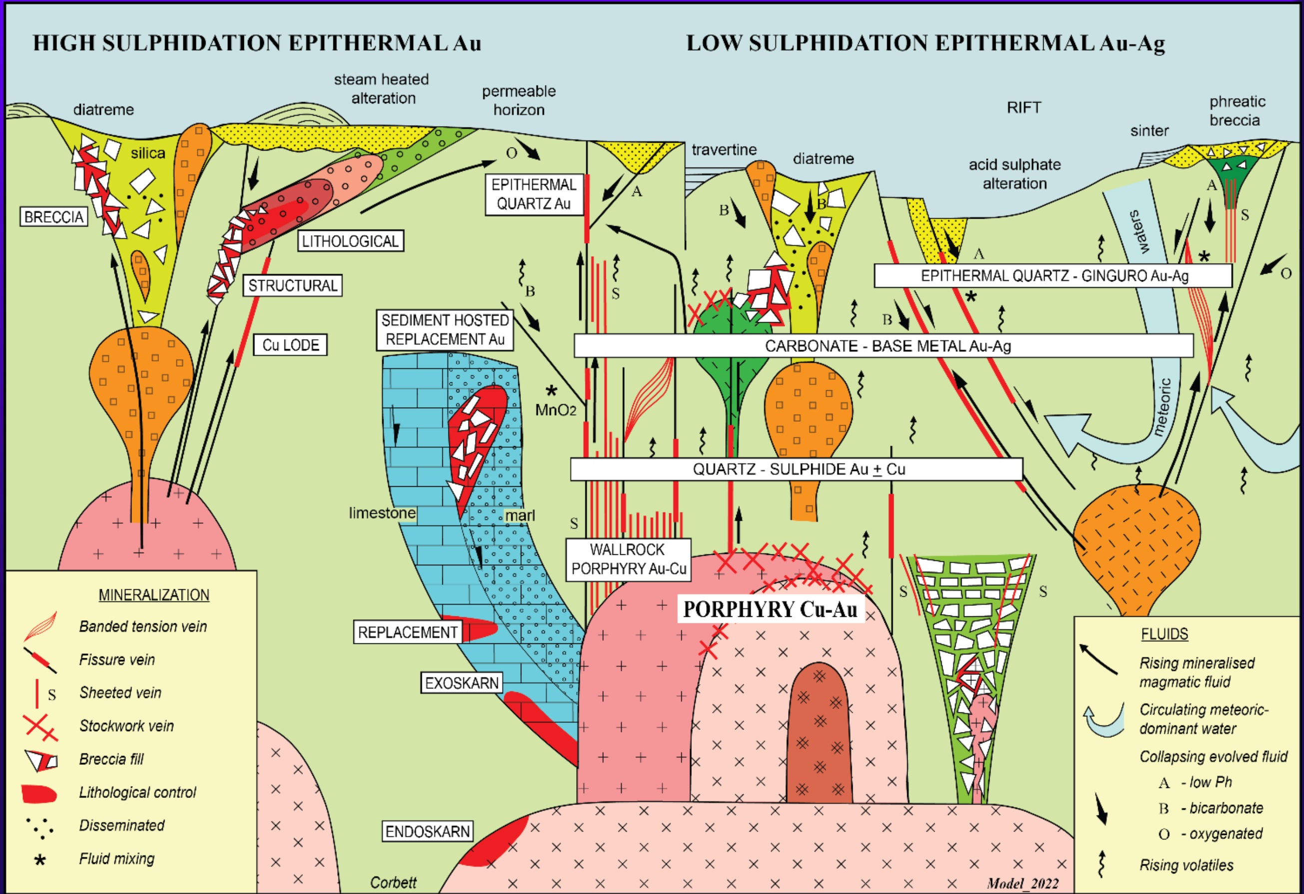
Porphyry Cu-Au and Epithermal Au-Ag Exploration in the Tasmanides



Greg Corbett

Mines and Wines 2022

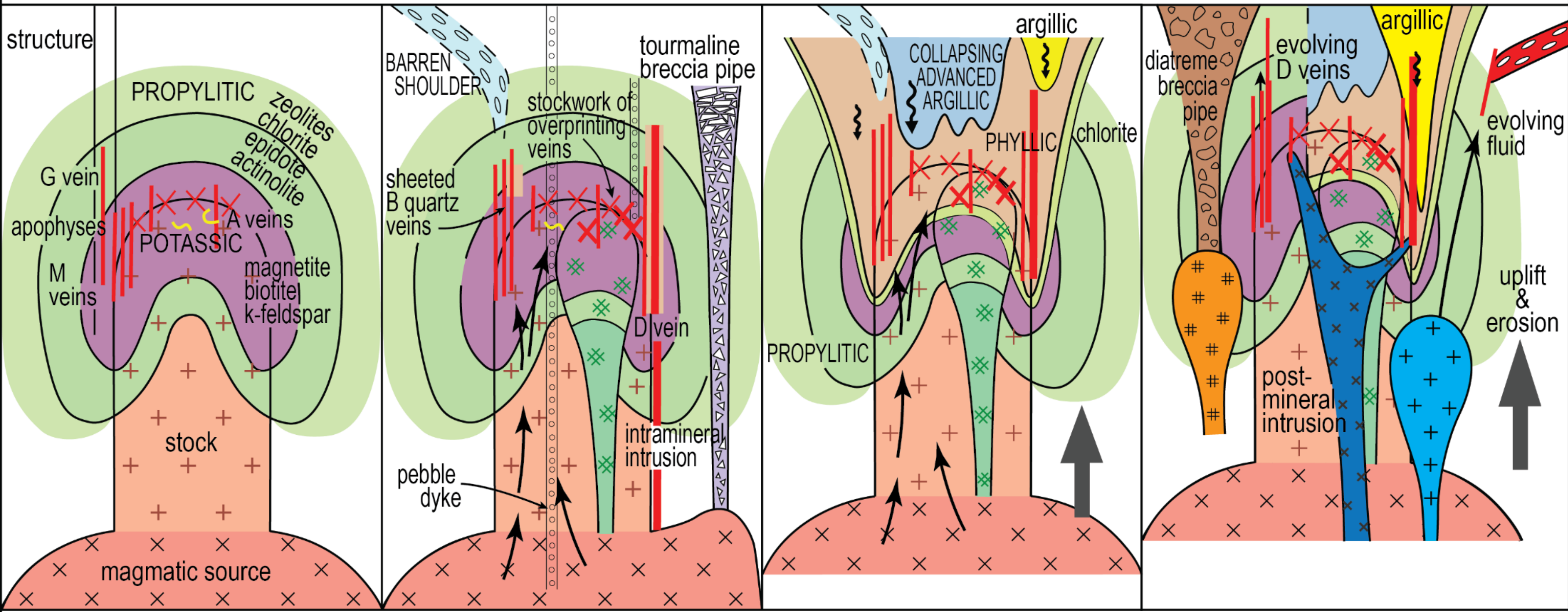
www.corbettgeology.com



STAGED PORPHYRY Cu-Au EVOLUTION

EARLY → **LATE**

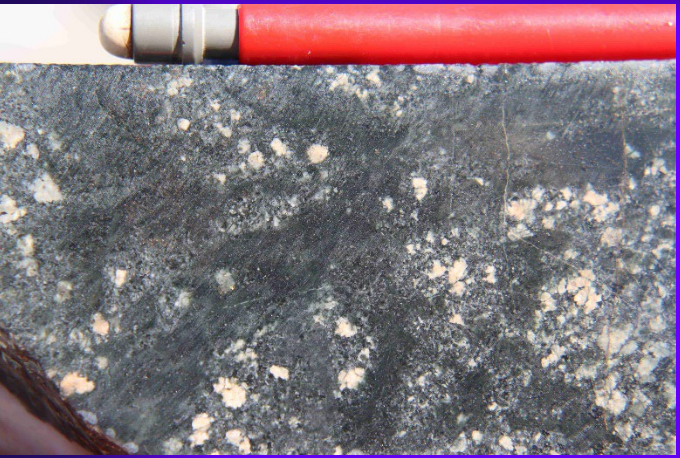
EMPLACEMENT, PROGRADE ALTERATION & EARLY MINERALISATION	PROGRESSIVE COOLING & CONTINUED MINERALISATION	DRAW DOWN, RETROGRADE ALTERATION & LATE MINERALISATION	SHUT DOWN & POST-MINERAL

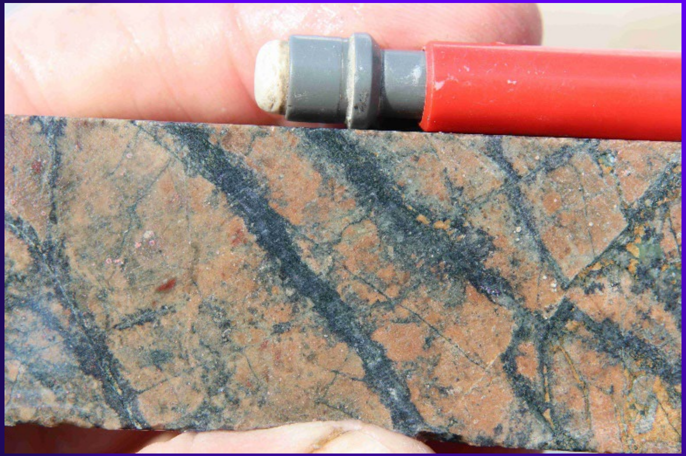


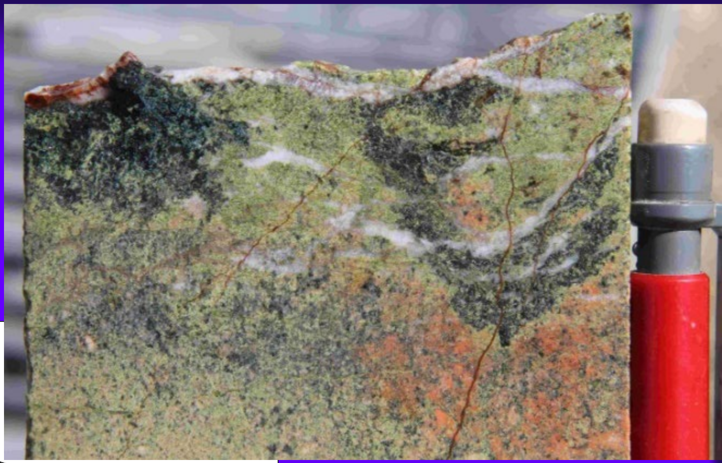
Zoned potassic to inner & outer propylitic alteration by heat transfer. Initiation of prograde A, M & G veins. Early mineralistion.	Exsolution of volatiles to form barren shoulders. Tourmaline breccia pipes. Metals from the magma source as B C & D veins Pebble dykes. Initiation of phyllic alteration.	Draw down of low pH waters onto cooling apophysis & phyllic-argillic alteration. Degassing of magma source at depth & late mineralisation. Collapsing advanced argillic contributes to lithocaps.	Uplift & erosion. Continued collapse of low pH and meteroic waters Evolution of alteration & mineralisation. Post-mineral intrusions & brecias stope out ore. Epithermal overprint.

