

Tectonic/structural controls to Au-Cu mineralisation in Papua New Guinea



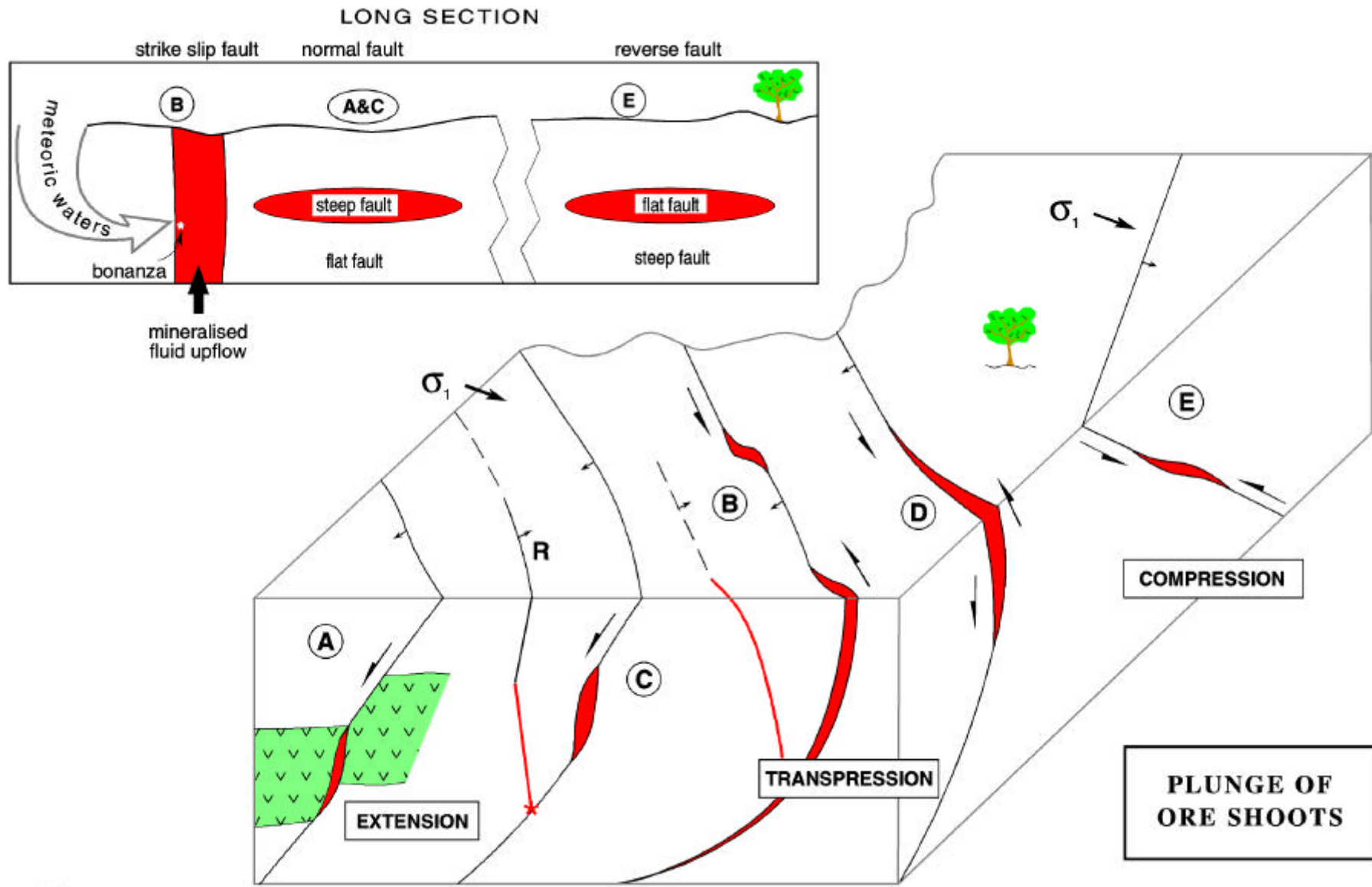
Greg Corbett
Consultant geologist
www.corbettgeology.com

Take home

- ◆ Terrain scale arc normal and arc parallel structures exhumed and mineralised
- ◆ Variations in mineralisation style related to relationship to intrusion source and linkages
- ◆ Uplift and erosion
- ◆ Geological mapping