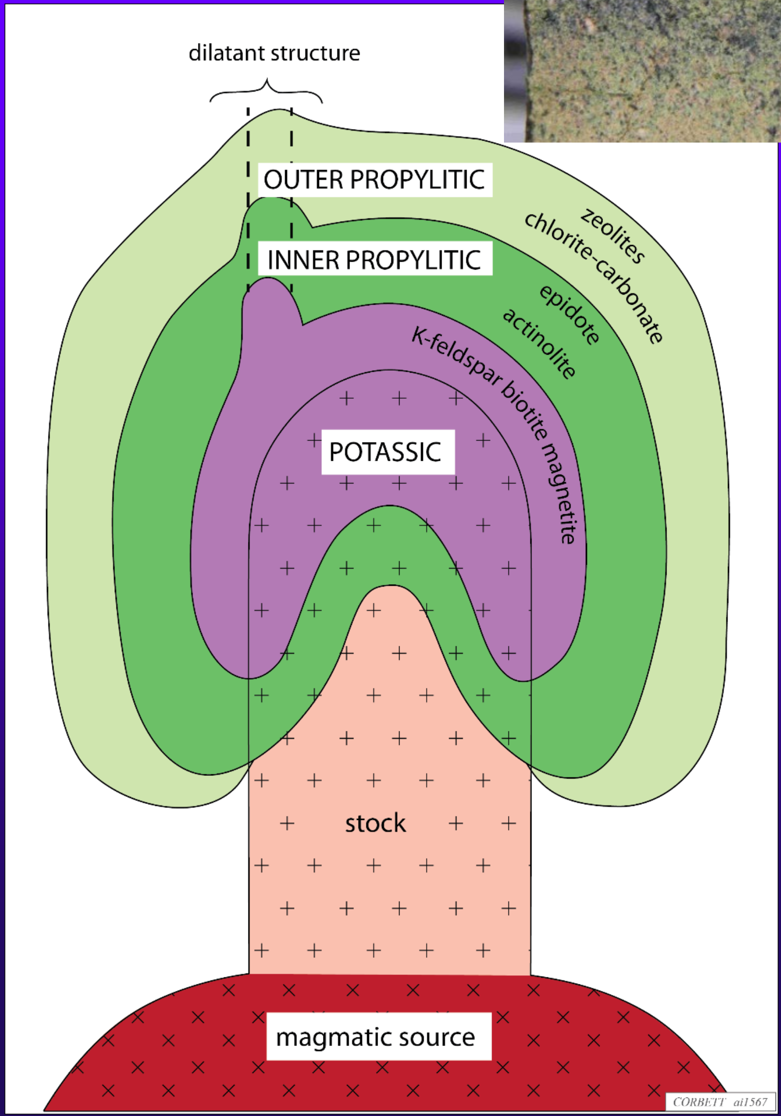
CORBETT ai1854c

Actinolite



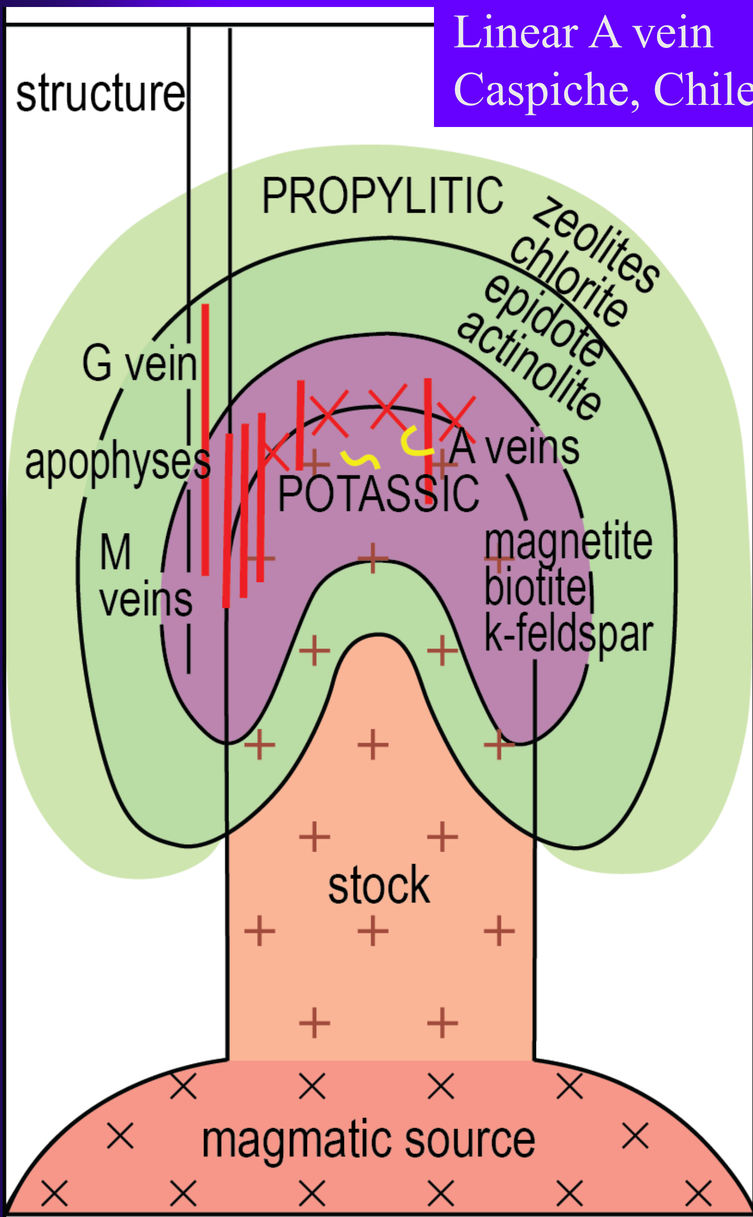






Ridgeway

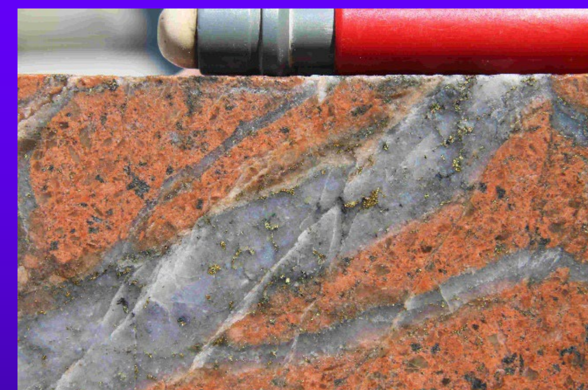
Early quartz-sulphide veins



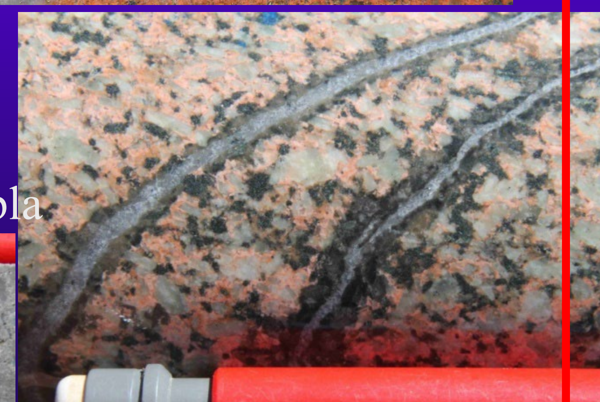
Linear A vein, Ridgeway

Linear A vein
Caspiche, Chile

Linear A vein, Goonumbla



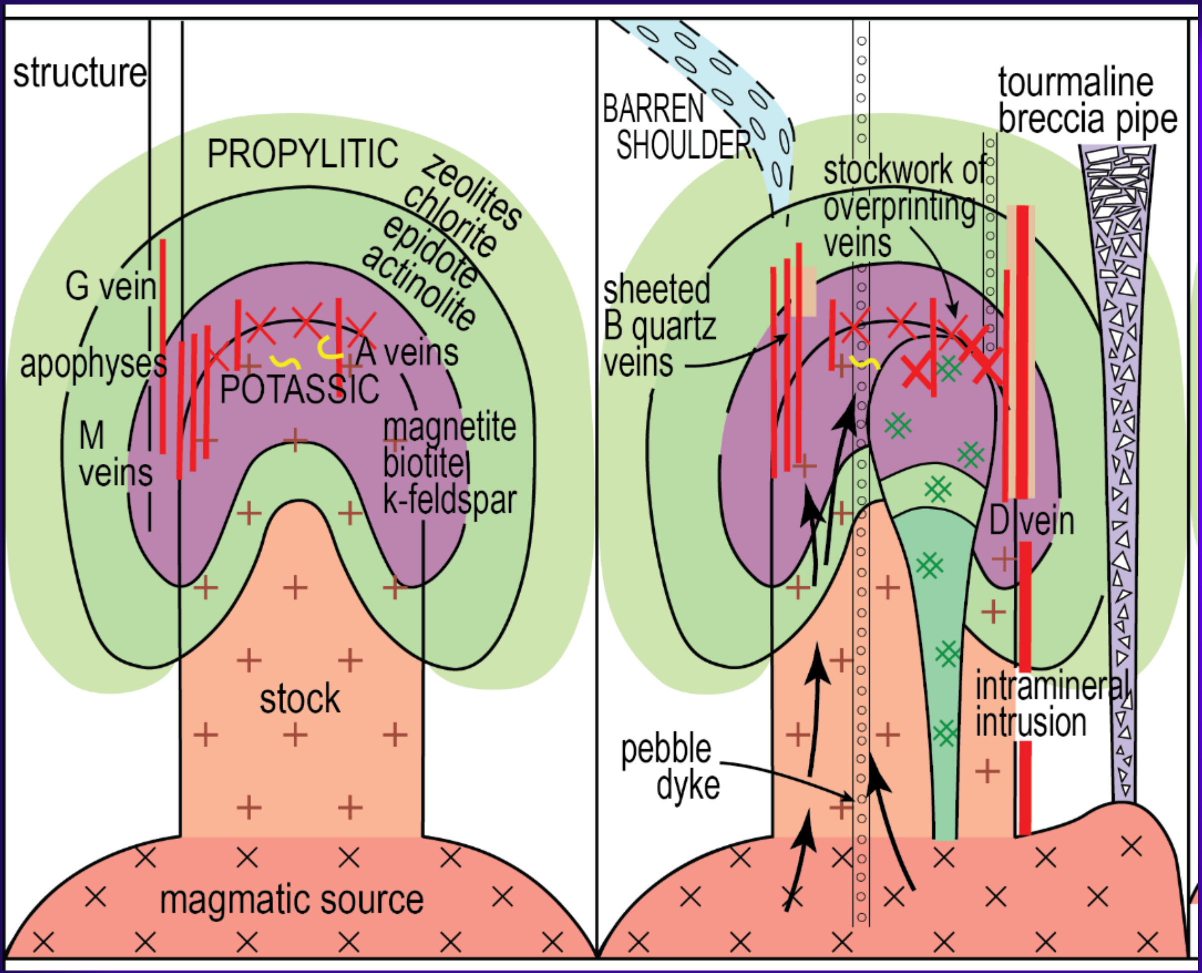
EDM Goonumbla

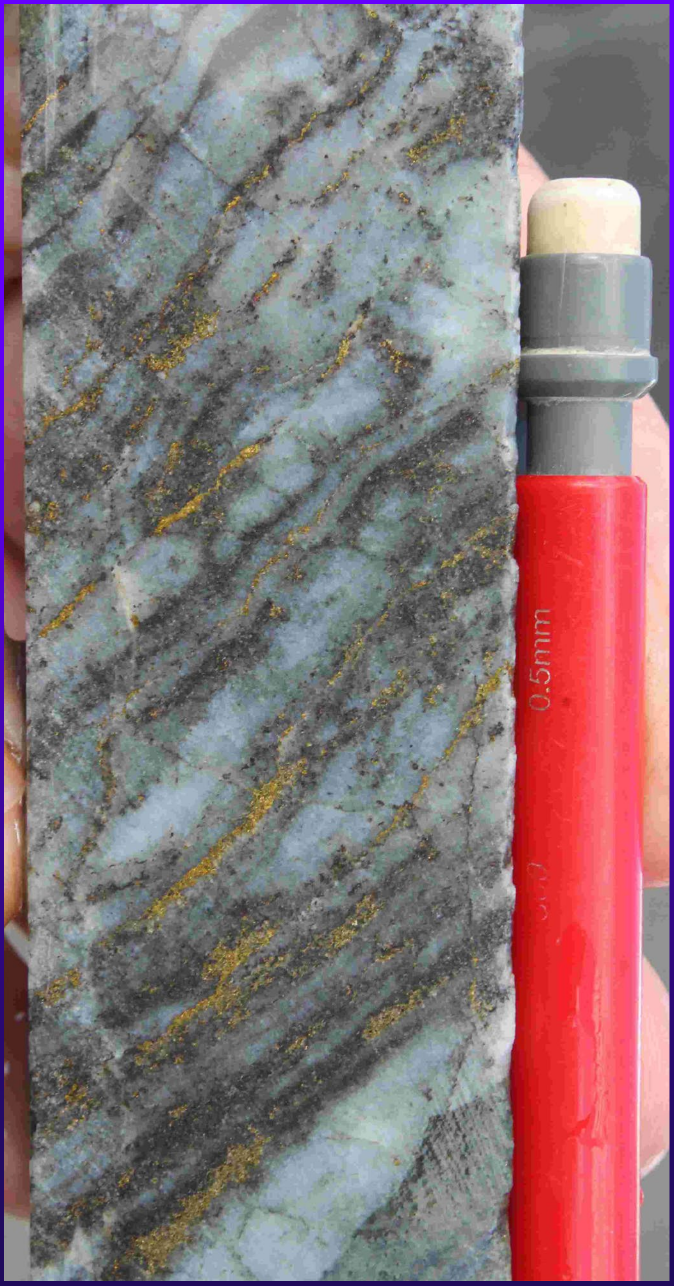


Barren
ptygmatic
A vein

time

M veins



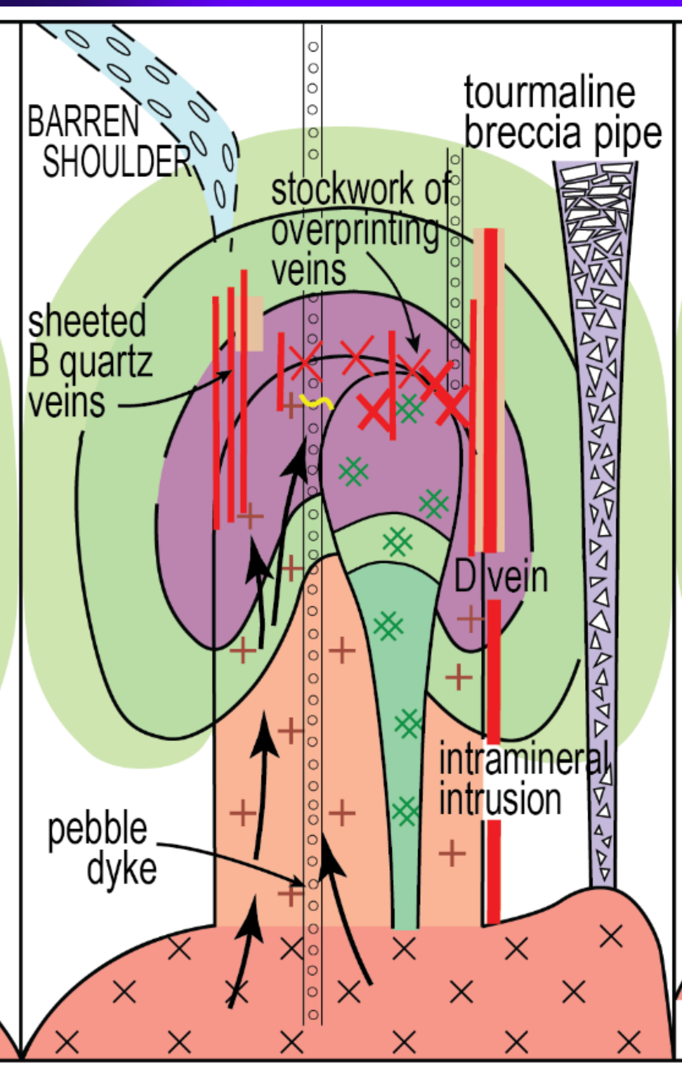


M vein
Copper Hill

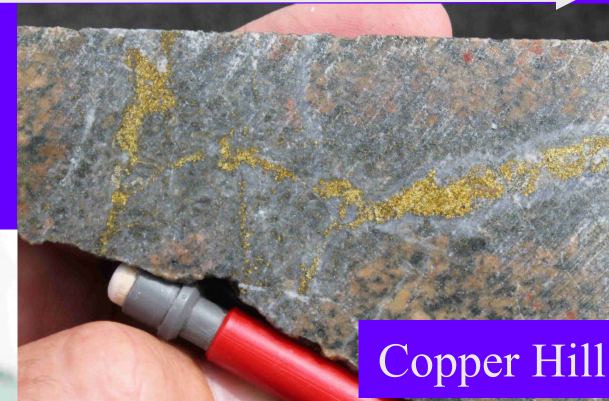
Barren M vein
Wonogiri, Indonesia

B and C veins

A M B time C D vein



B veins Goonumbla

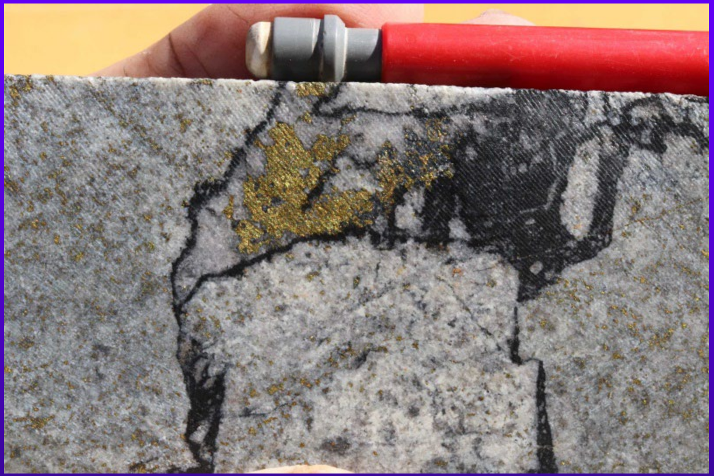


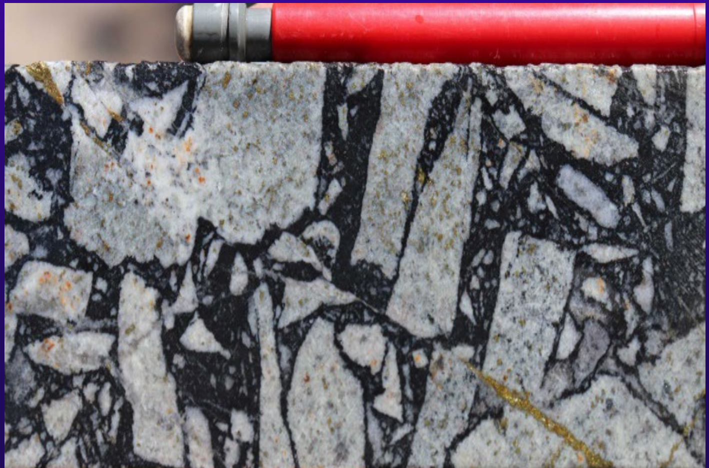
Copper Hill

C veins Grasberg, Indonesia

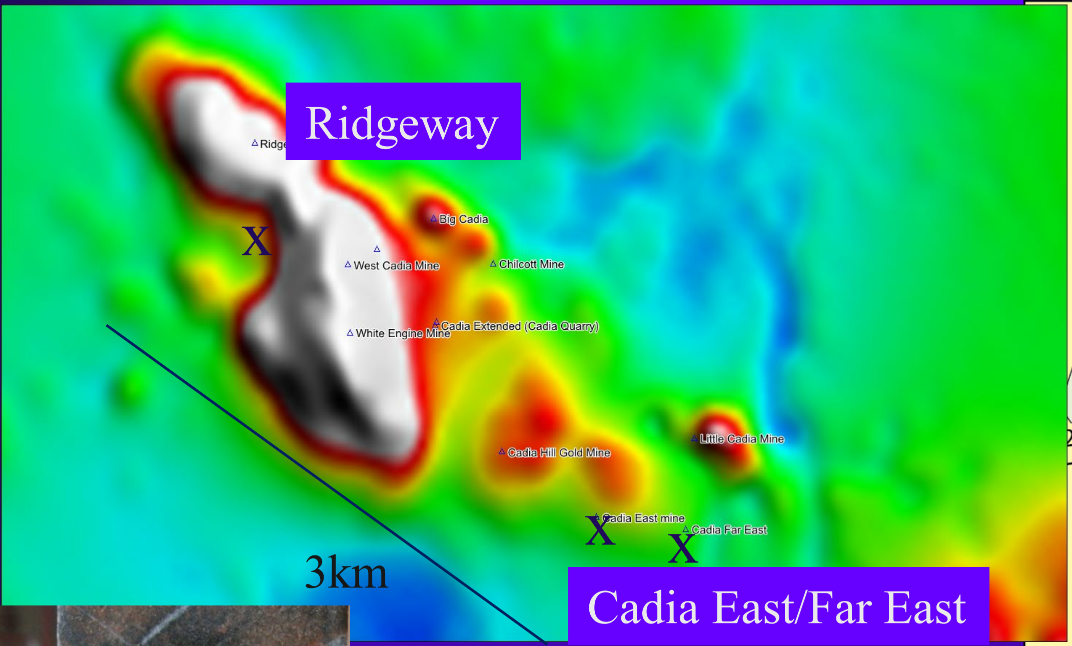
Cu-tourmaline breccias – Rio Blanco-Los Bronces, Chile

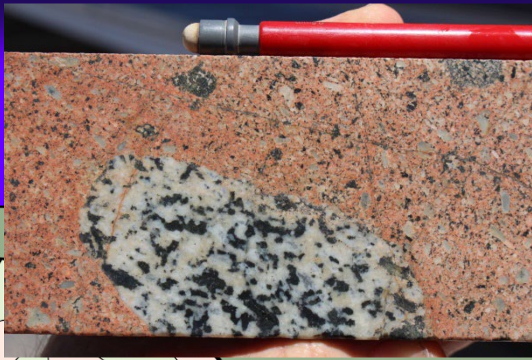
Combined:
24 Bt @ 0.66-0.7% Cu

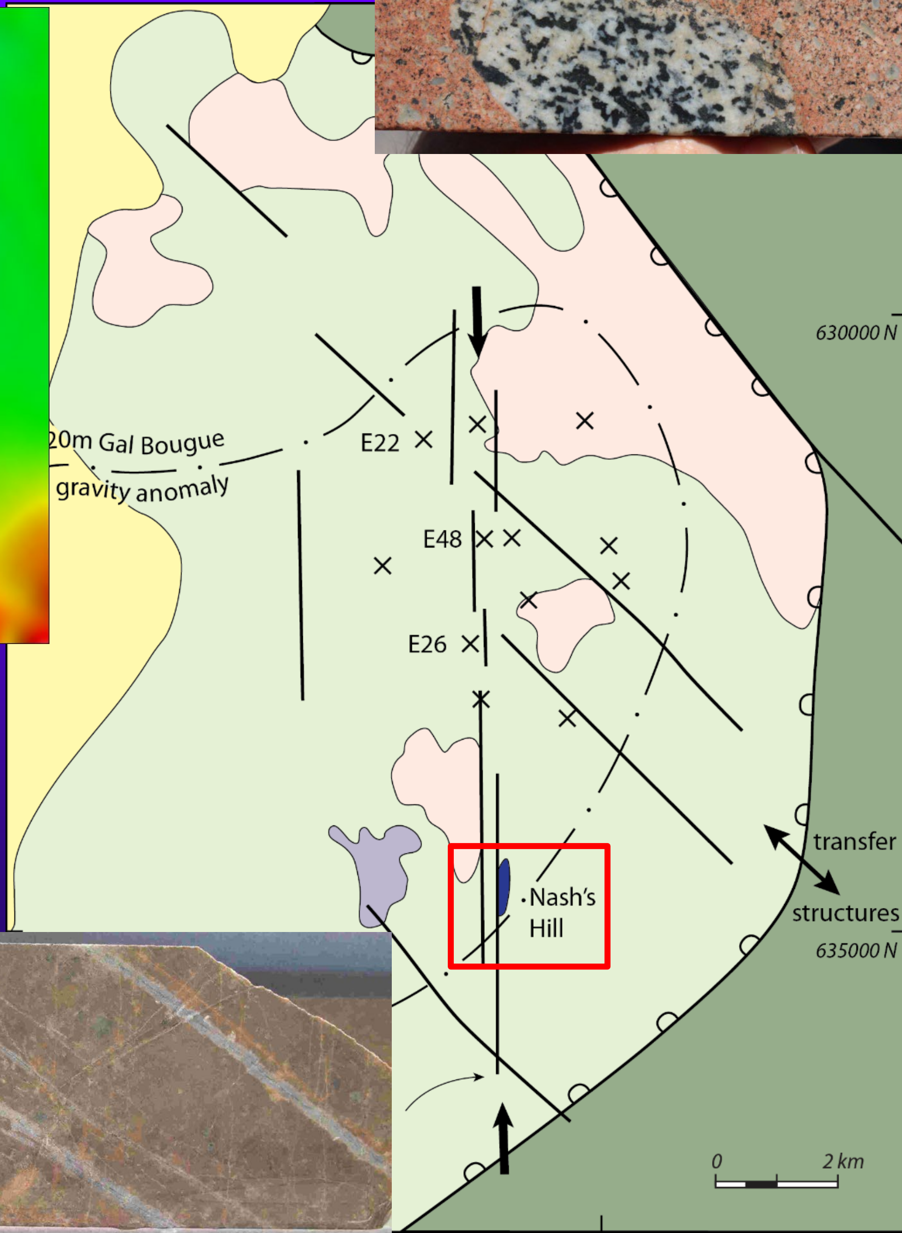




Magmatic sources

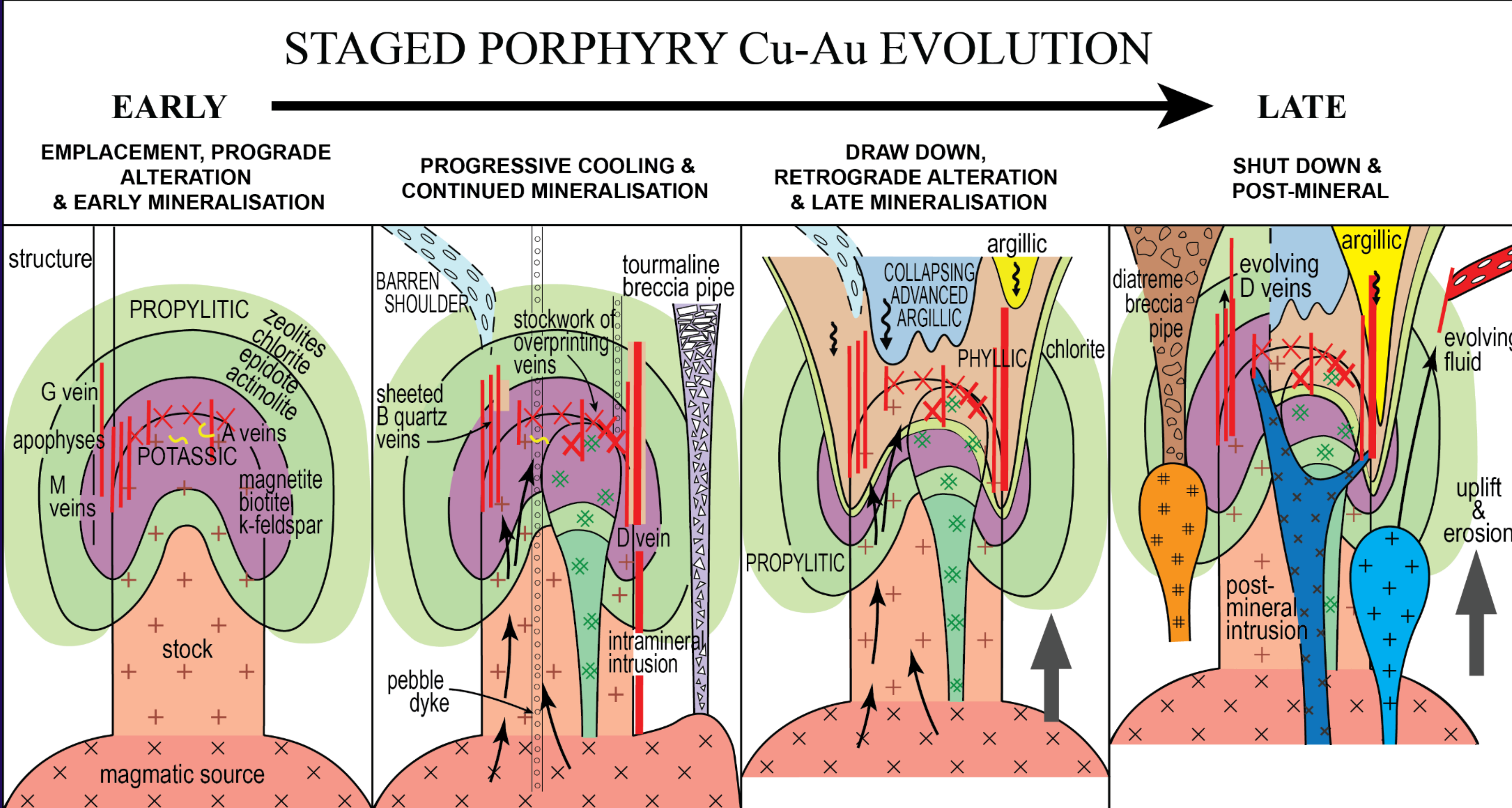






- Batholith source
  - Apophyses
  - Dilatant structures

D veins



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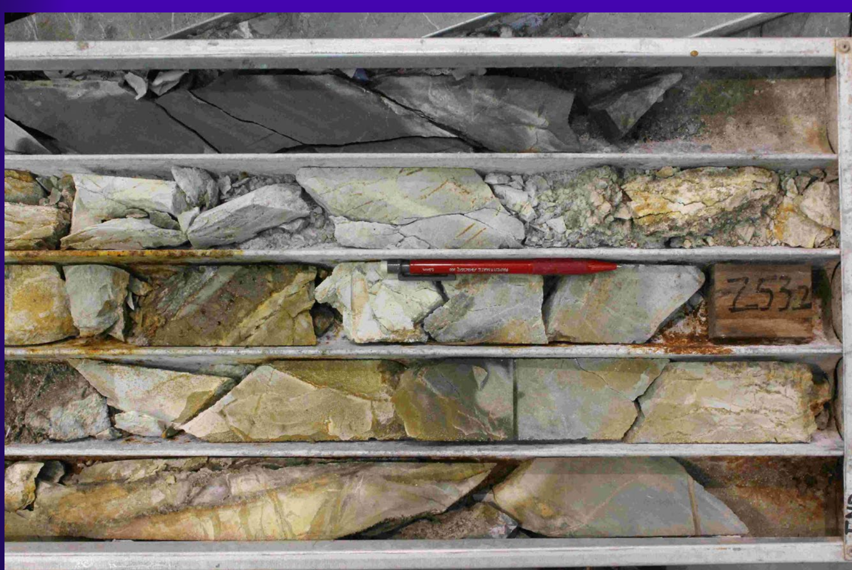
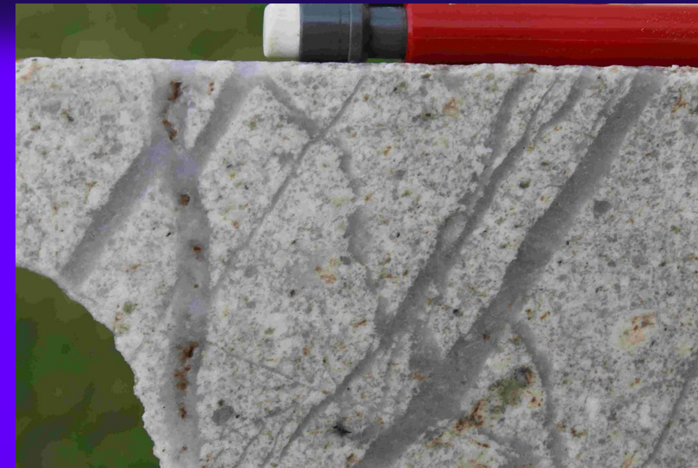
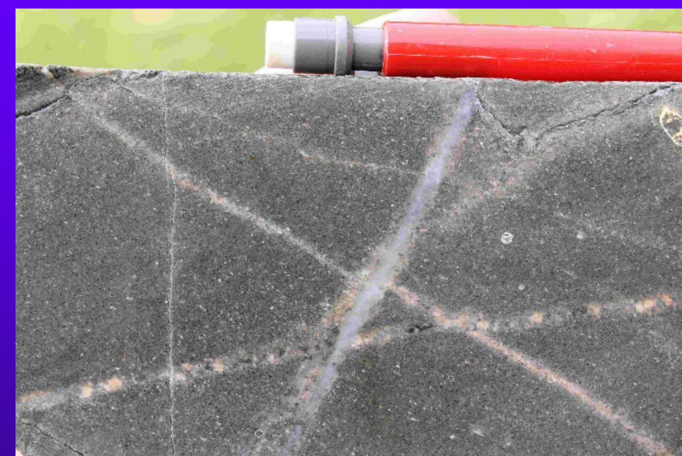
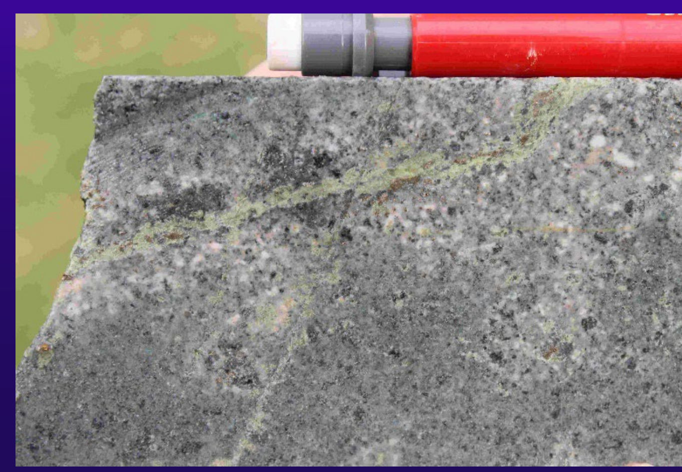
Stavely 2012 for the Geological Survey of Victoria

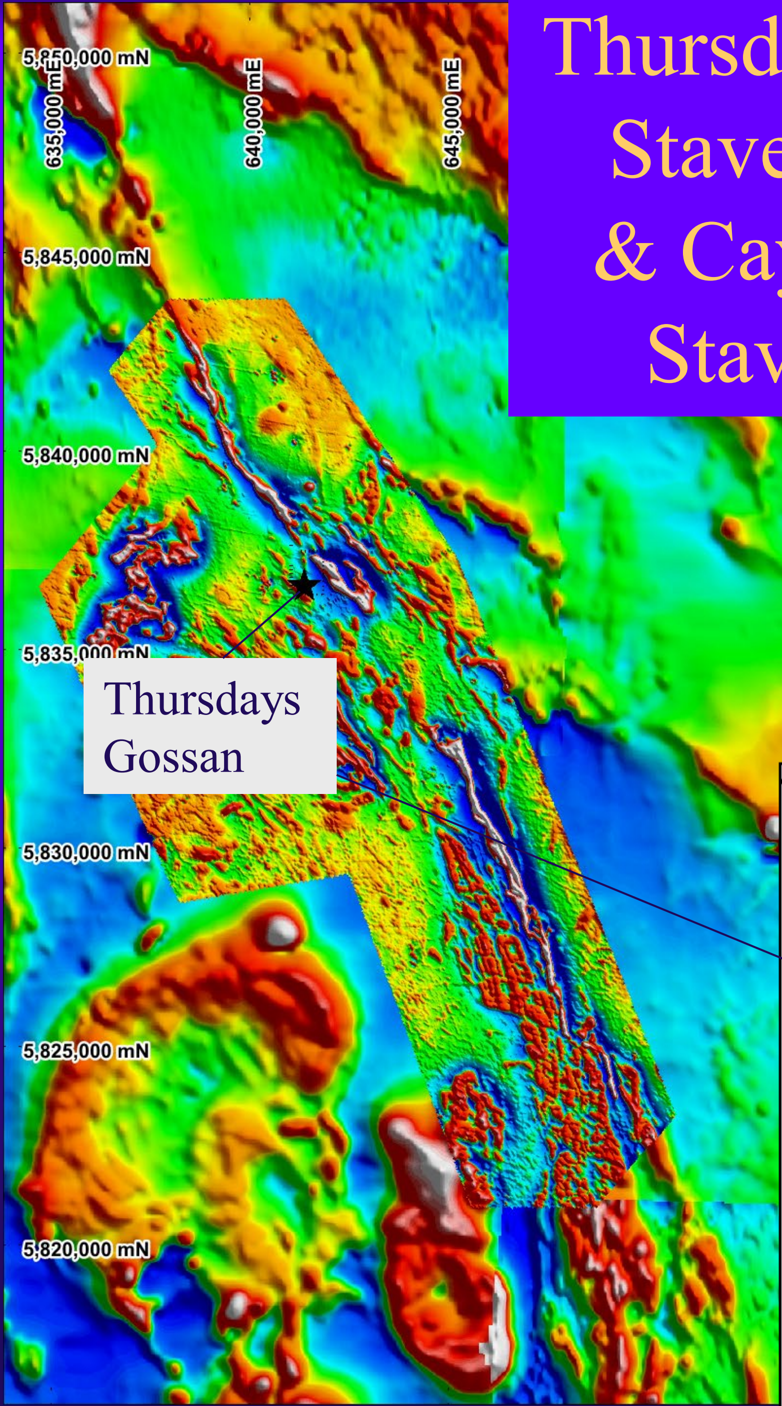


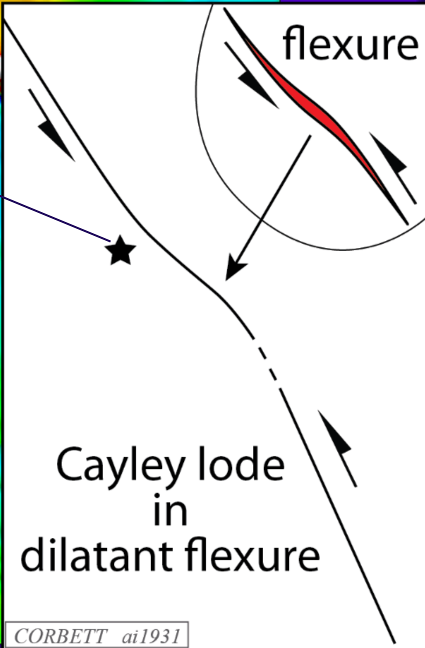




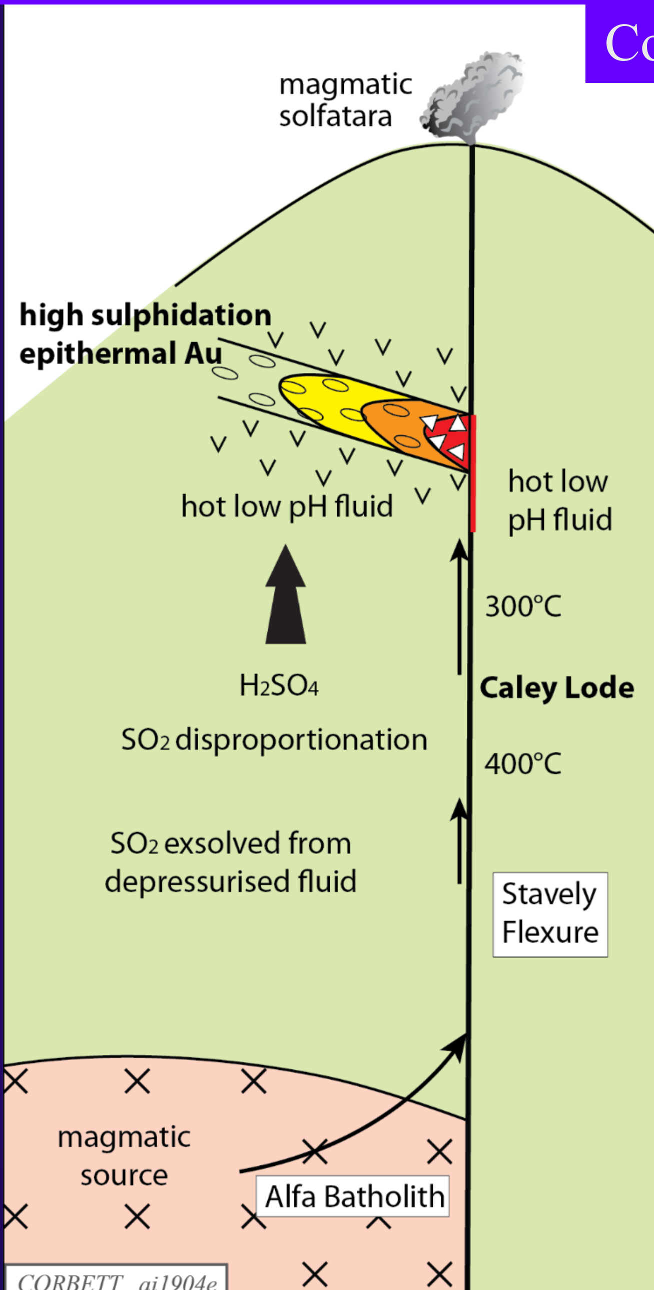


Thursdays Gossan
Stavely Flexure
& Cayley Lode
Stavely, Vic

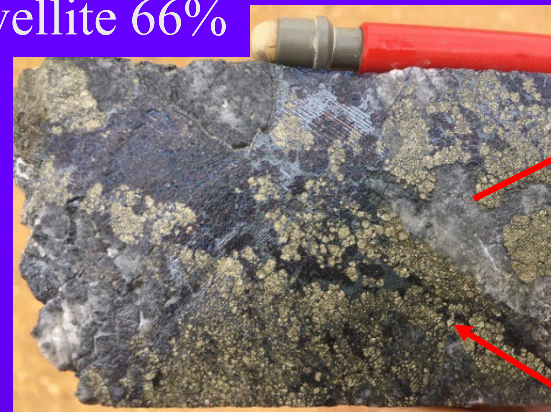




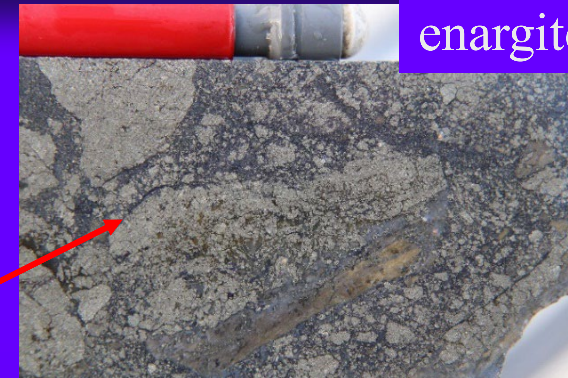
Fluid evolution - Cayley Lode



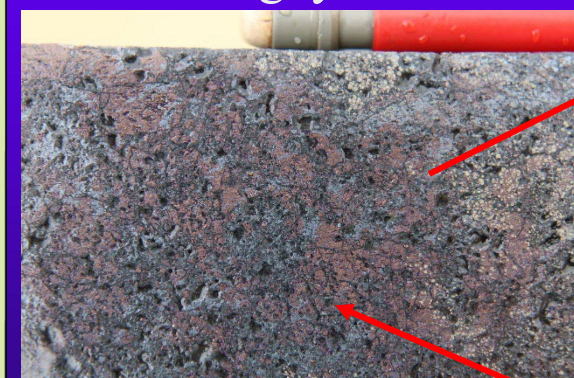
Covellite 66%



enargite



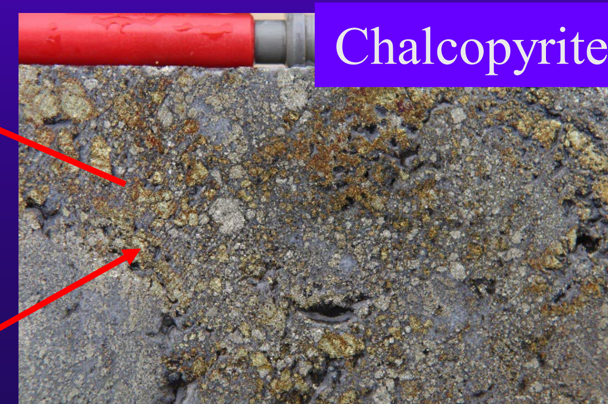
Bornite-vughy silica 63%



Chalcocite-vughy silica 80%

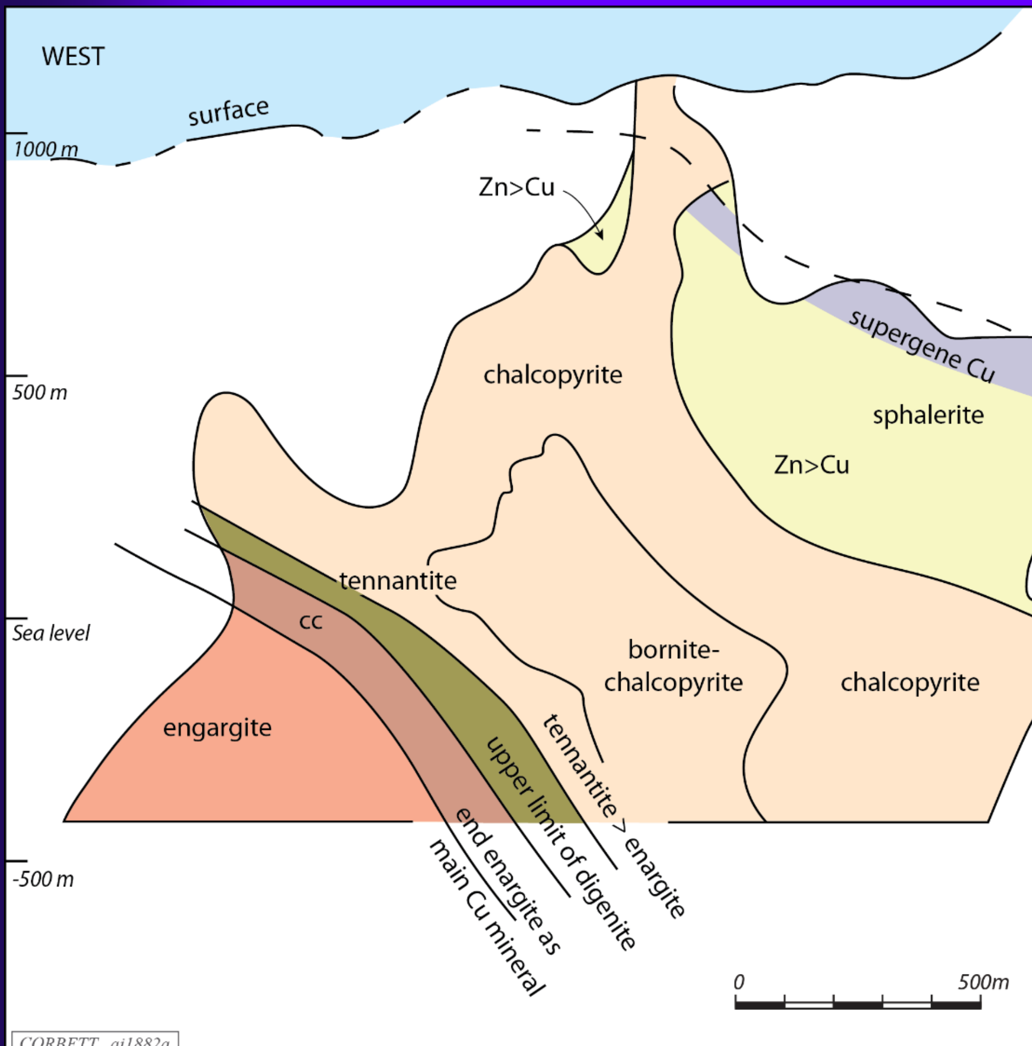
D vein massive pyrite

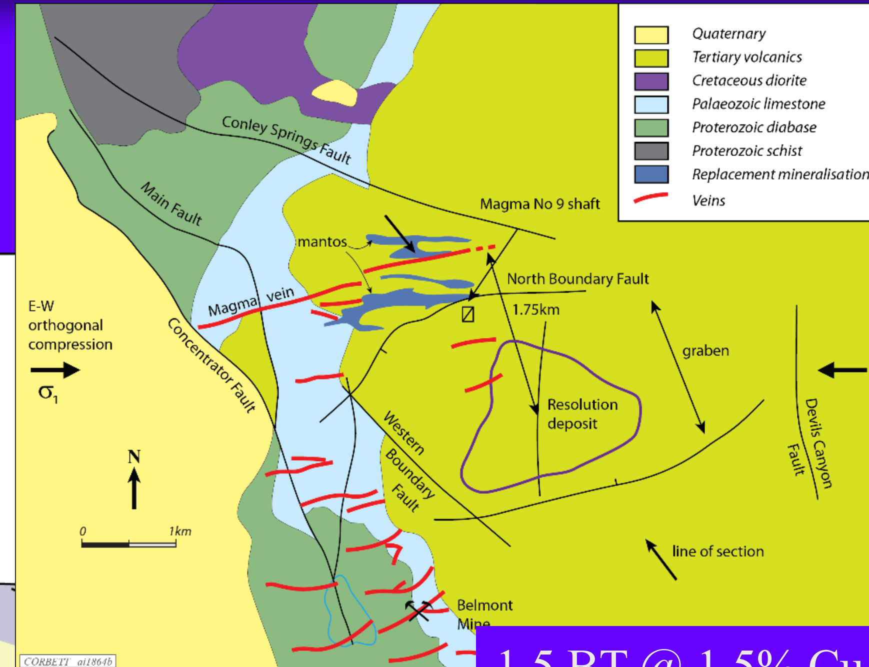
Chalcopyrite



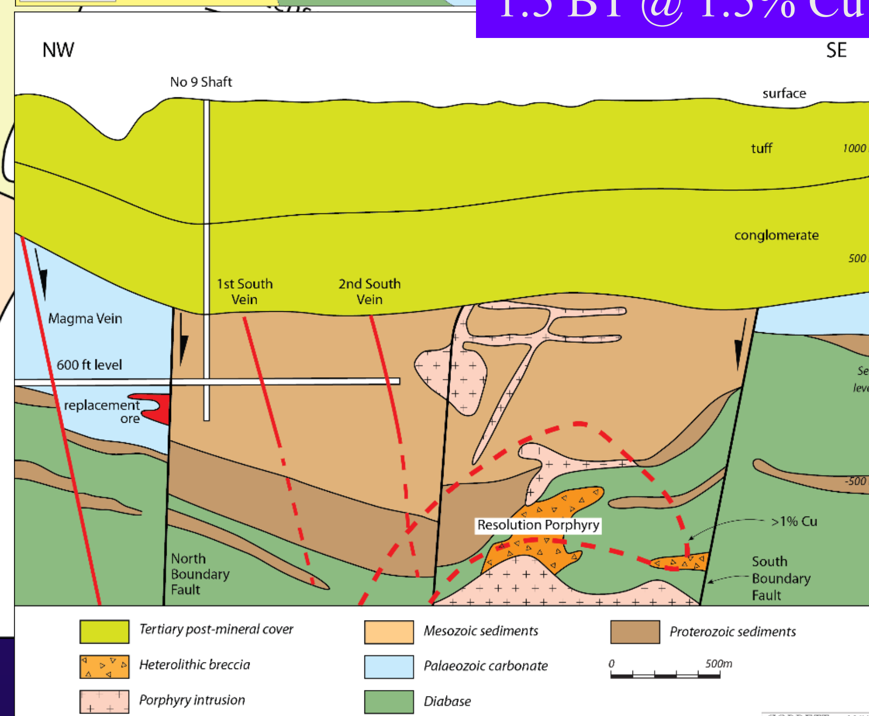
35% Cu

Magma vein – Resolution porphyry



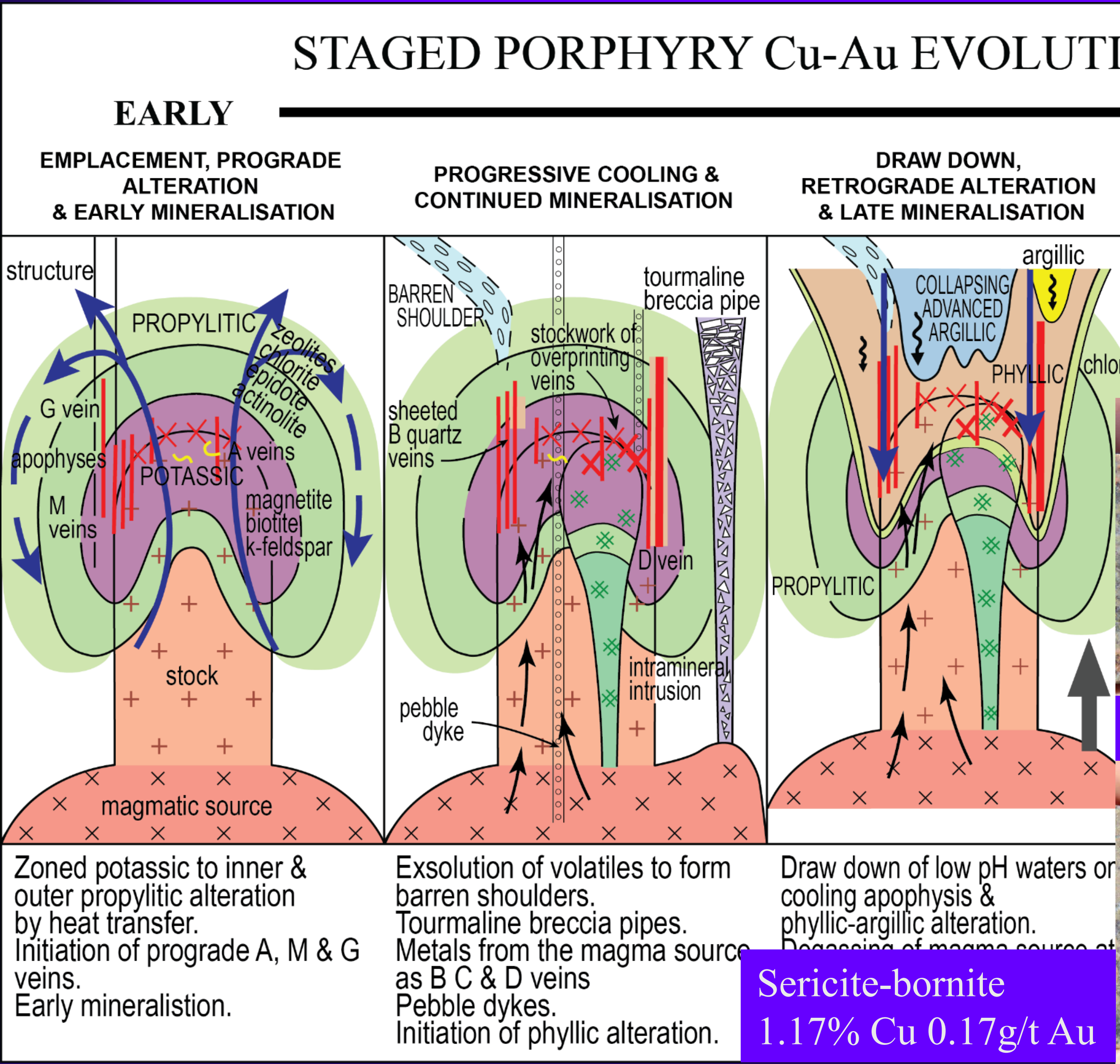


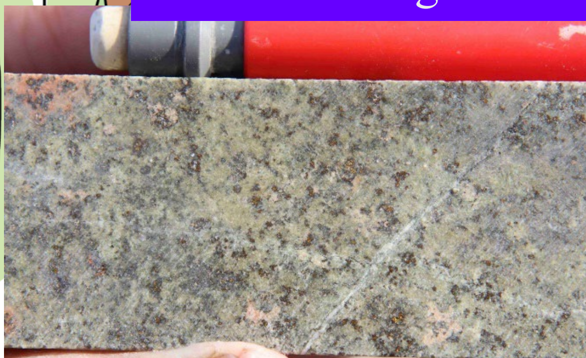
1.5 BT @ 1.5% Cu



Production of 1.3 M t Cu mined at 4.9%

Phyllic alteration



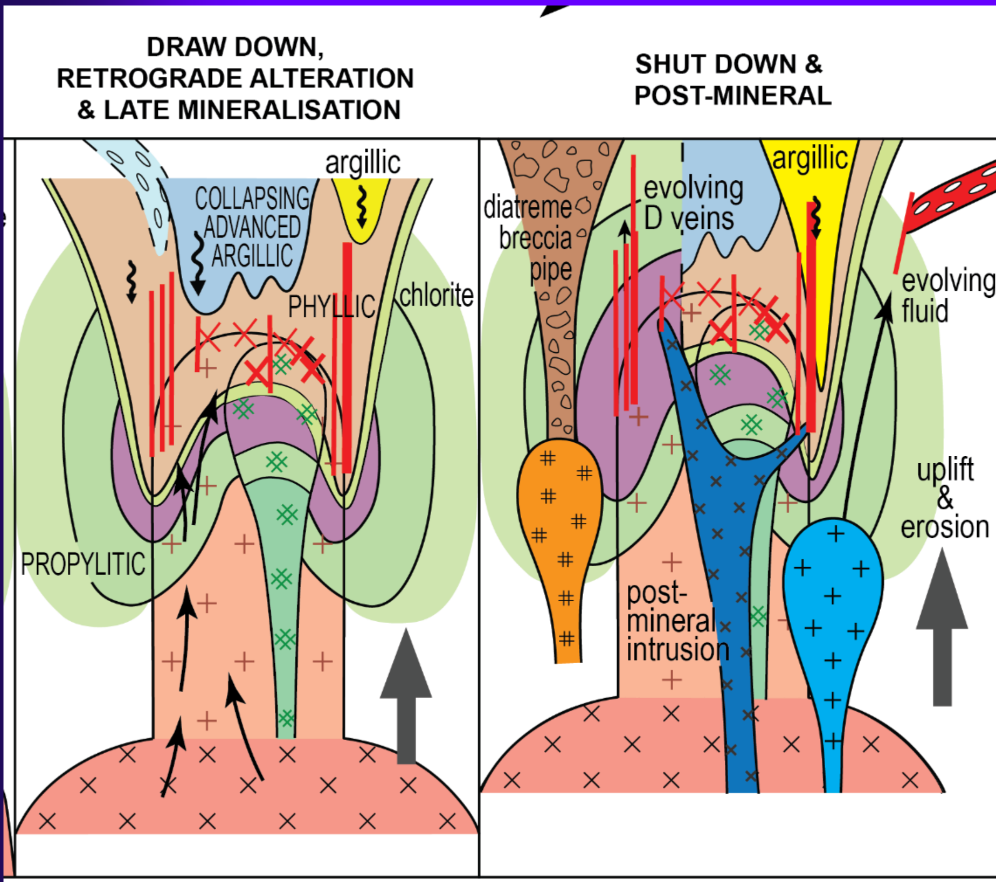


Sericite-chalcopyrite
1.48% Cu 0.1g/t Au

Goonumbla

Sericite-bornite