Ore shoots in steep dipping vein portions



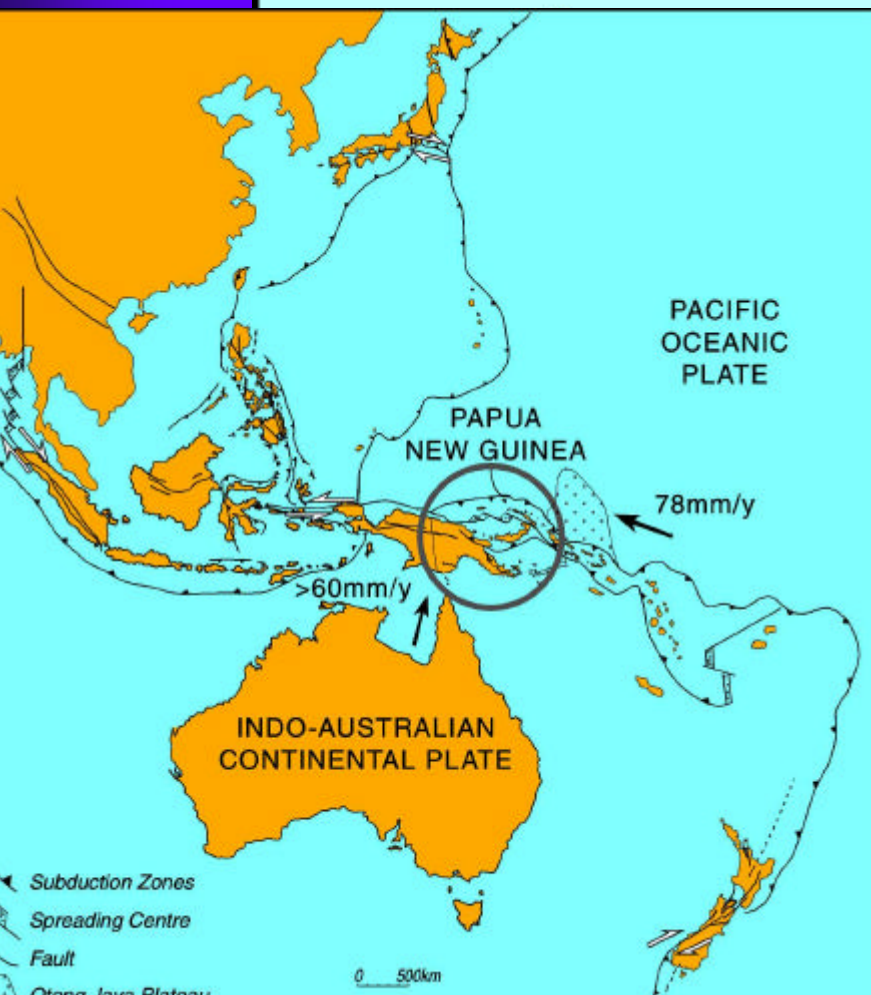
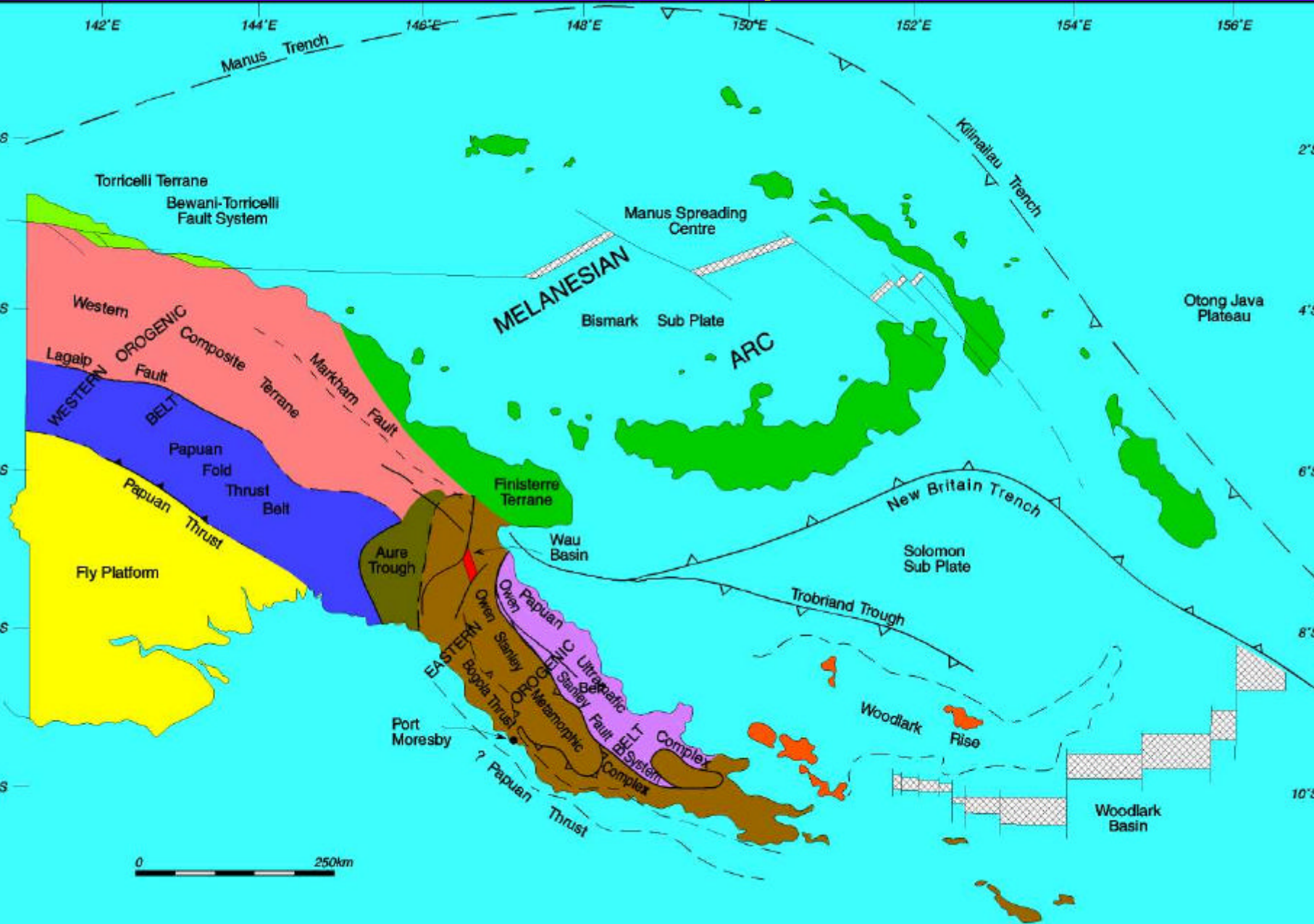
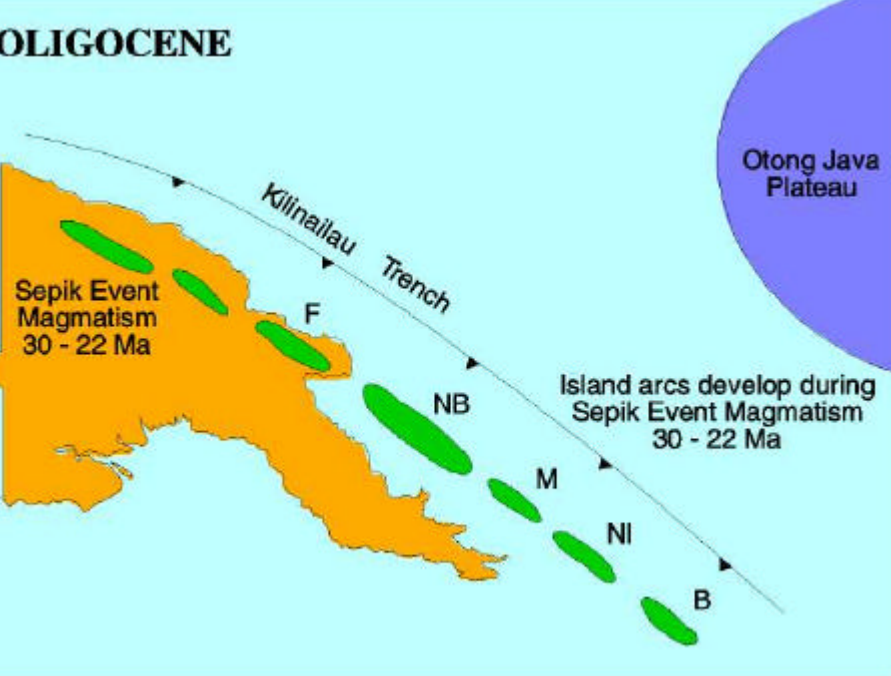


Plate tectonic
setting of Papua
New Guinea

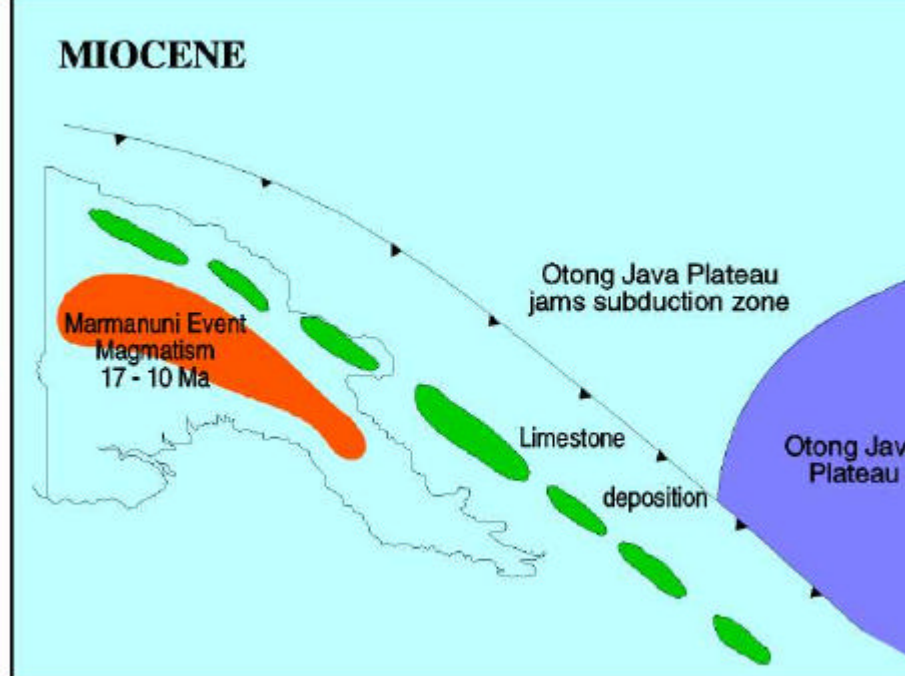
Tectonic elements of Papua New Guinea



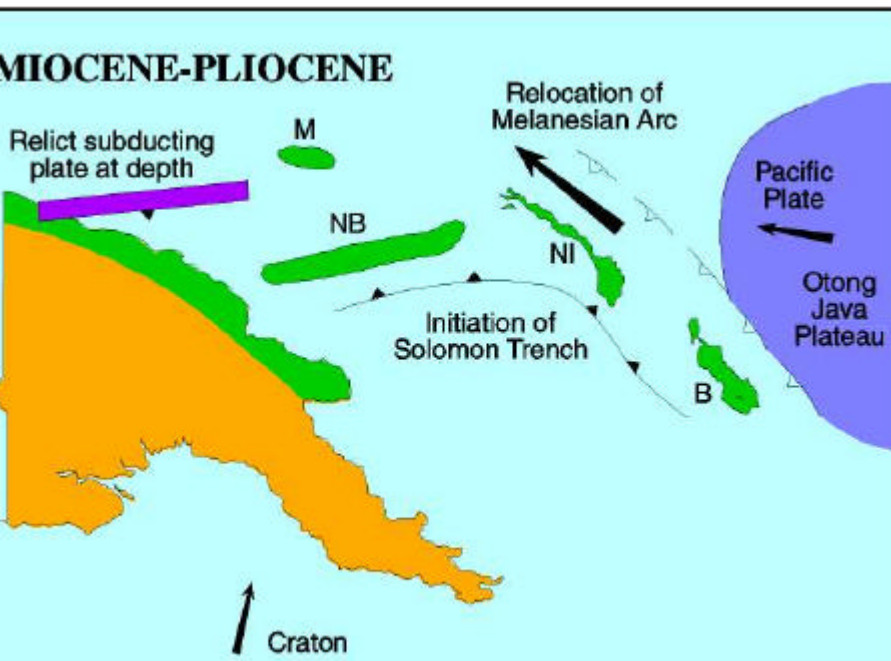