1.17% Cu 0.17g/t Au

Entry of additional meteoric waters and clay alteration



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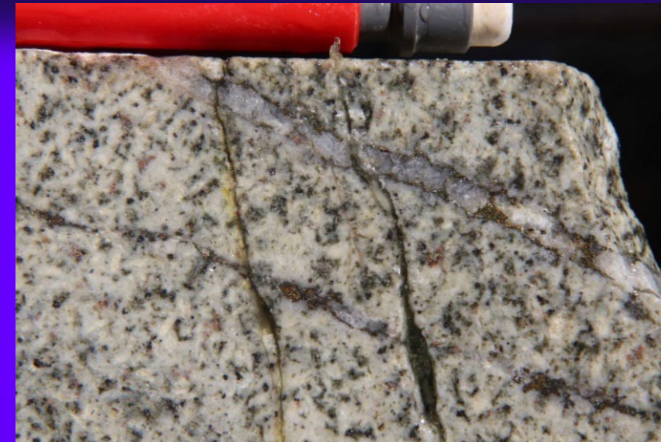
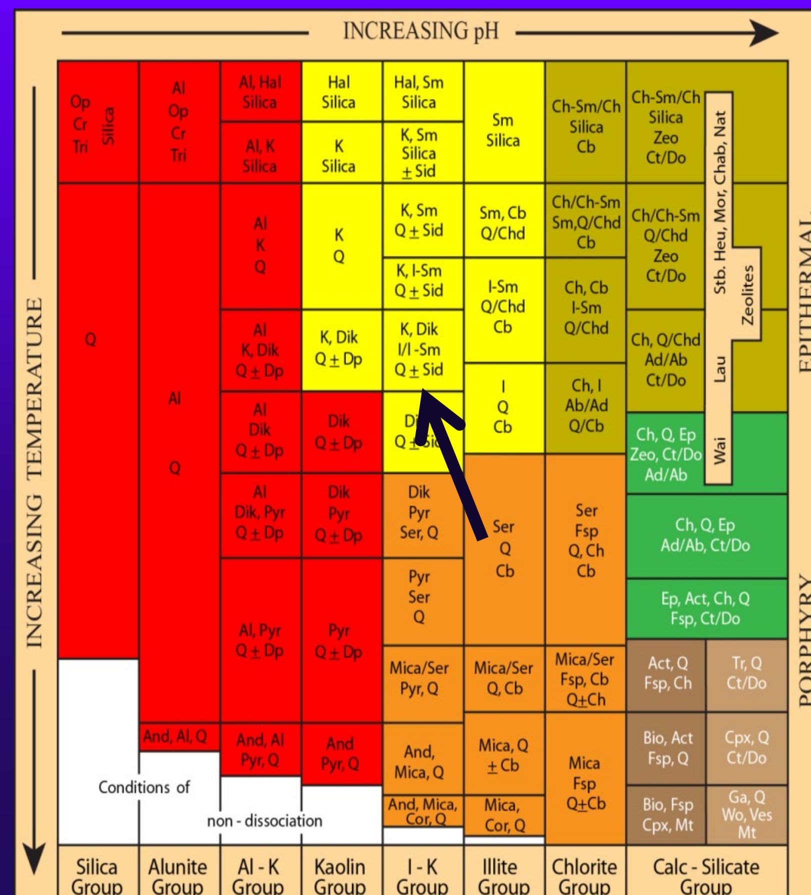


Didipio sericite-illite kaolinite chlorite



Lithocaps

STAGED PORPHYRY Cu-Au EVOLUTION

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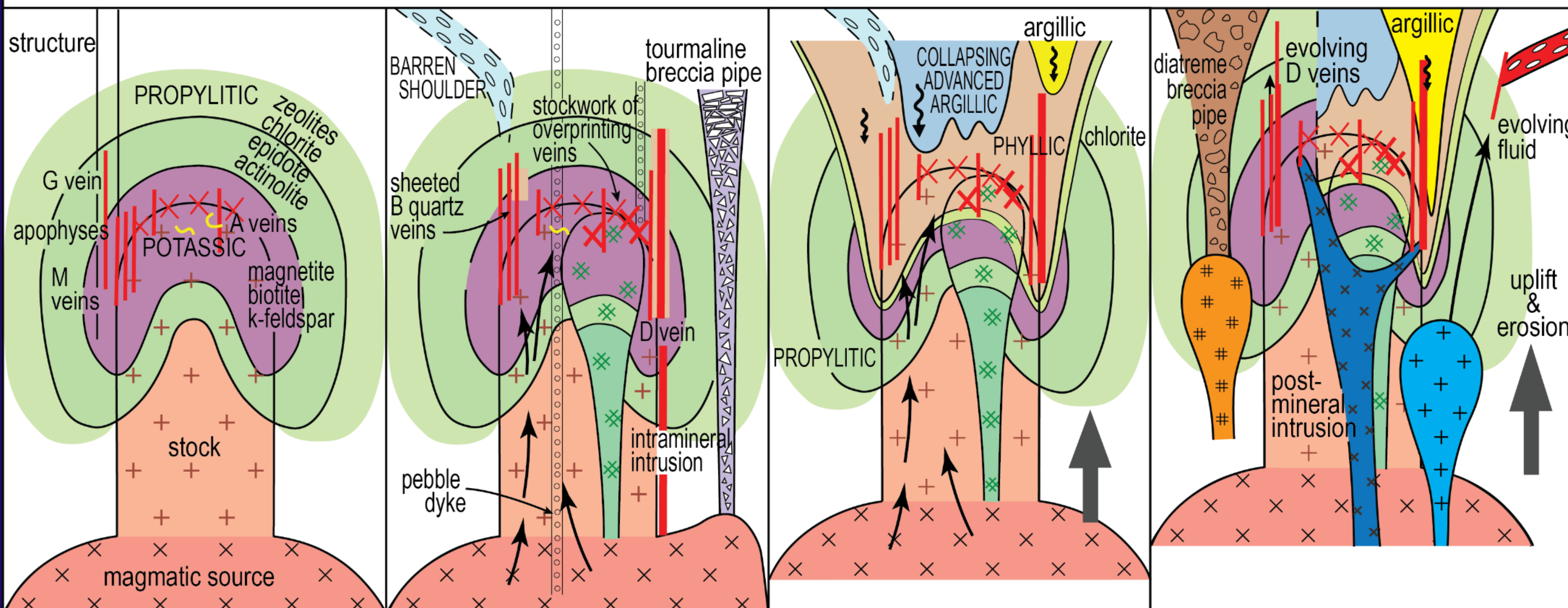

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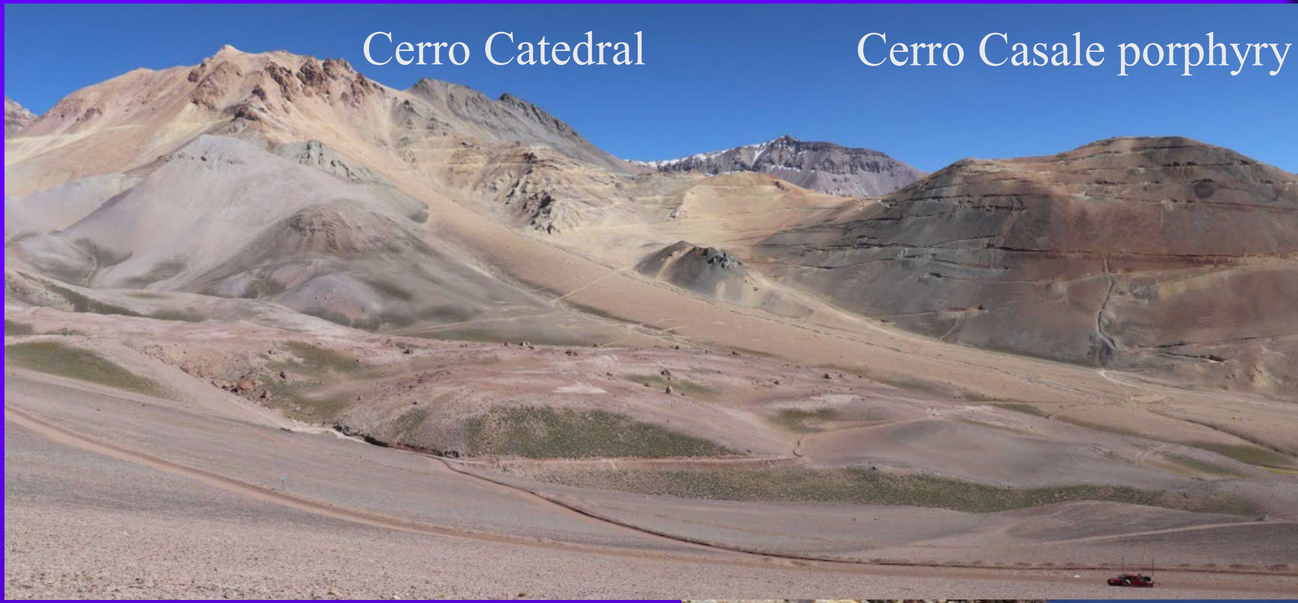
Barren shoulders of zoned advanced argillic alteration

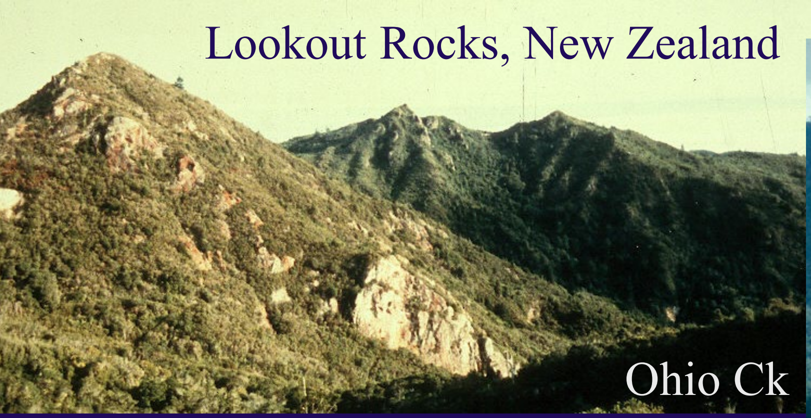
Nash's Hill, Goonumbla



Cerro Catedral

Cerro Casale porphyry

Cerro Catedral structures



Lookout Rocks, New Zealand

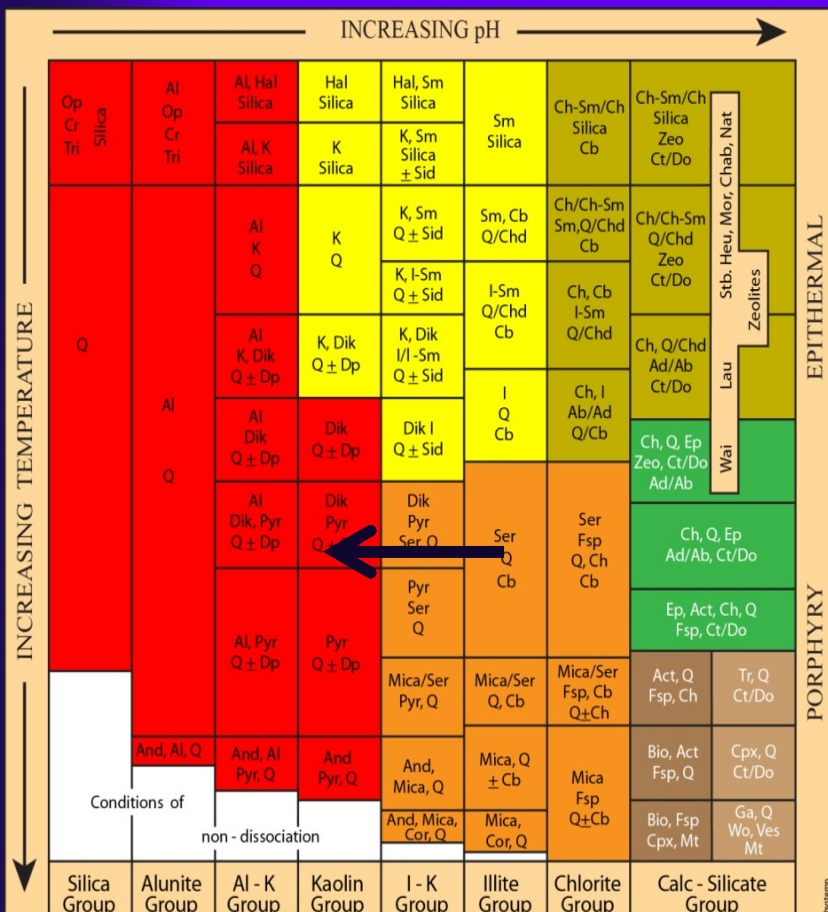
Ohio Ck porphyry

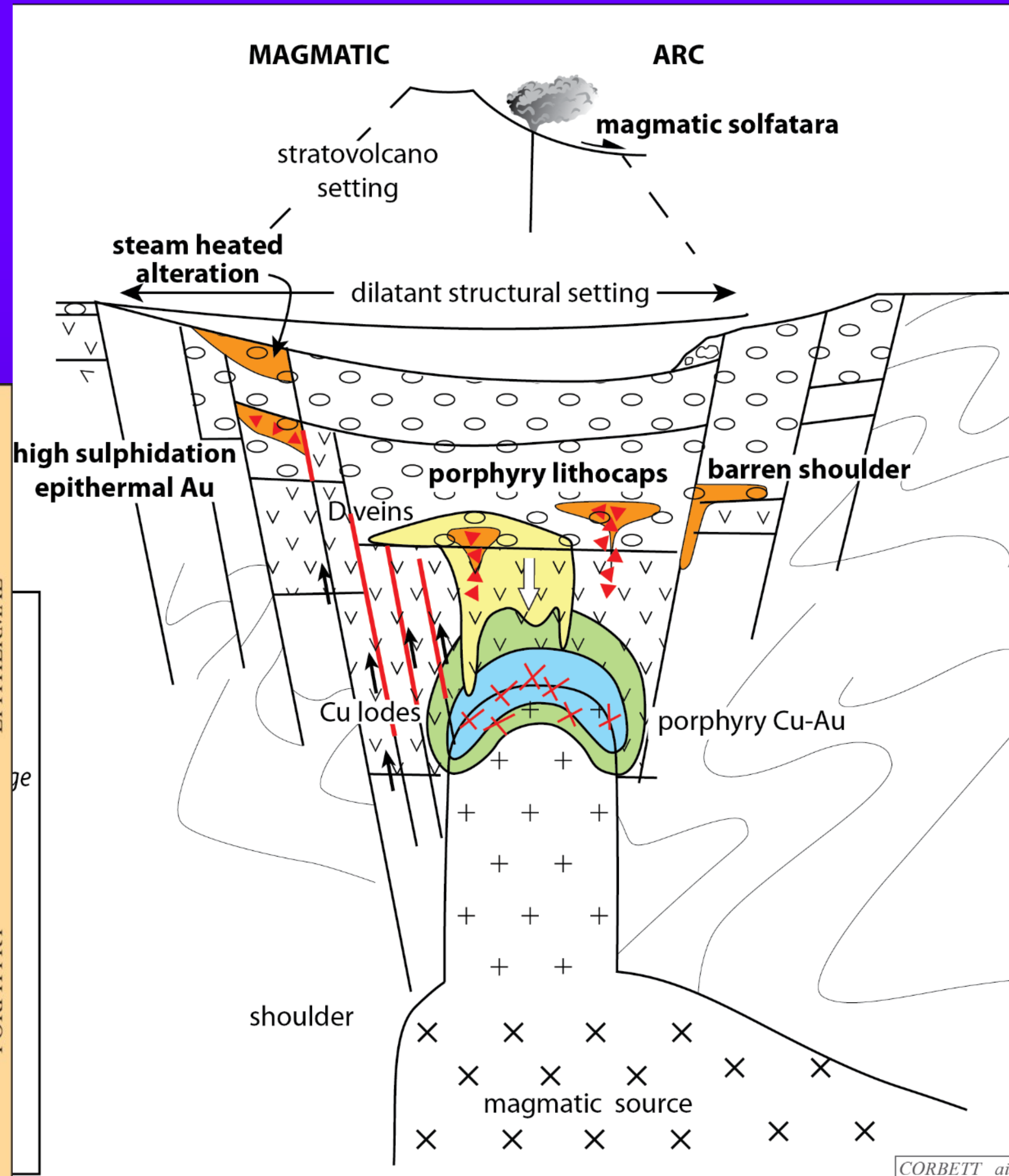
Ekwai Debom
Frieda river, PNG

Horse-Ivaal porphyry

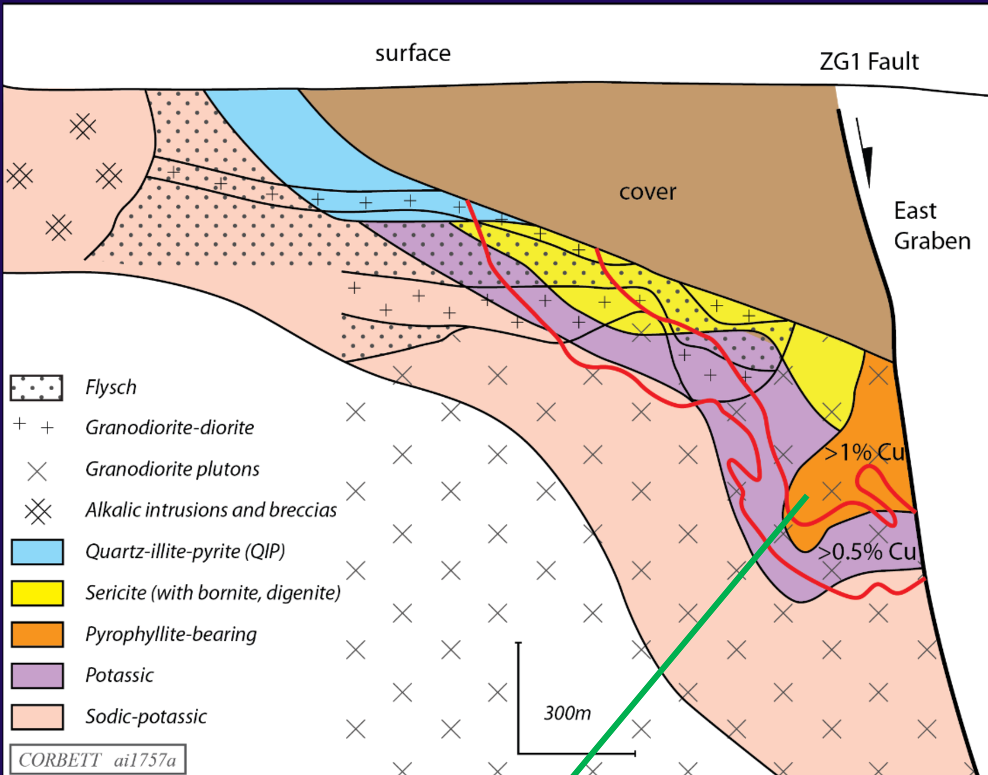
Porphyry-related lithocaps AAA within phyllic alteration