OLIGOCENE



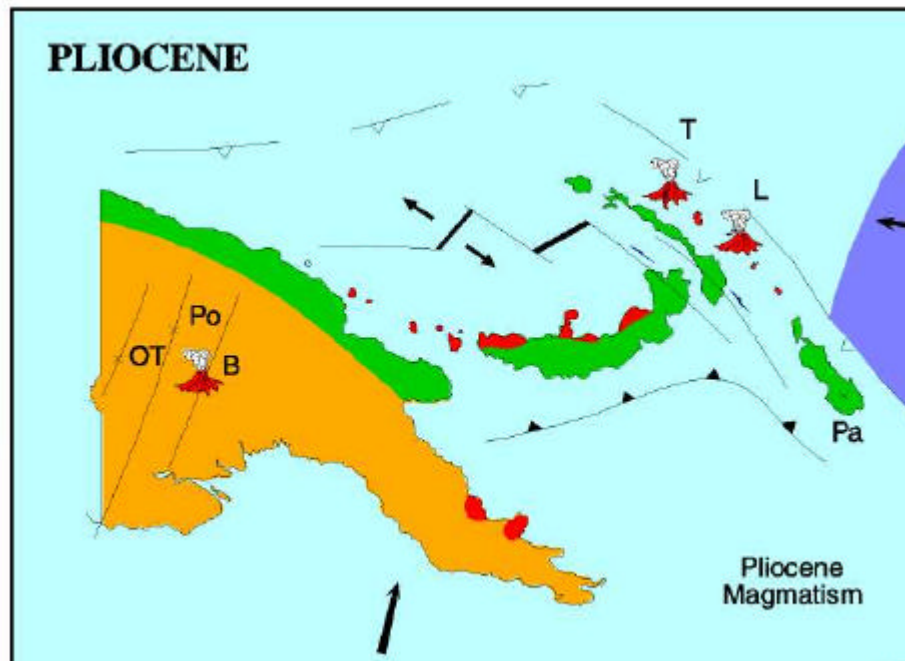
MIOCENE



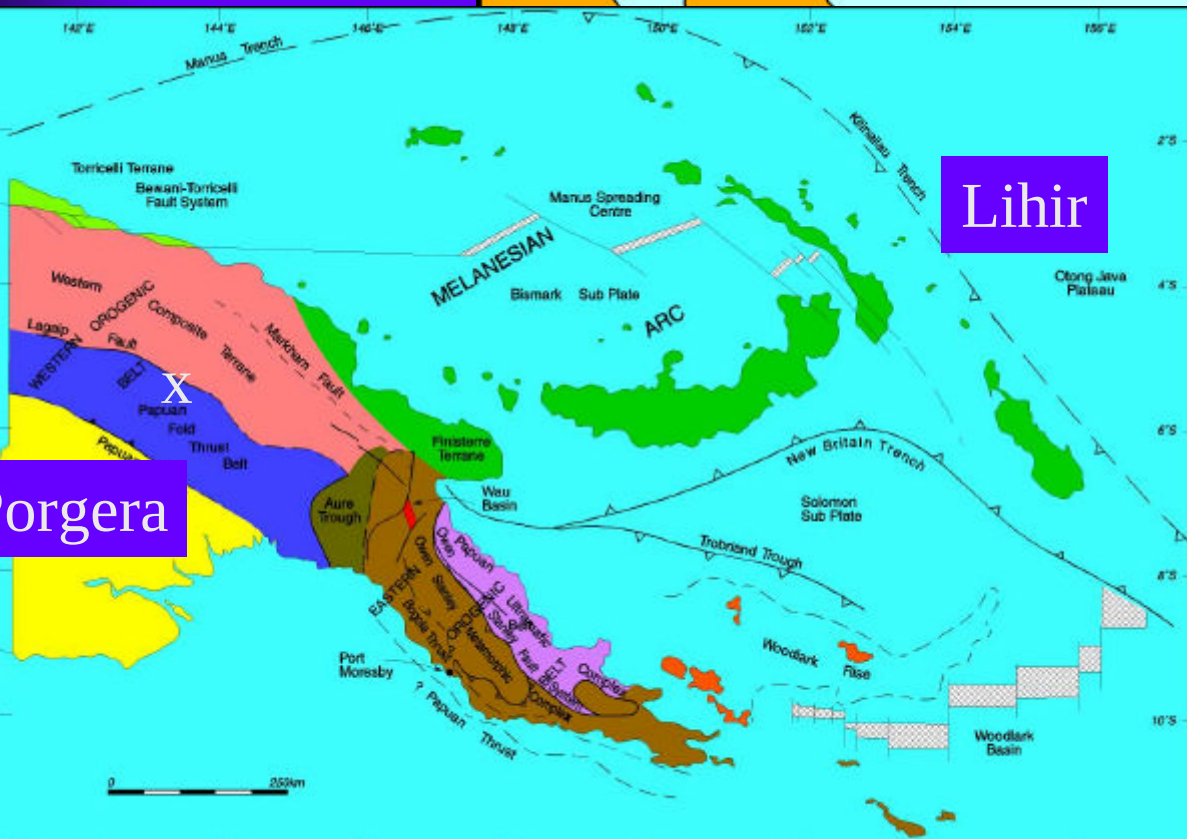
MIOCENE-PLIOCENE