From Corbett and Leach, 1998



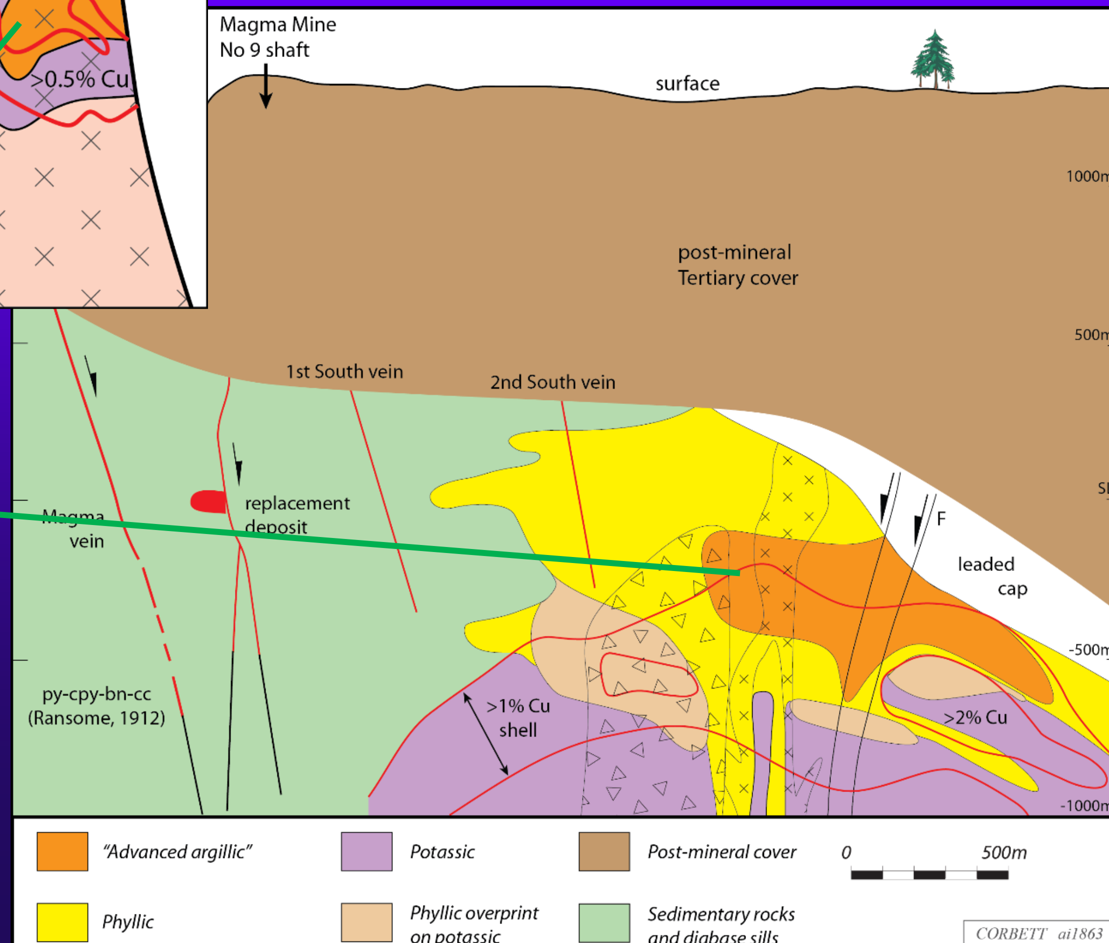


Porphyry lithocap advanced argillic alteration



Pebble, Alaska

“advanced argillic” enclosed by sericite overprints potassic

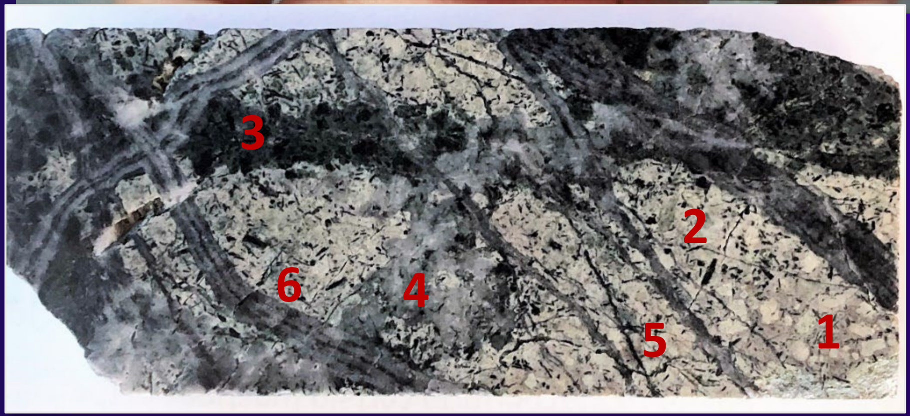


Resolution, Arizona

Best porphyry deposits are polyphasal

Contact
Namosi
Fiji

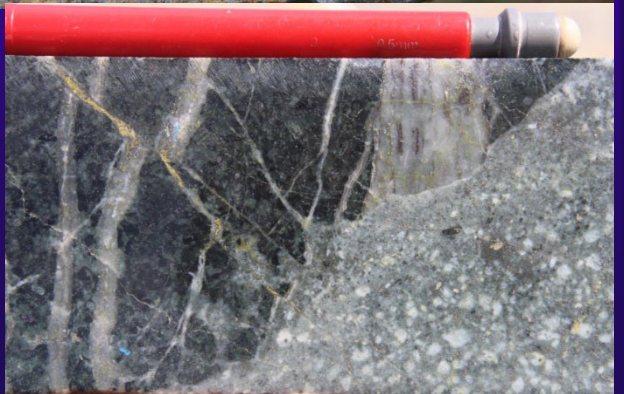
4 vein events
Ridgeway



6 events
Stavely

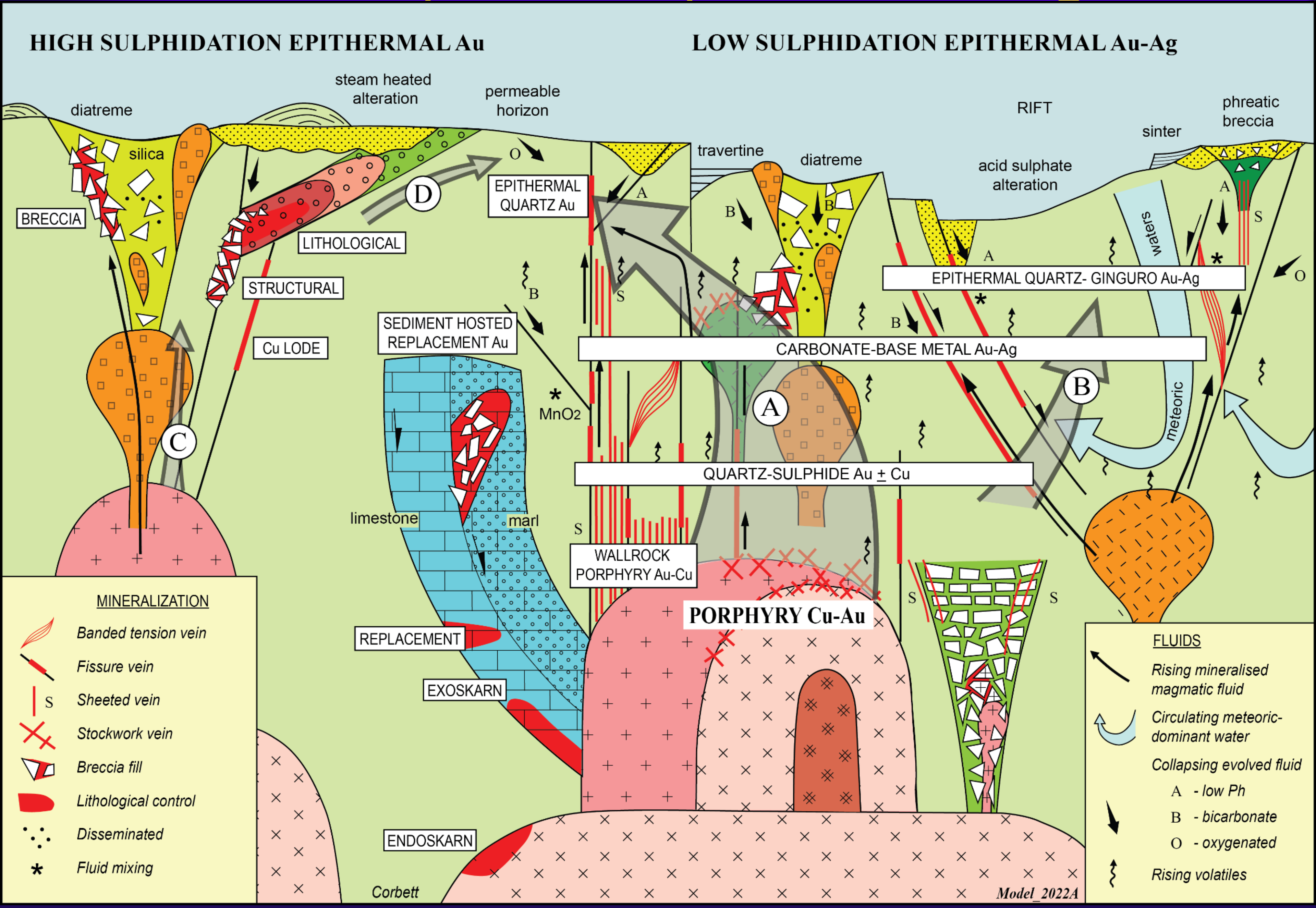
Residual quartz vein clasts La Arena, Peru

Konak
Turkey



Post-mineral intrusion, Marsden 'wipe out porphyry'