PLIOCENE

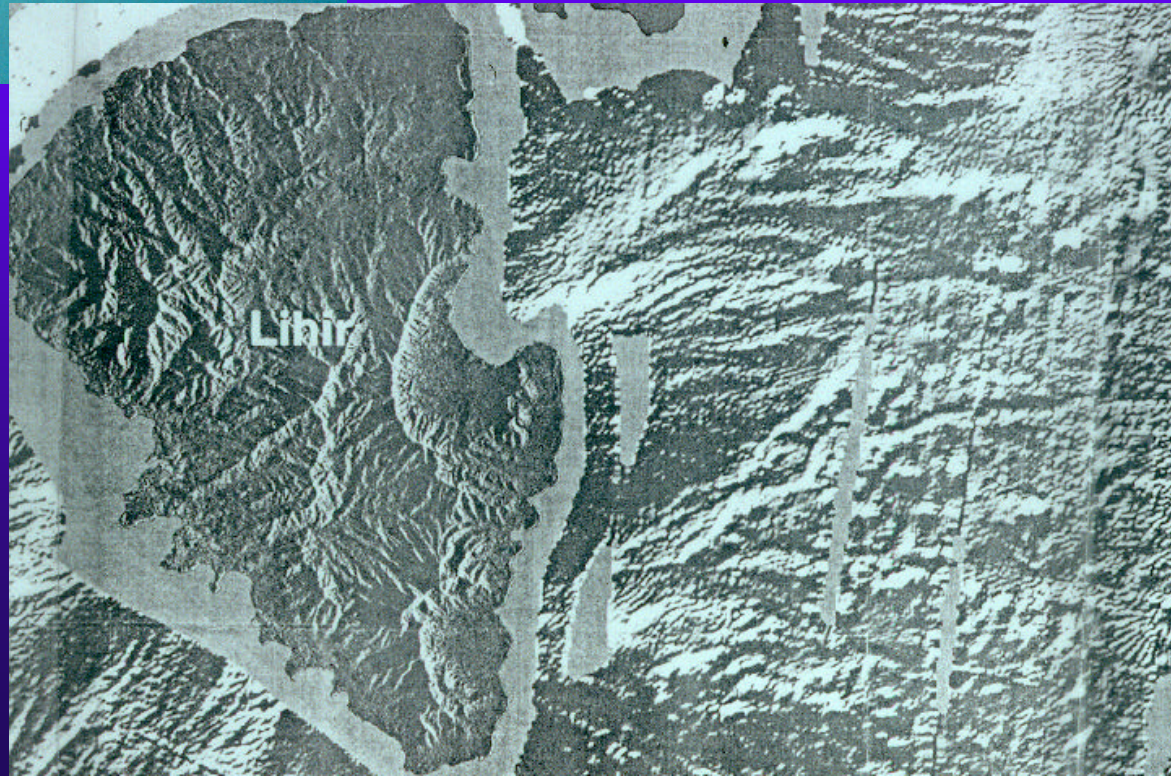


PNG Tectonics

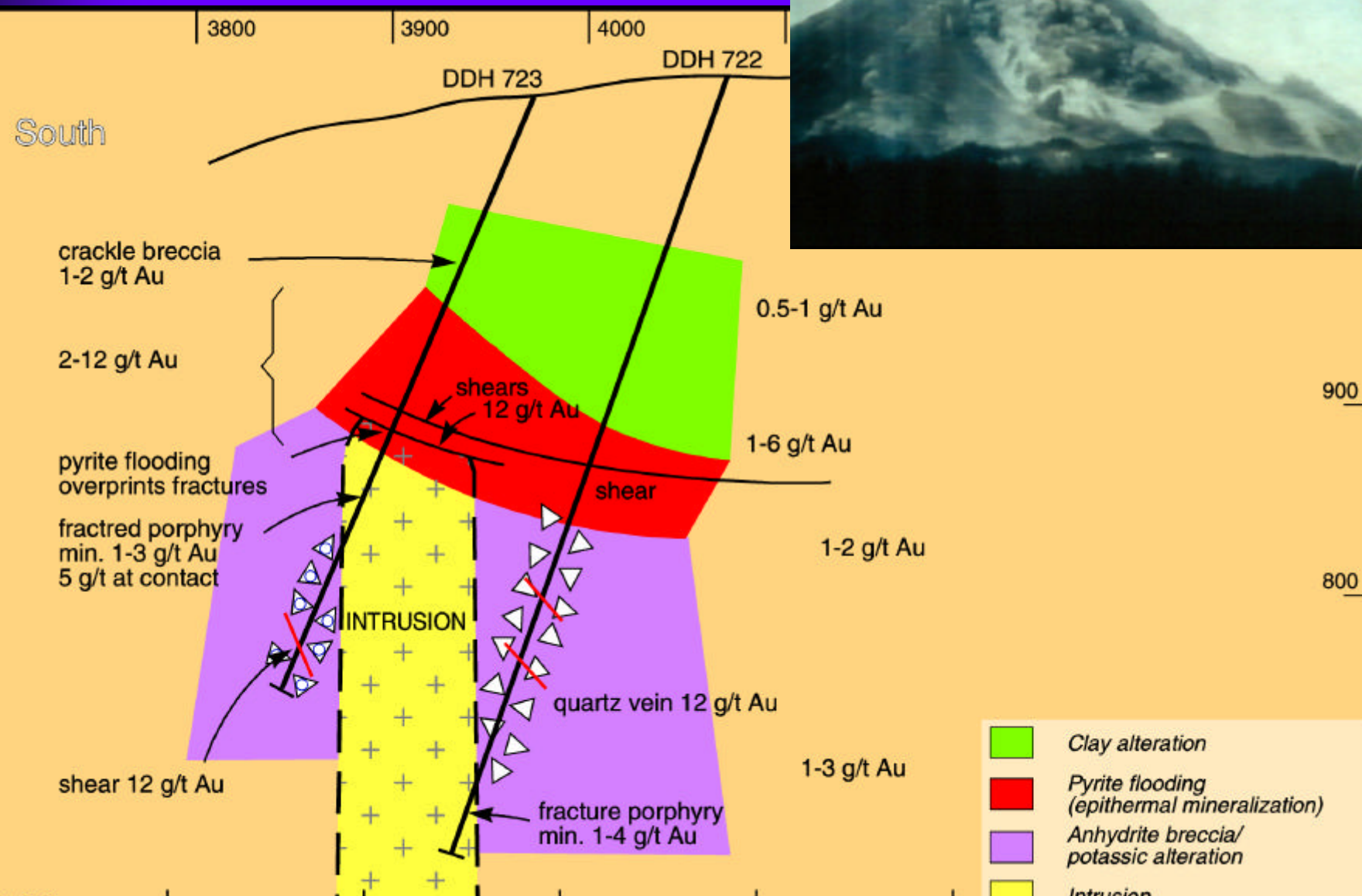


Lihir Luise volcano

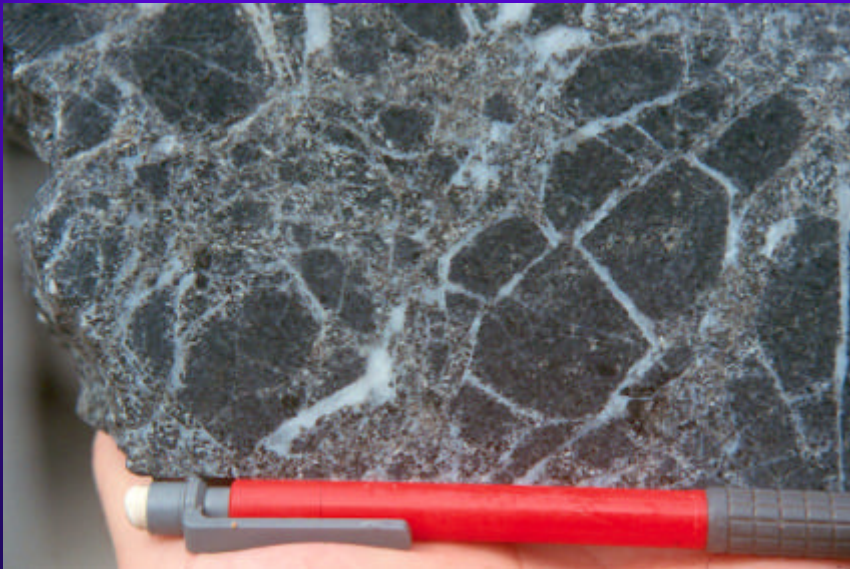
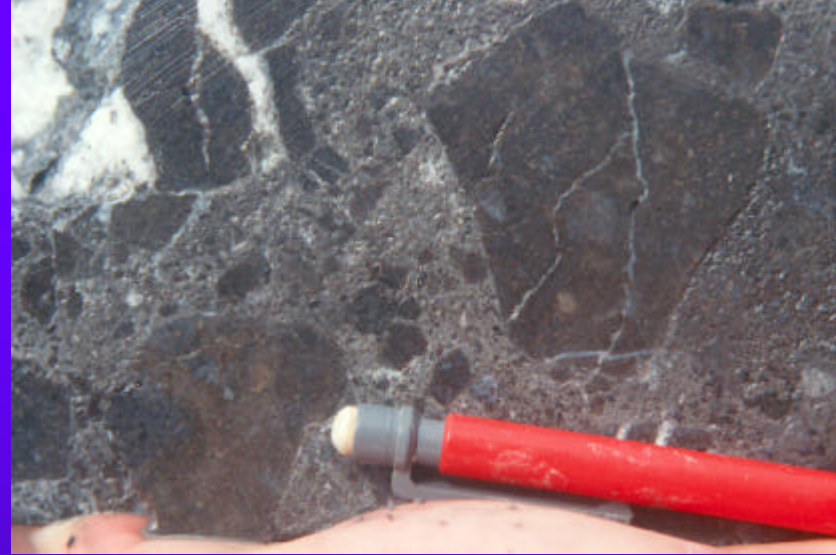
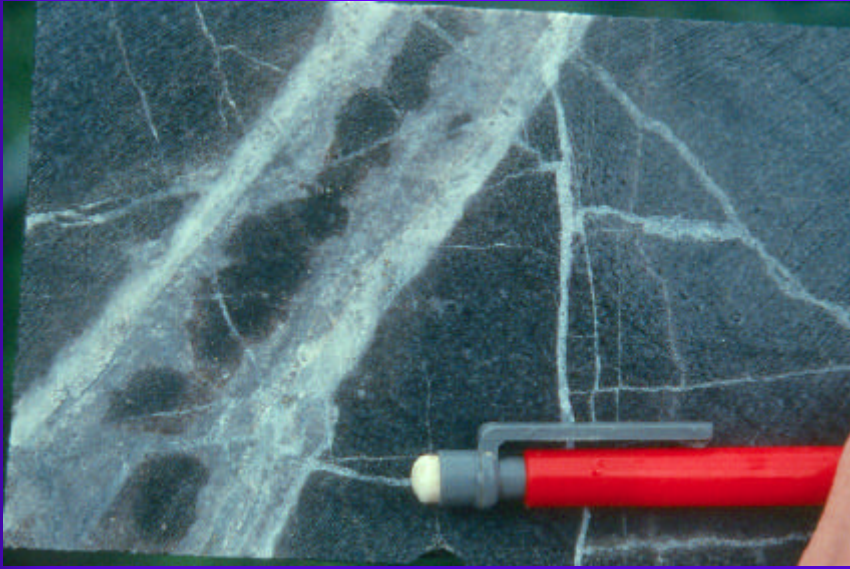
Side looking radar
and off shore seismic