Low sulphidation epithermal Au-Ag



Quartz-sulphide Au ± Cu

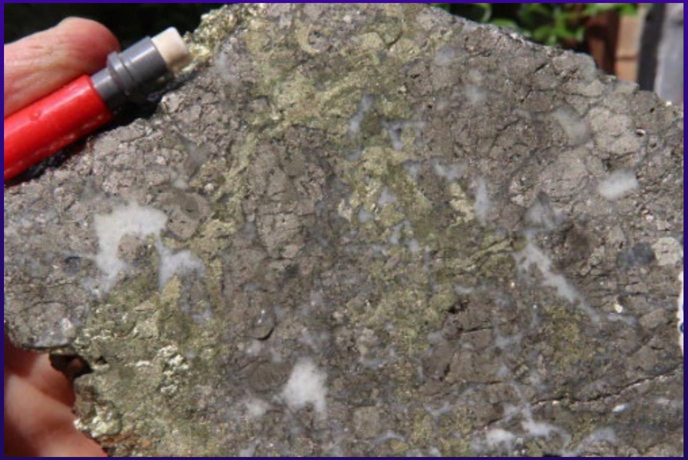
SHALLOW
Lihir Is. 13g/t

Adelong

Nolans in the Ravenswood

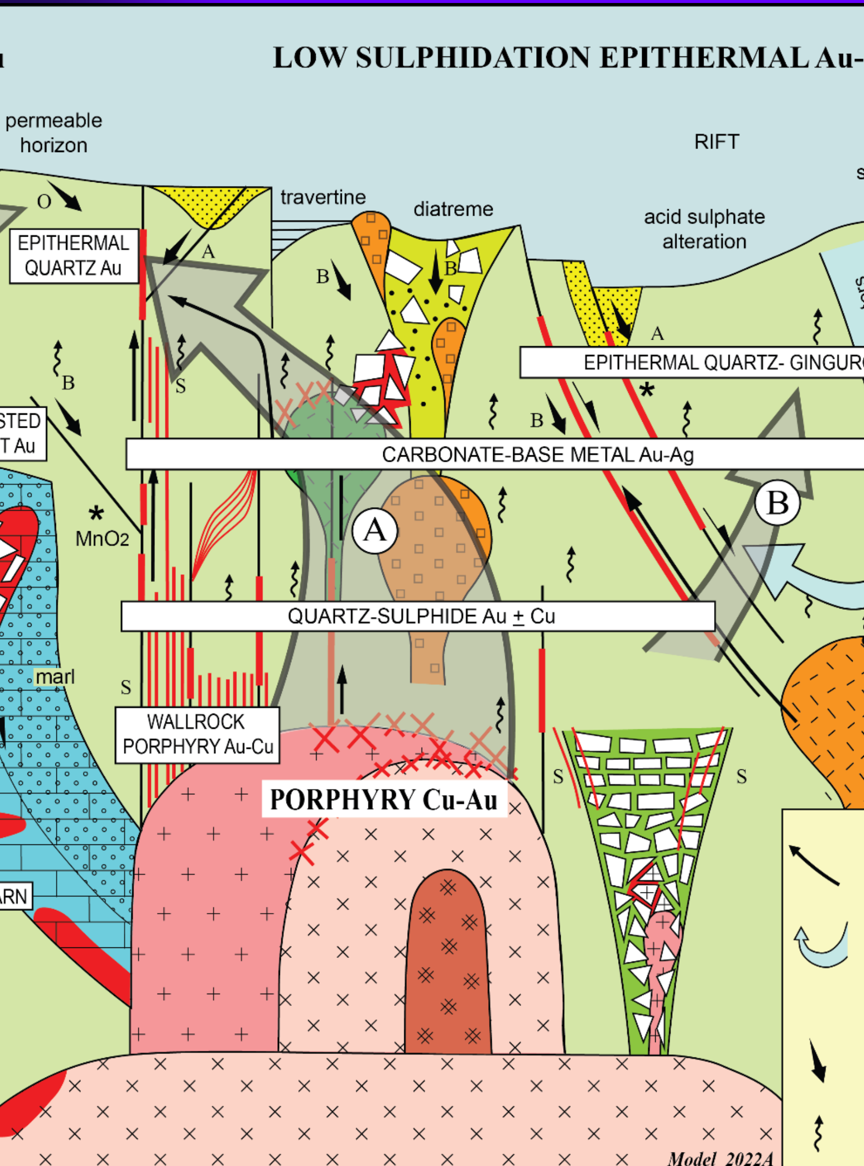
Mt Wright

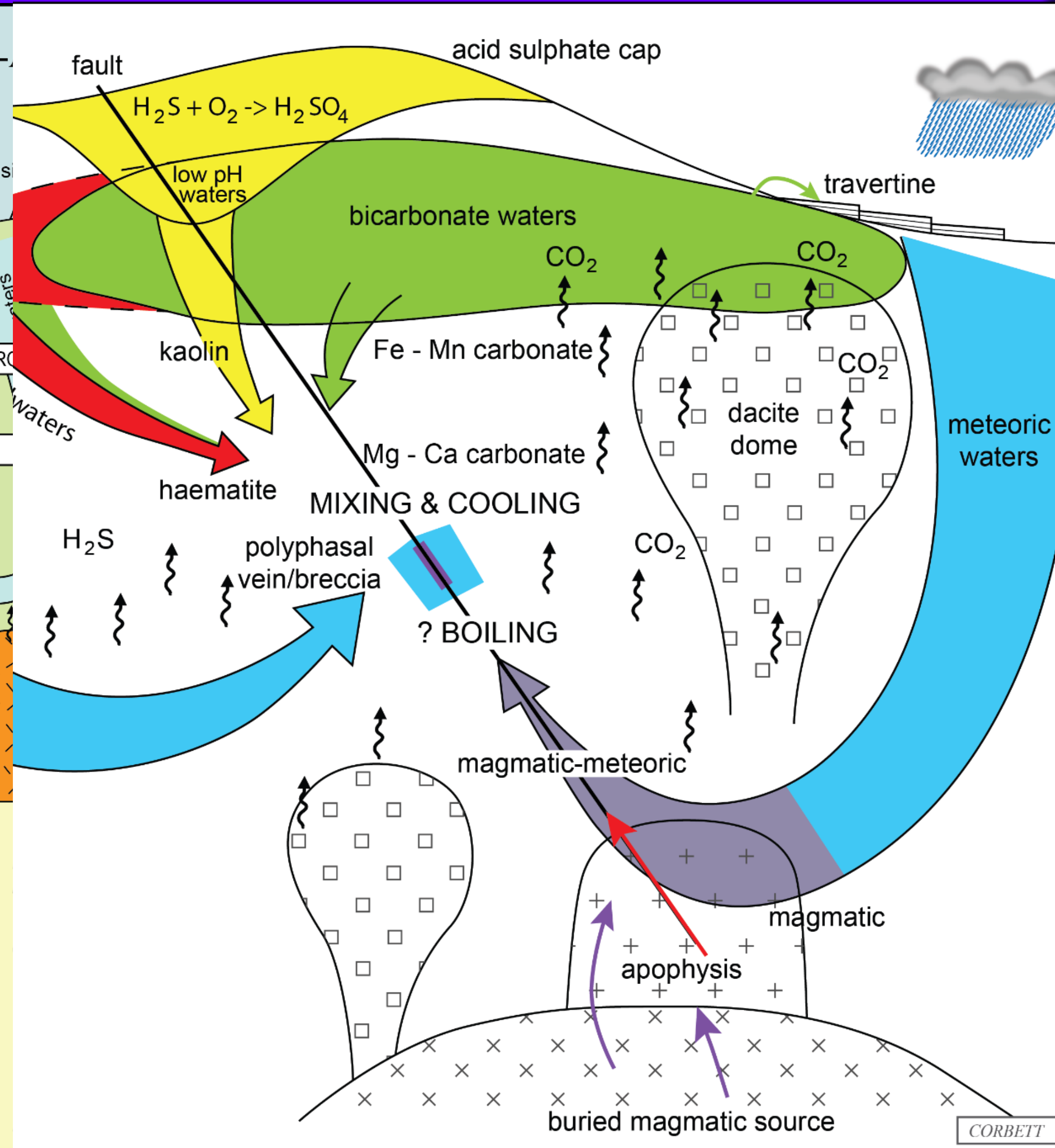
Mt Rawdon



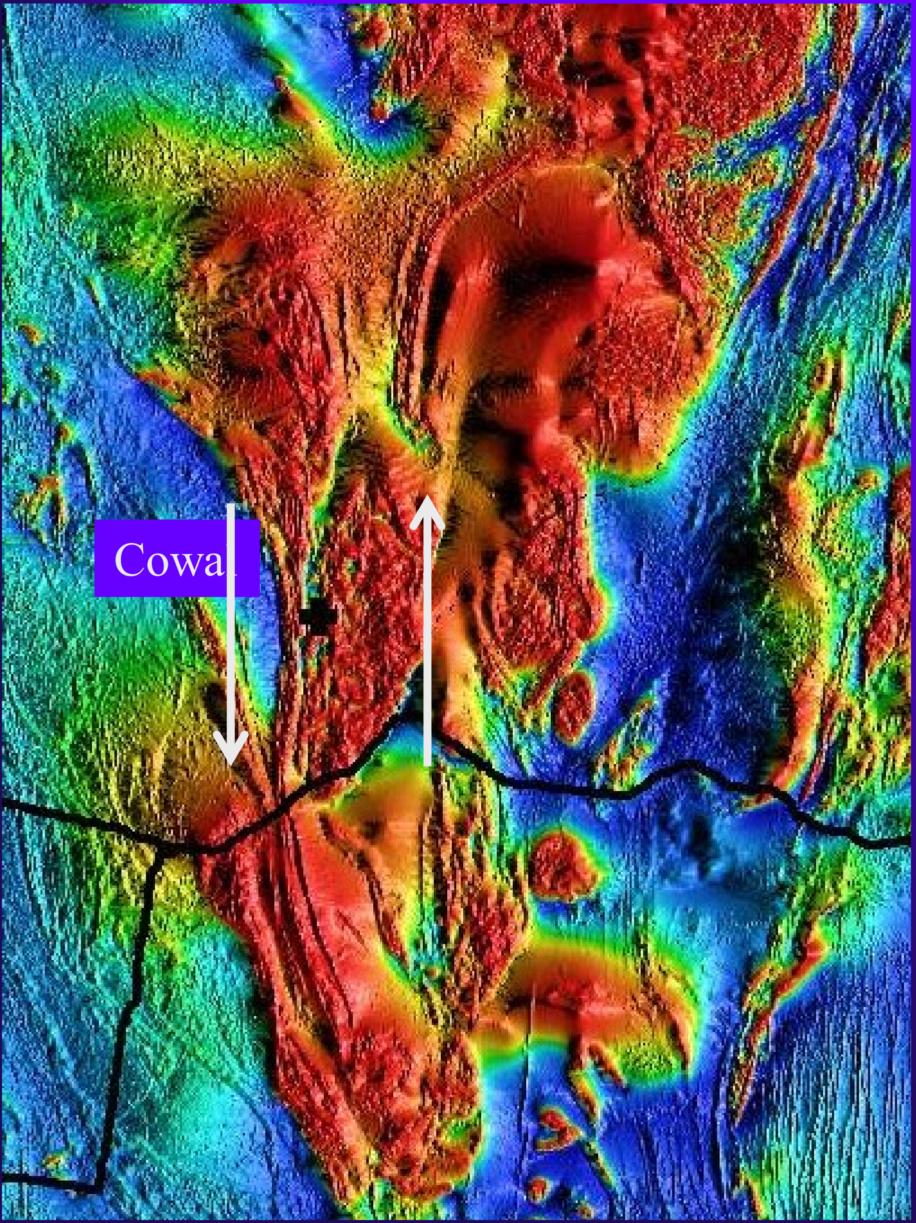
DEEP
Bilimoia/Kora

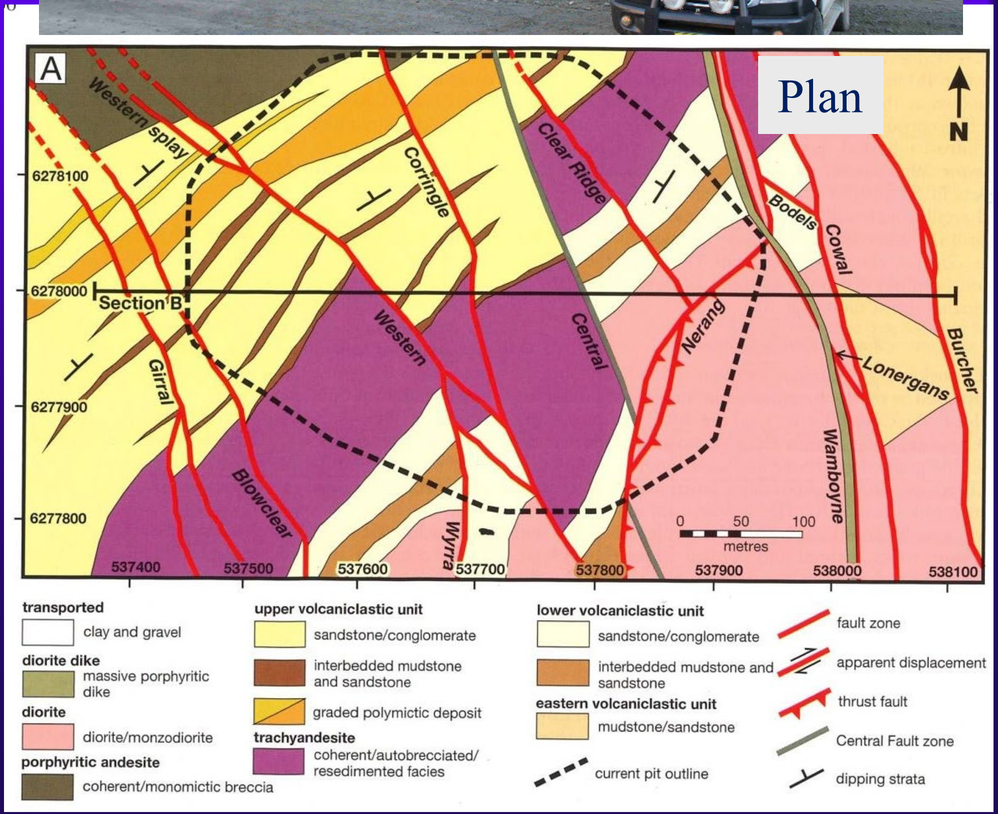
Low sulphidation carbonate-base metal Au deposits





Cowal, Australia

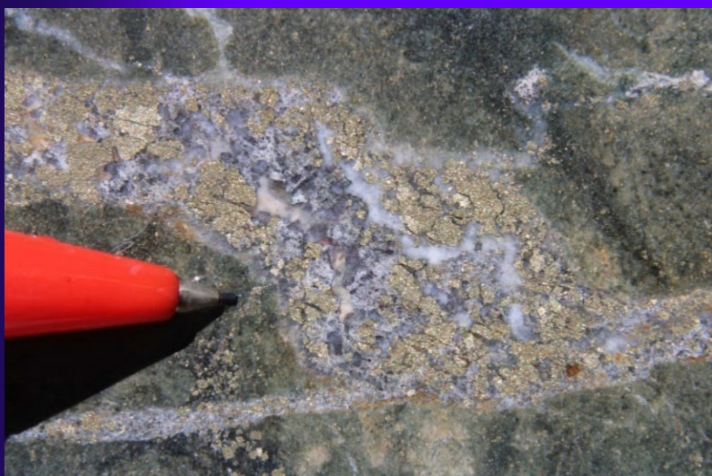




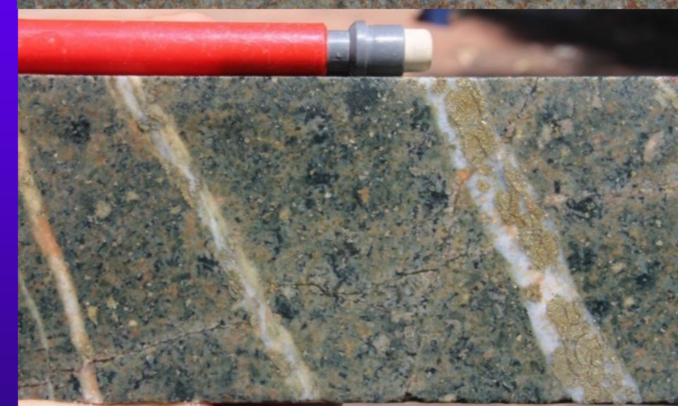
Cowal Londonderry
Carbonate-base metal Au

14 g/t Au

3.44 g/t Au



16.2 g/t Au

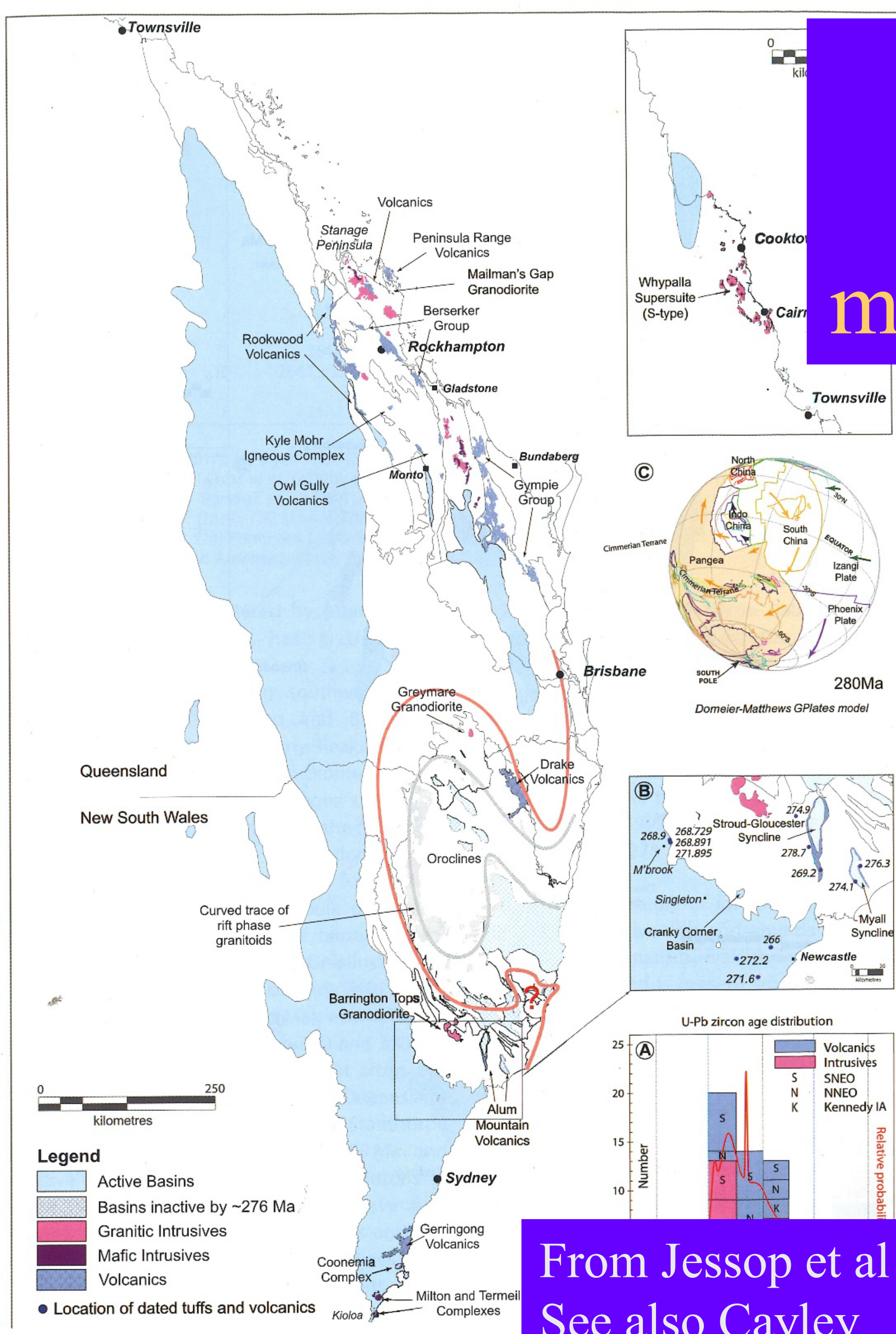


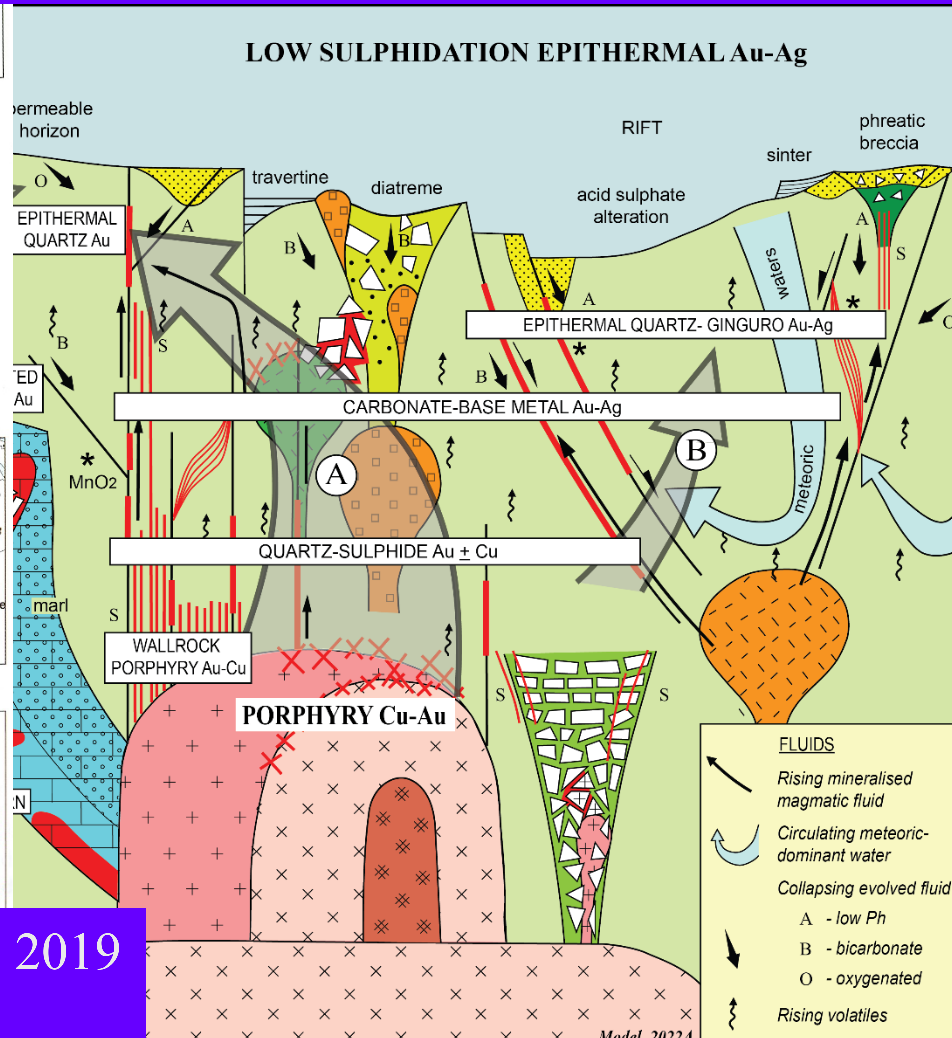
0.56 g/t Au

50 g/t Au

0.86 g/t Au

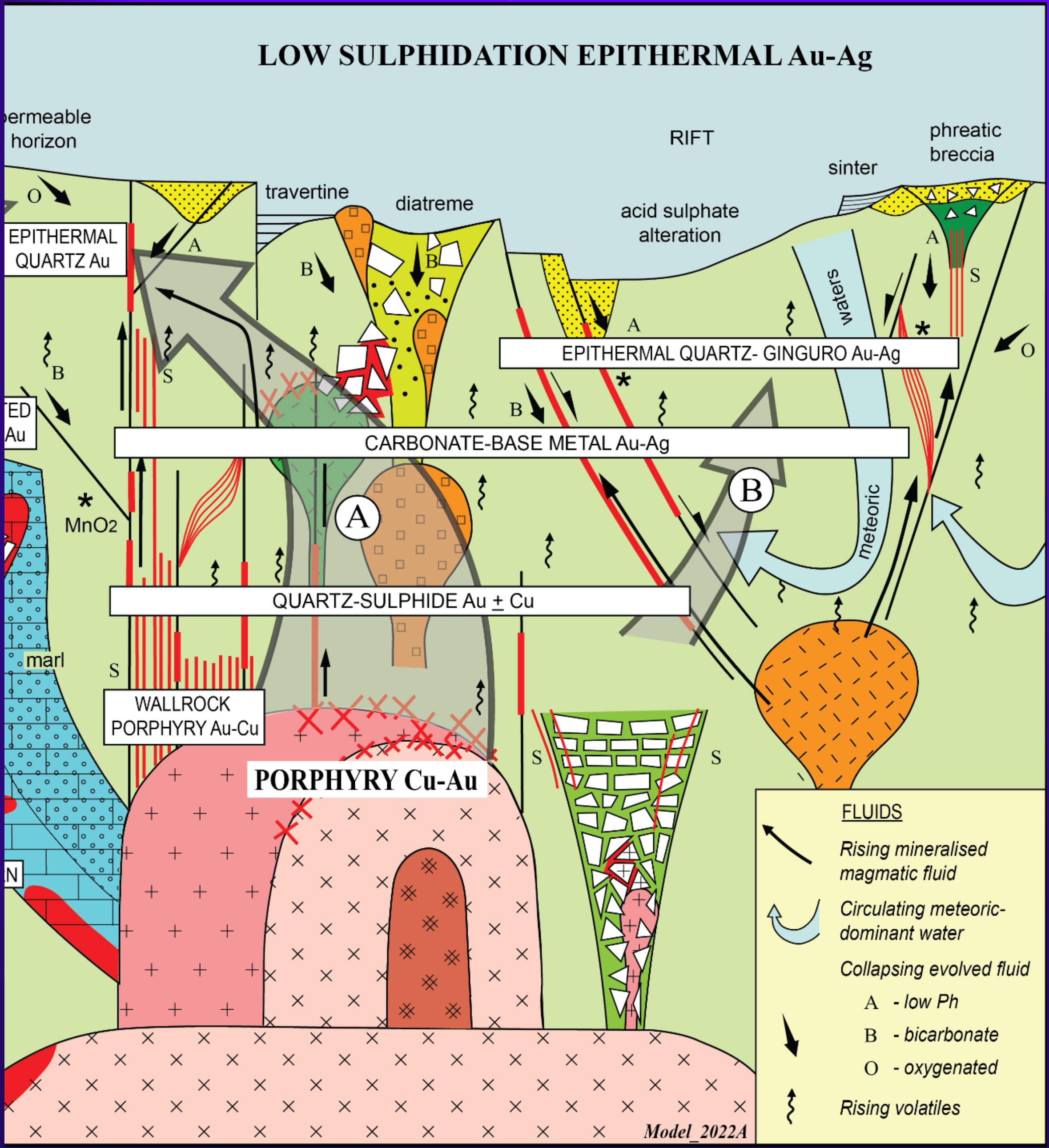
Tooloom and Drake Change form typical magmatic arc to extension

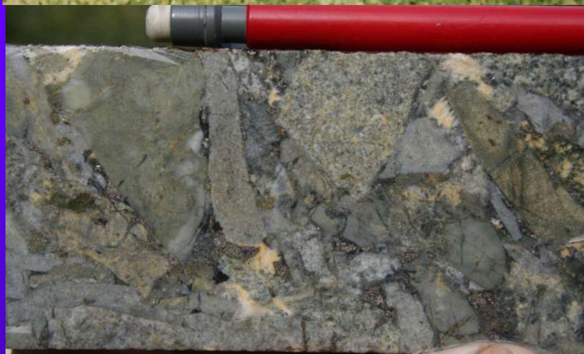




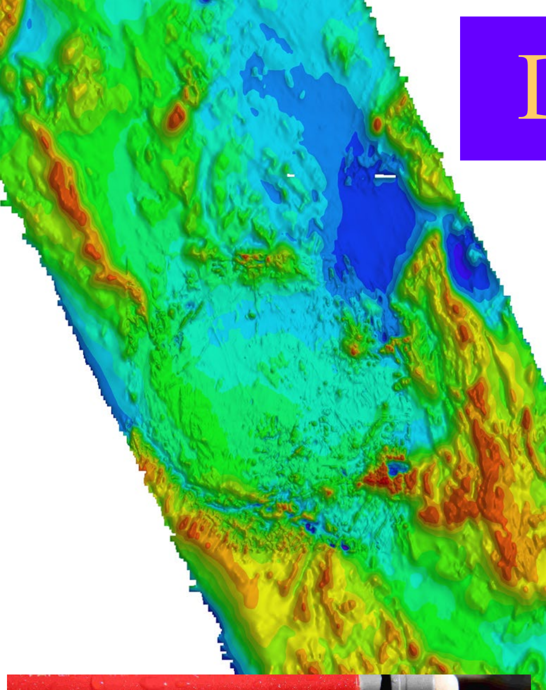
From Jessop et al 2019
See also Cayley

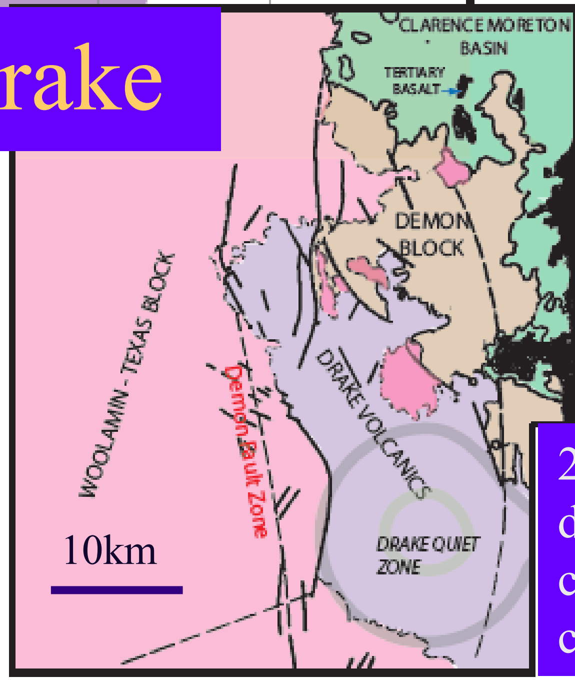
Tooloom - magmatic arc trend

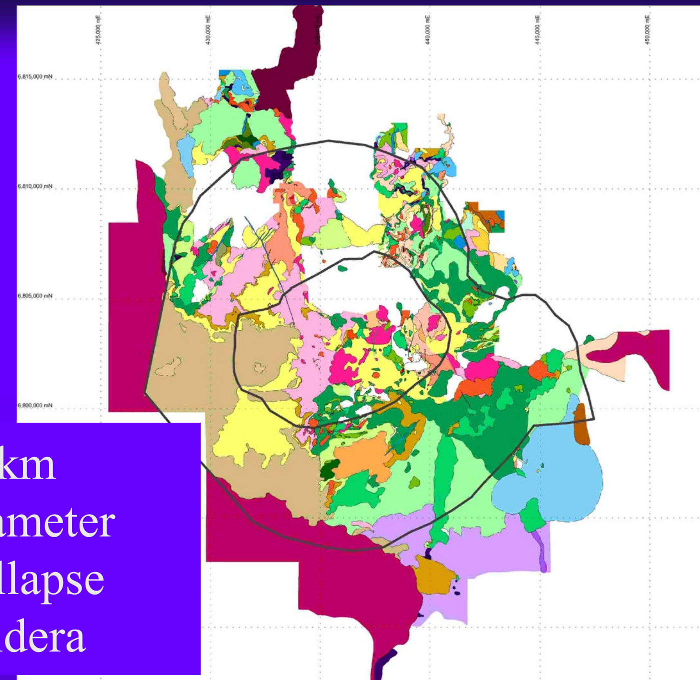




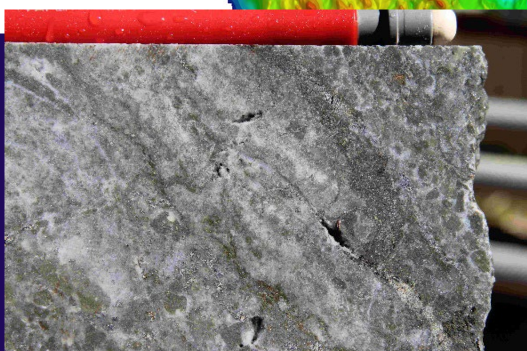
Drake





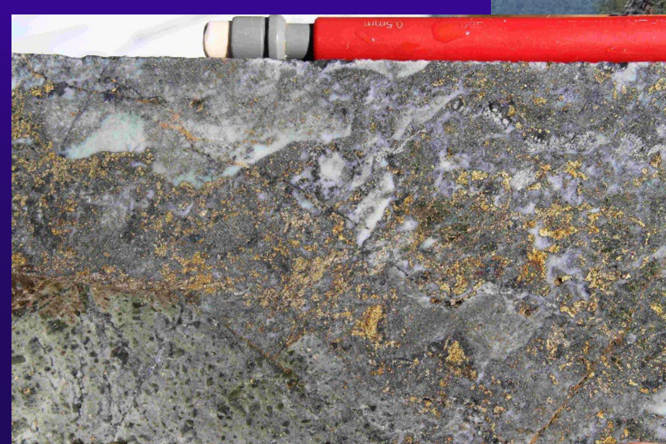


25km diameter collapse caldera



bedding plane shear

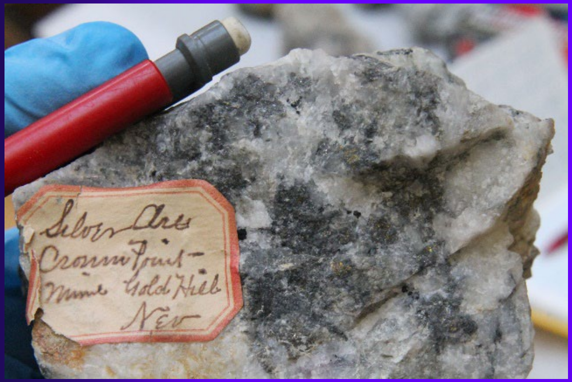
lode



felsic dome

99.7g/t Au, 3.17% Cu
231g/t Ag

Carbonate-base metal Ag-Au (polymetallic Ag-Au)

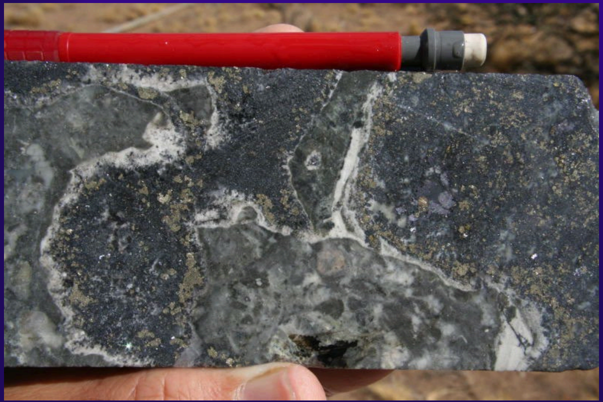


Comstock, Nevada
(Mckay Museum,
Reno)

Arcata, Peru

Caylloma Peru,
30,000ppm Ag

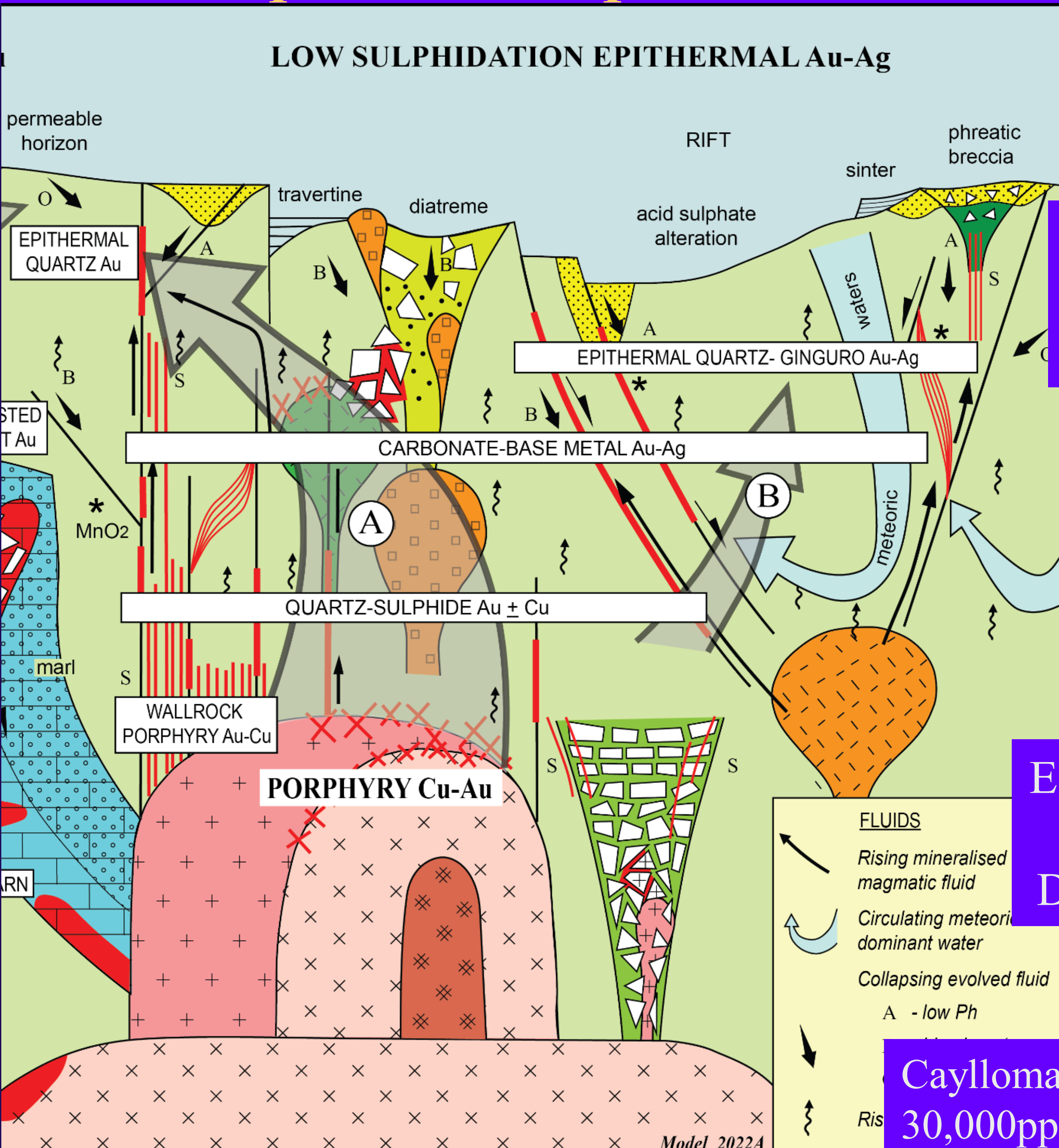
Palmarejo, Mexico



Cerro Negro
Argentina

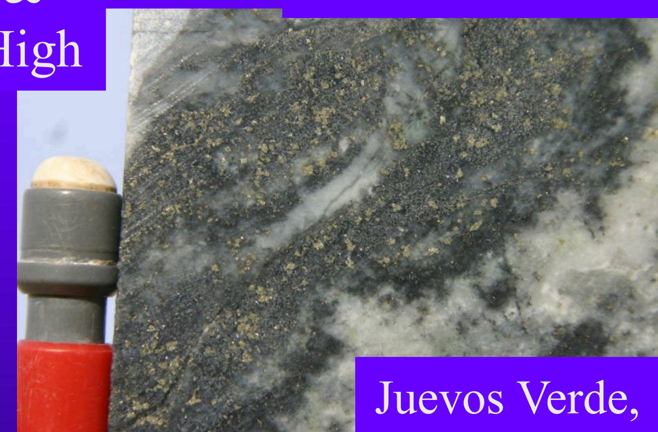
Cerro Moro Argentina
68.44 g/t Au, 6157 g/t Ag
with kaolin

Low sulphidation epithermal Au-Ag



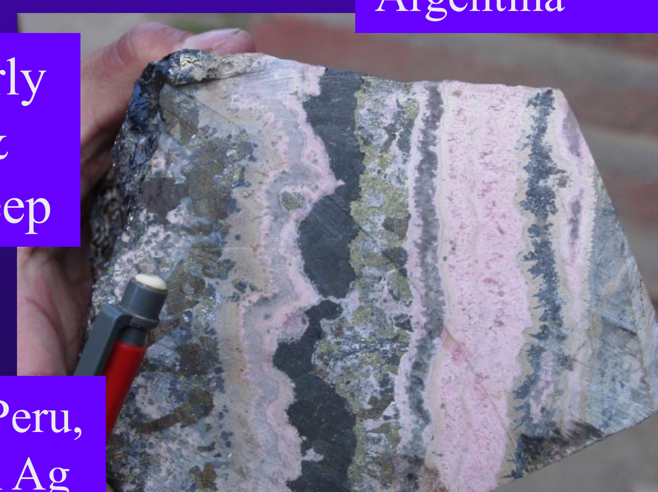
Late & High

Golden Cross NZ



Juevos Verde, Argentina

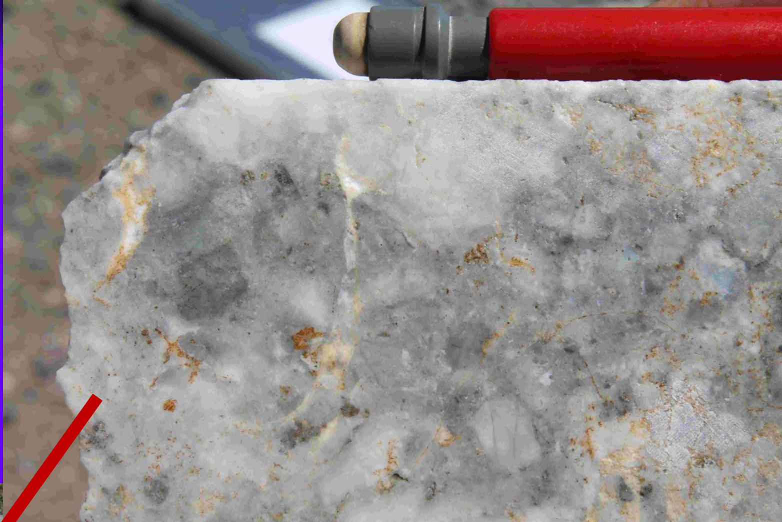
Early & Deep



Caylloma Peru, 30,000ppm Ag

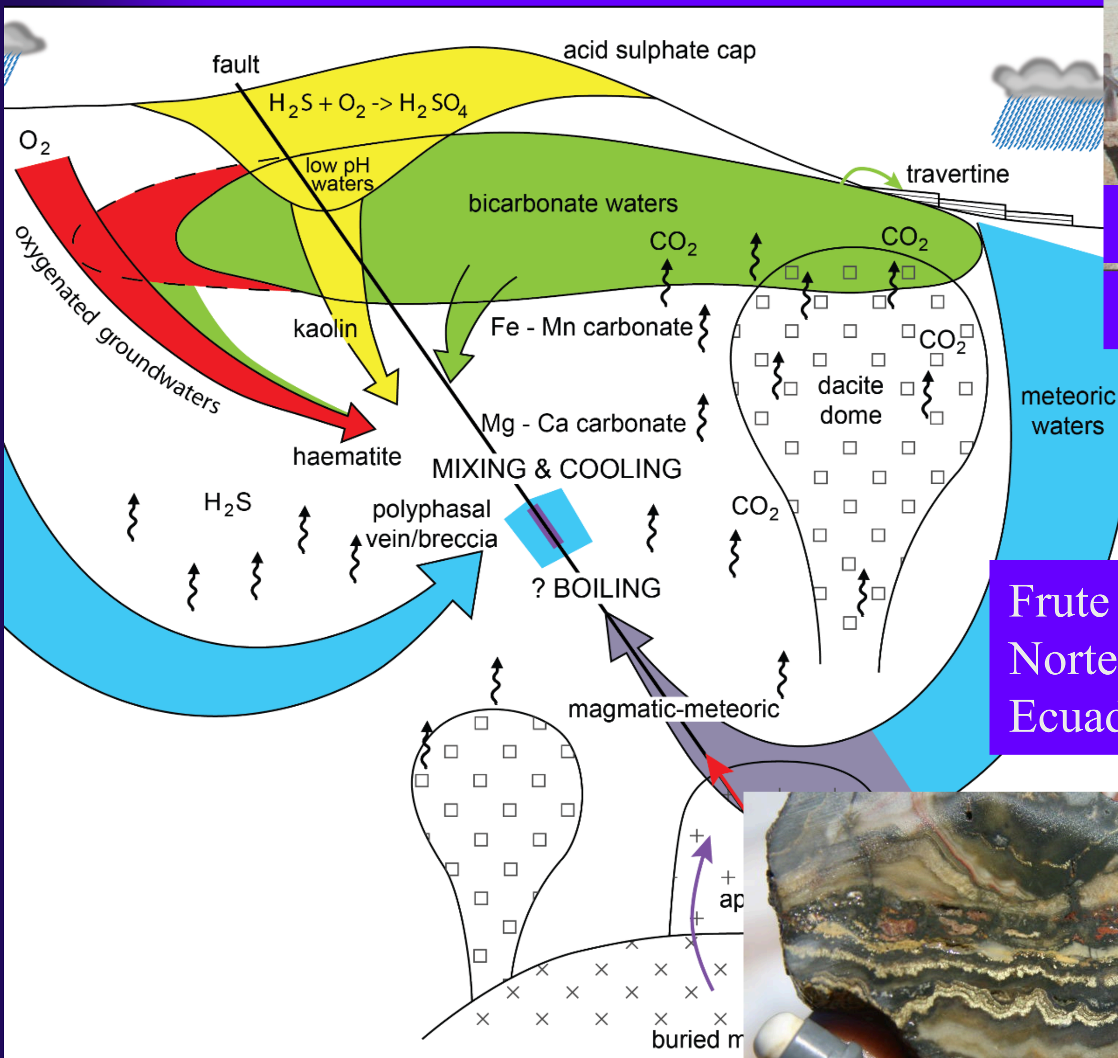
Low sulphidation chalcedony-ginguro Au-Ag, Cracow

Kilkenny Vein, Cracow Gold mine Australia.
Au in sulphide with kaolin DDH VBK189
837m, 62.9g/t Au & 19.8g/t Ag



16.5 g/t Au & 25 g/t Ag

Mixing with low pH acid sulphate waters



“85% of Au with pyrite-kaolin”

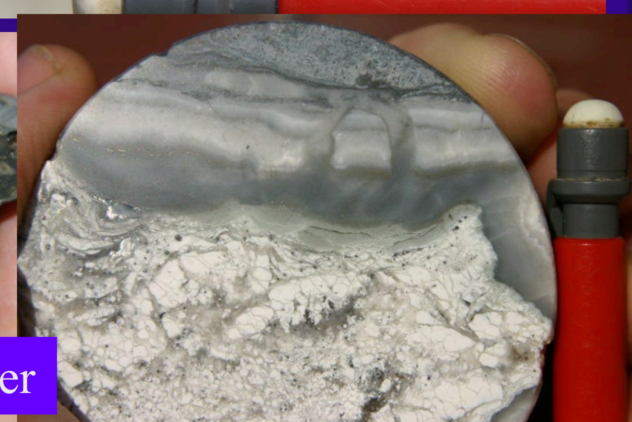
543 ppm Au (Pope et al., 2005)