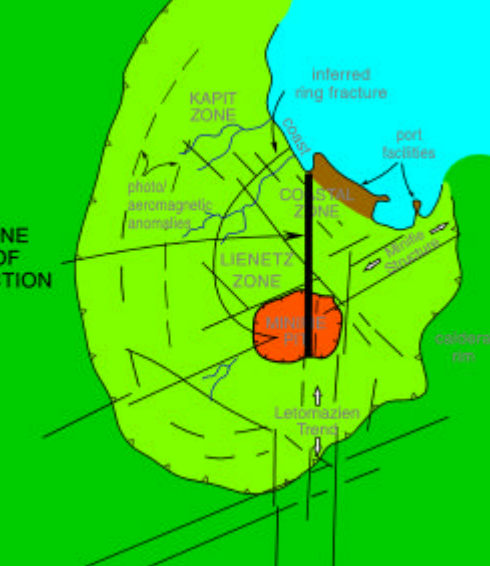


Cross section 9390



Porphyry style alteration





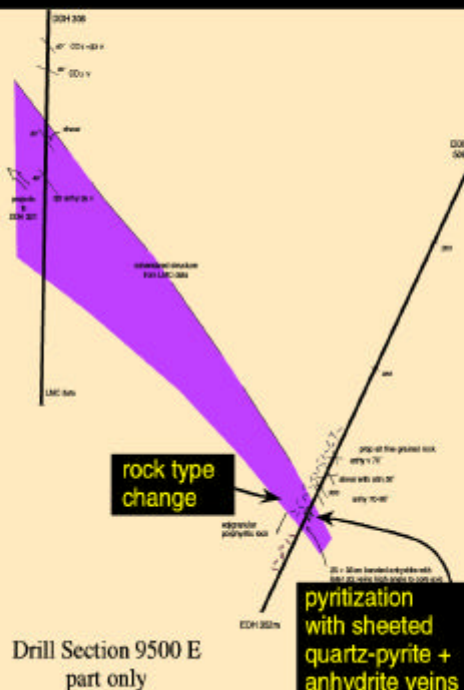
NS long section

Minifie Drill Sections

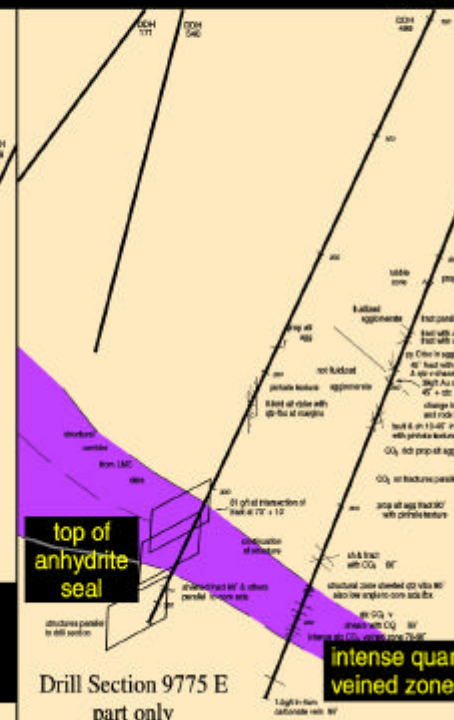
South



Drill Section 9500 E part only



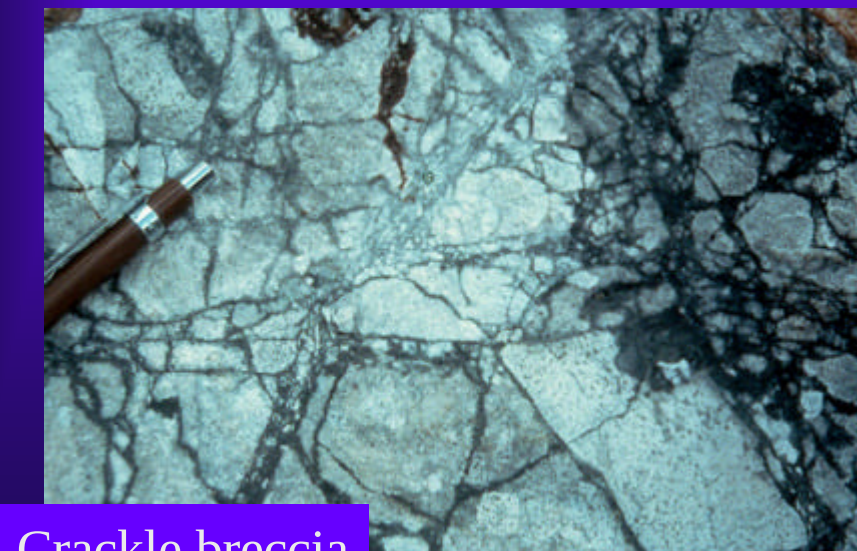
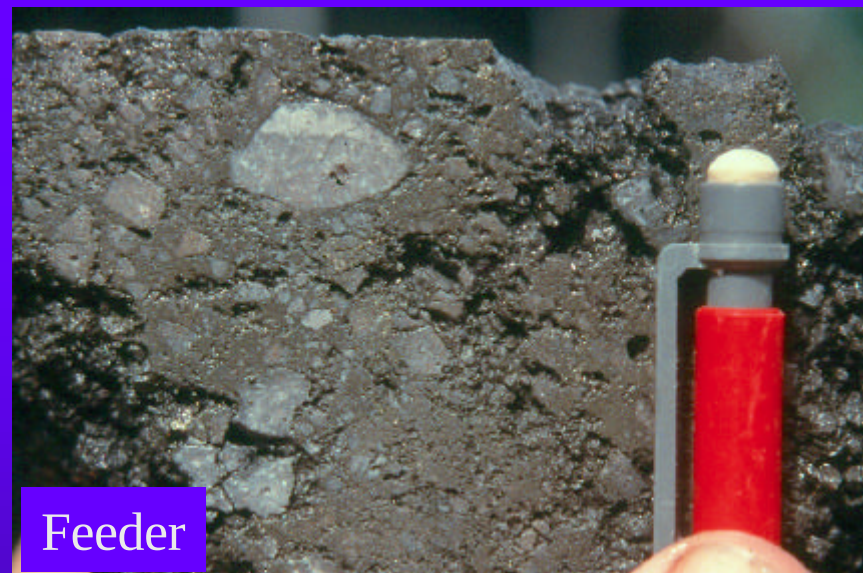
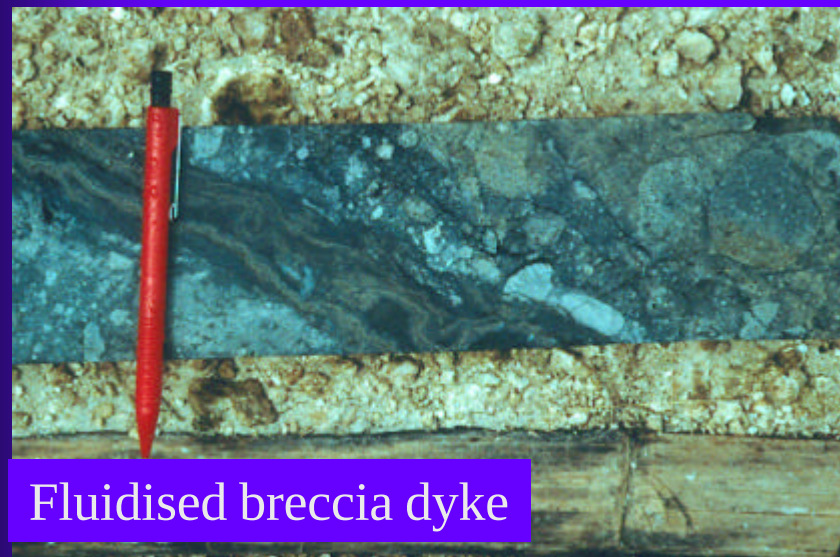
Drill Section 9775 E part only