Champange Pool

185.5 g/t Au & 214 g/t Ag

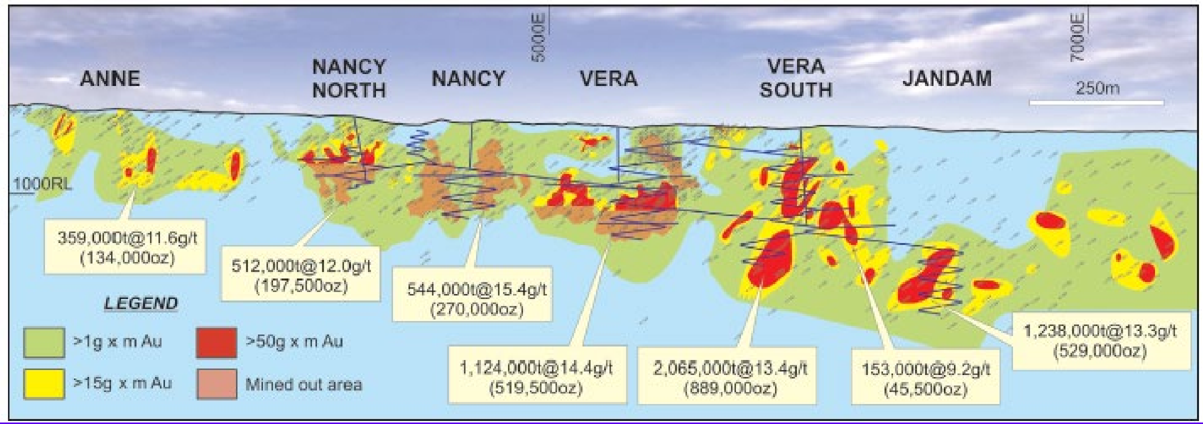
Frute del Norte, Ecuador

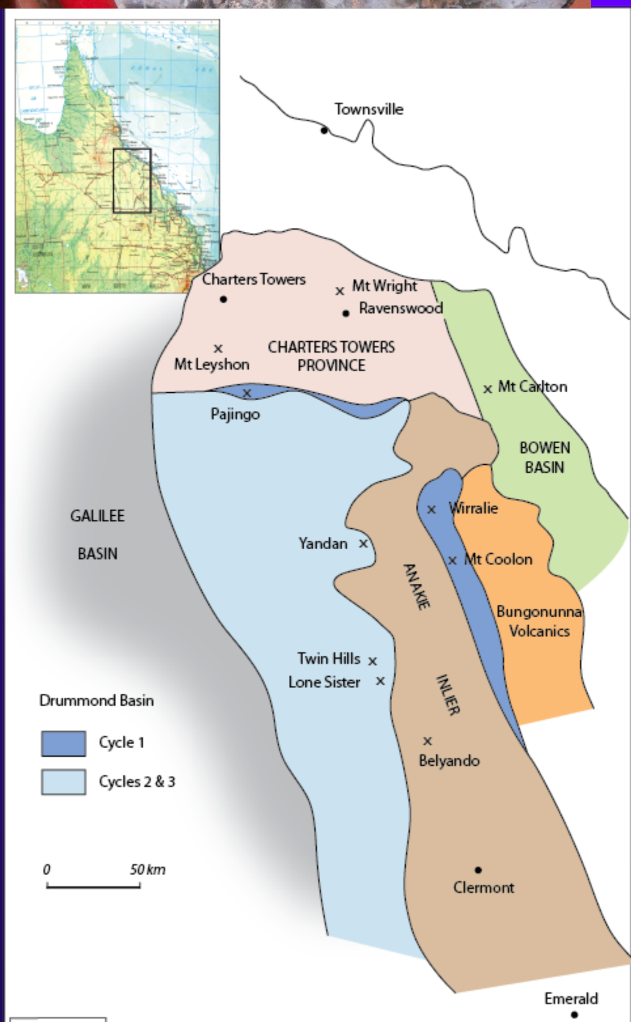
Sleeper



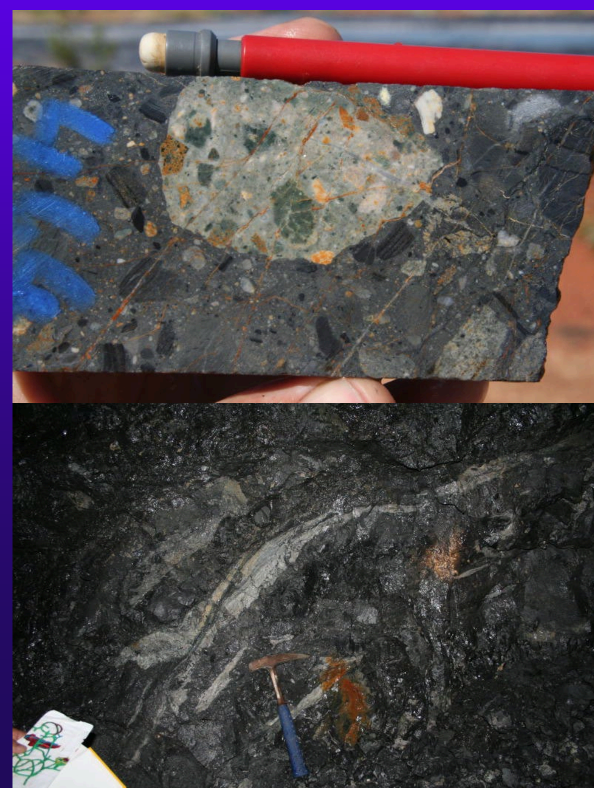
Drummond Basin Au-Ag

Vera Nancy





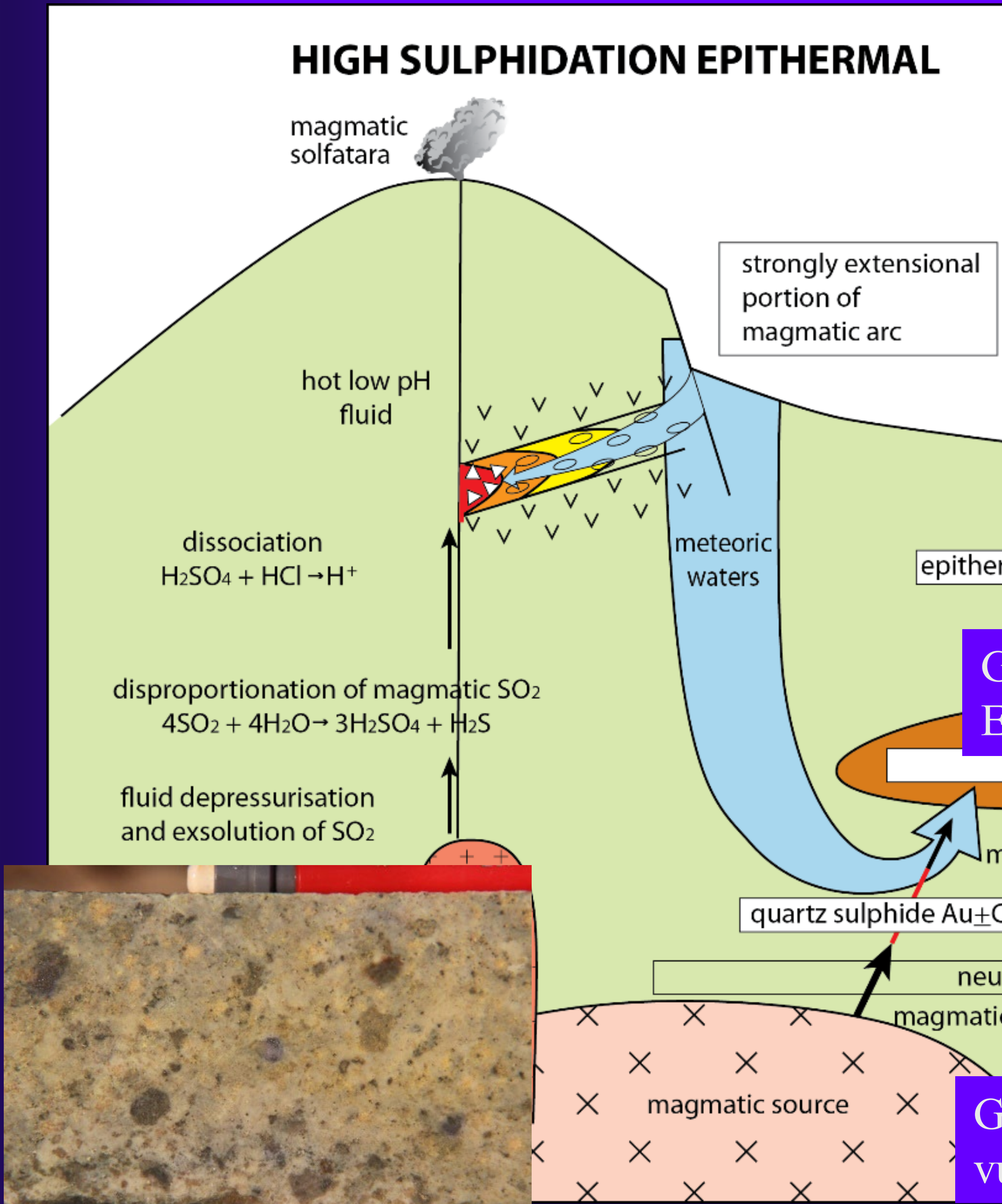
Twin Hills

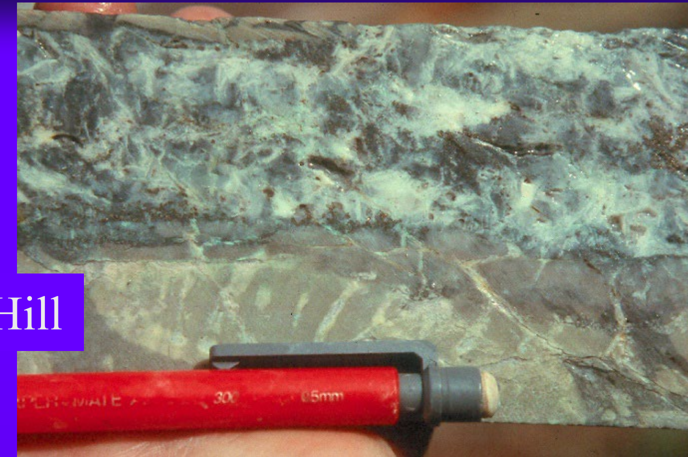


Wirralie

Lone Sister

High sulphidation epithermal Au



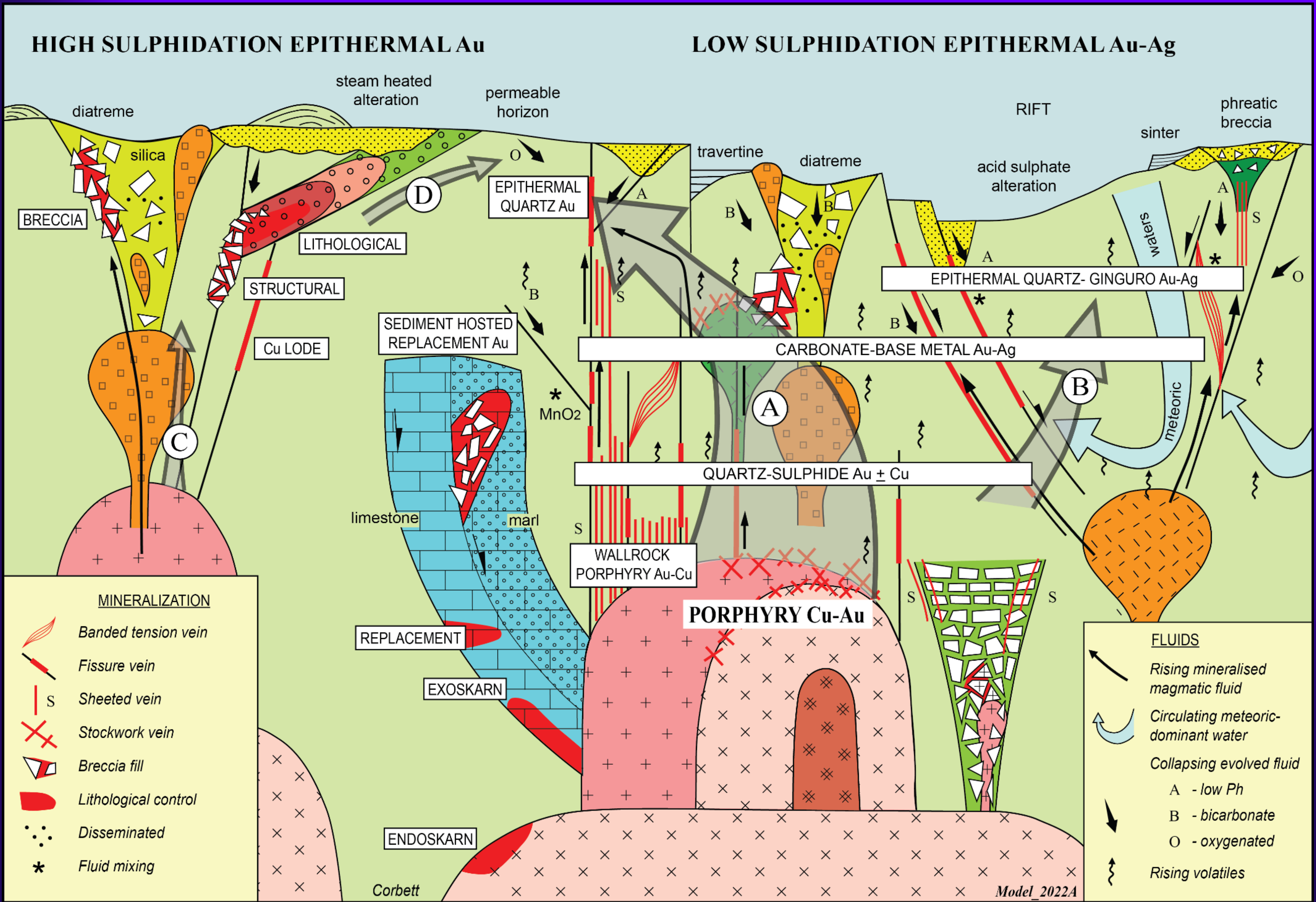


Peak Hill

Gidginbung
Enargite-pyrite

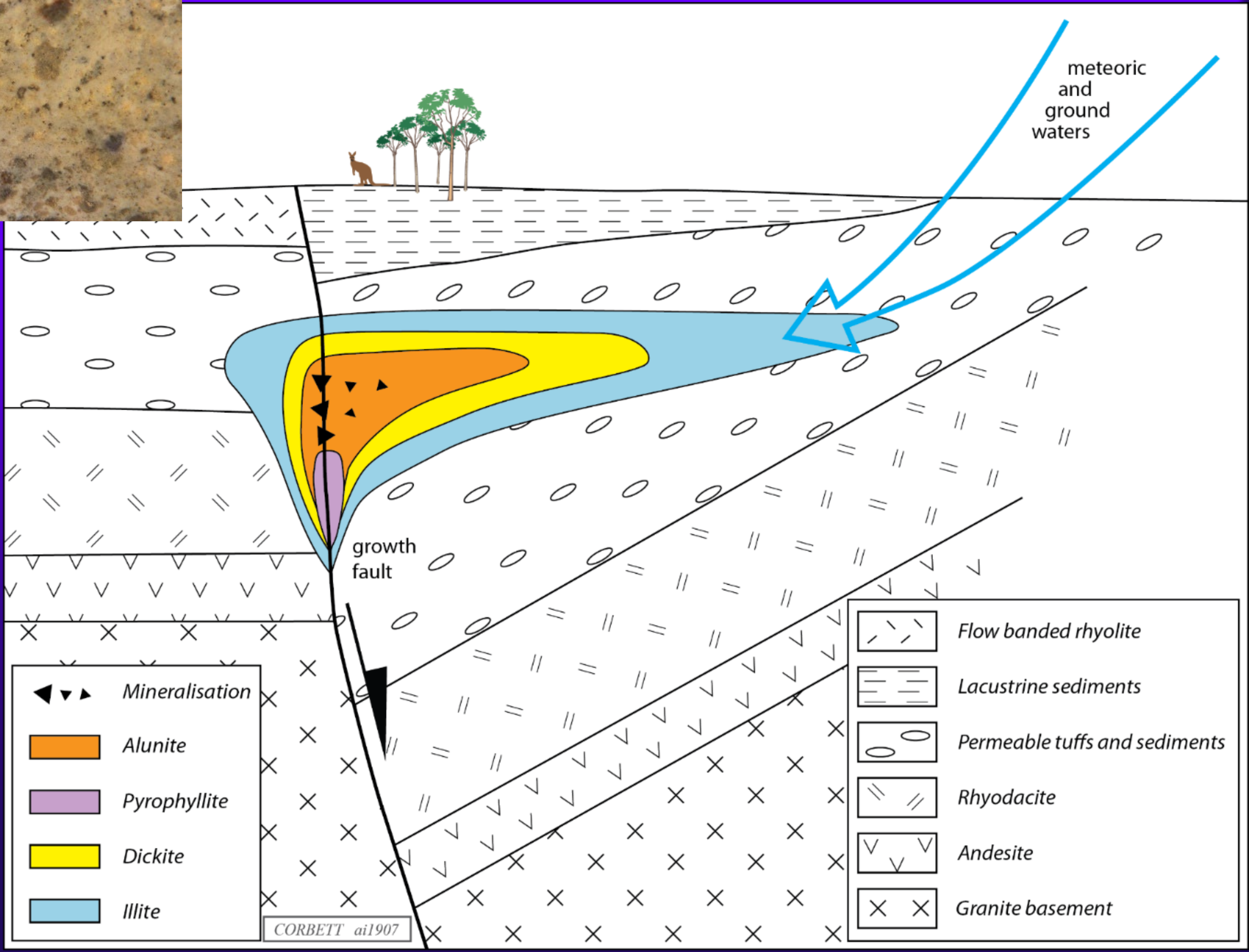
Gidginbung
vughy silica

High to lower fluid evolution



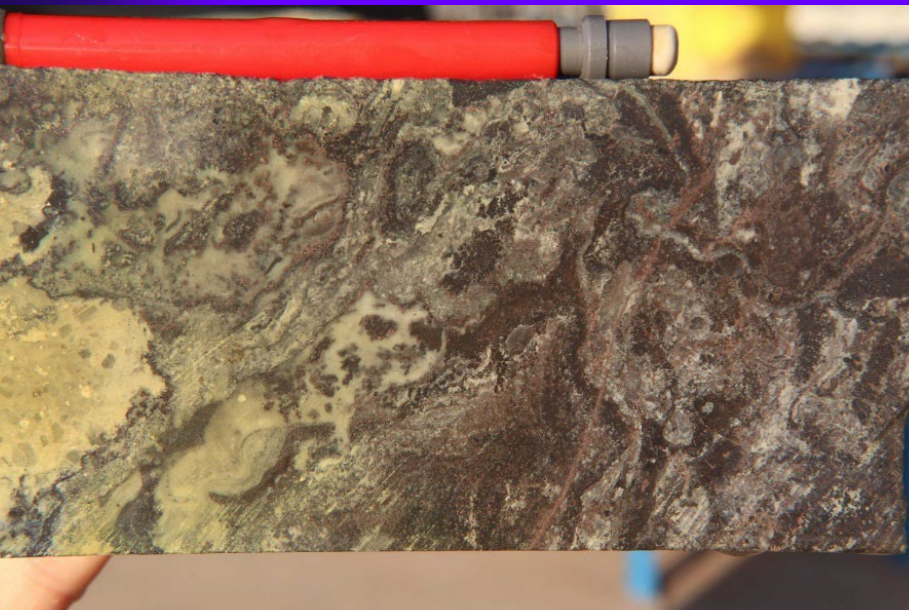
Mt Carlton – Evolution to lower sulphidation

NB position of pyrophyllite
From Corbett, pers. observ.; Dugdale and Howard, 2017; Sahlström et al., 2018

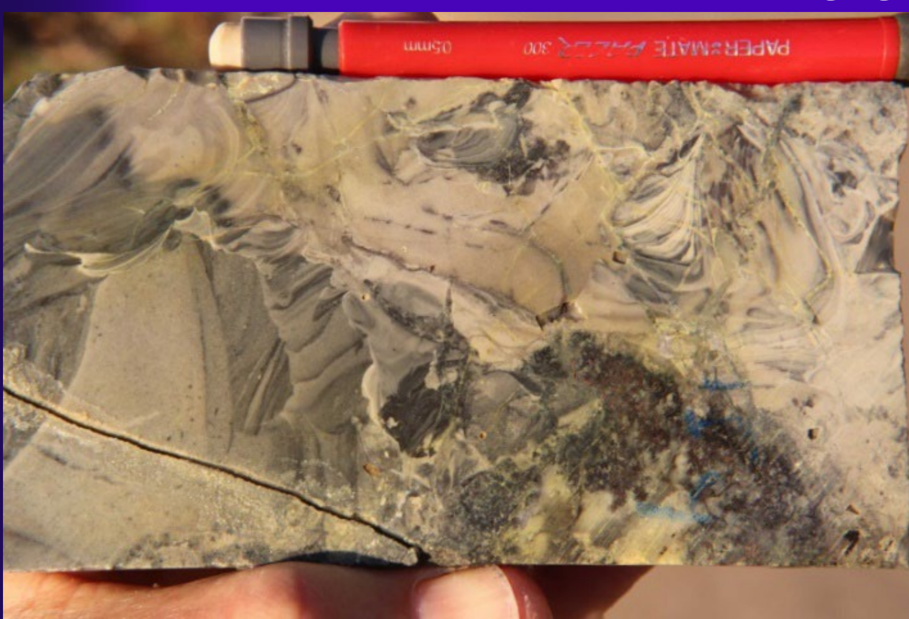


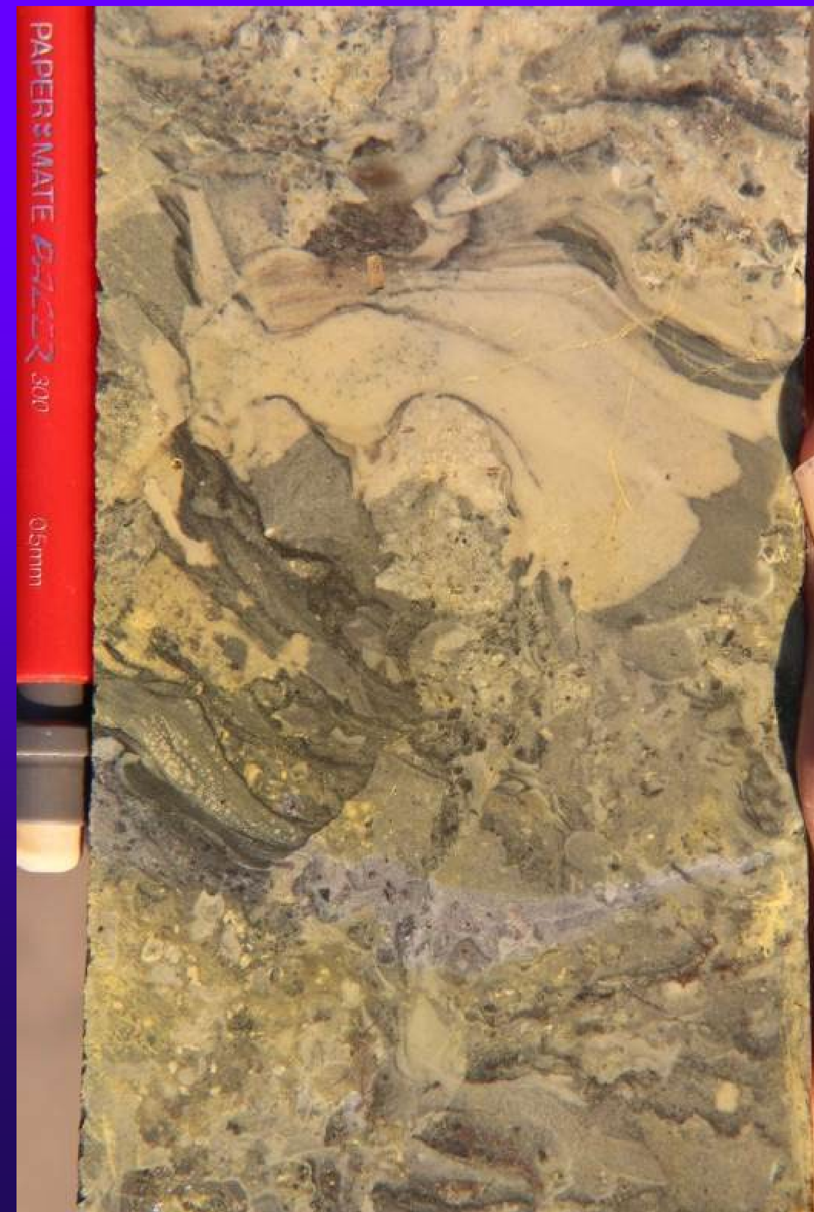
A39

Subsurface sedimentary structures – A39



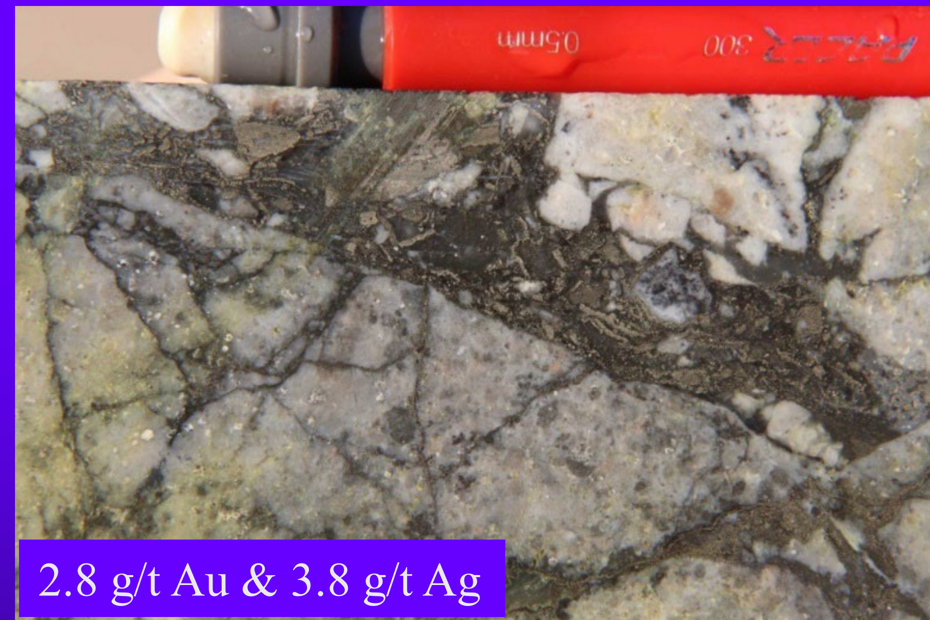
3237 g/t Ag



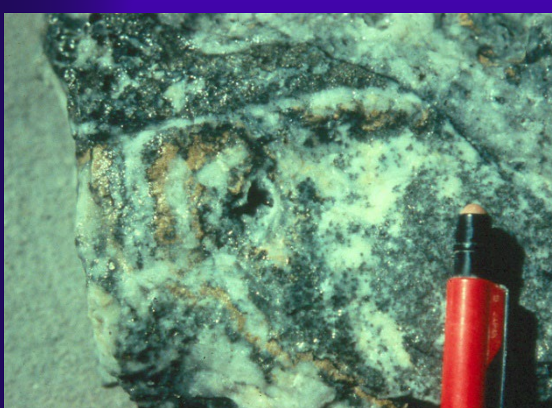


Mt Carlton V2 DDH, HC8RCD484 – Transition from high to low sulphidation

0.33 g/t Au & 5.5g/t Ag



2.8 g/t Au & 3.8 g/t Ag



Direct shipping ore
El Indio, Chile

Carbonate-base metal Au with visible Au
126 g/t Au, 21.9Ag g/t Ag, 814ppm Cu, 953ppm Pb, 5120 ppm Zn & 239 ppm As.

Exploration implications

- Staged model for porphyry development
  - Explains overprinting events of alteration and mineralisation
  - Provides vectors towards blind mineralization
- Different styles of advanced argillic alteration display varying relationships to mineralization and uses as vectors
- High and low sulphidation no intermediate member
- For low sulphidation two fluid flow trends in magmatic arc and extensional such as back arc settings with varying mineralogy
- High sulphidation epithermal typically display low Au grades and difficult metallurgy BUT sometimes evolve to lower sulphidation with bonanza Au grades ….Zn

Tambomayo, Peru – 23 March 2020