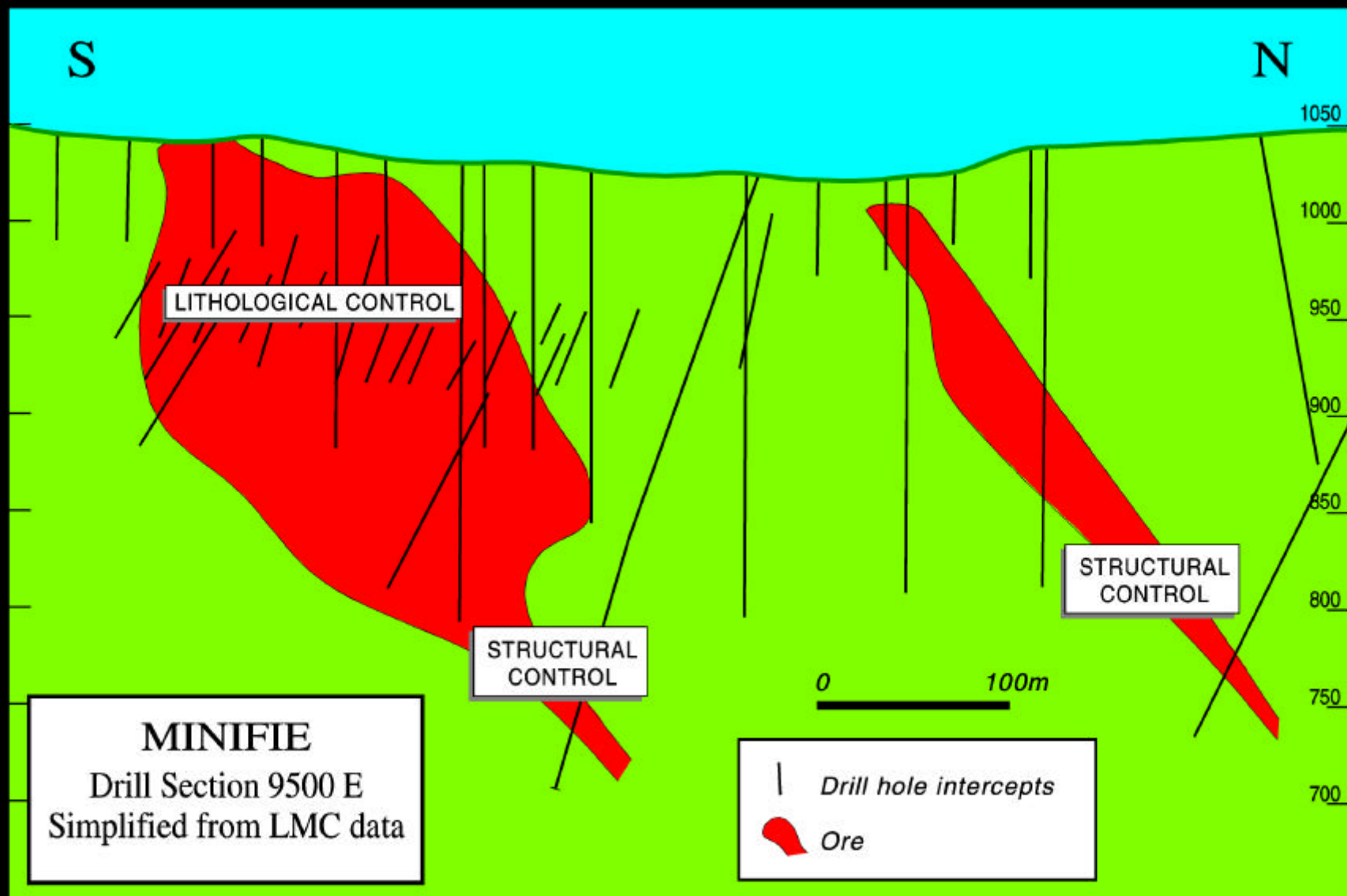


Minifie structure



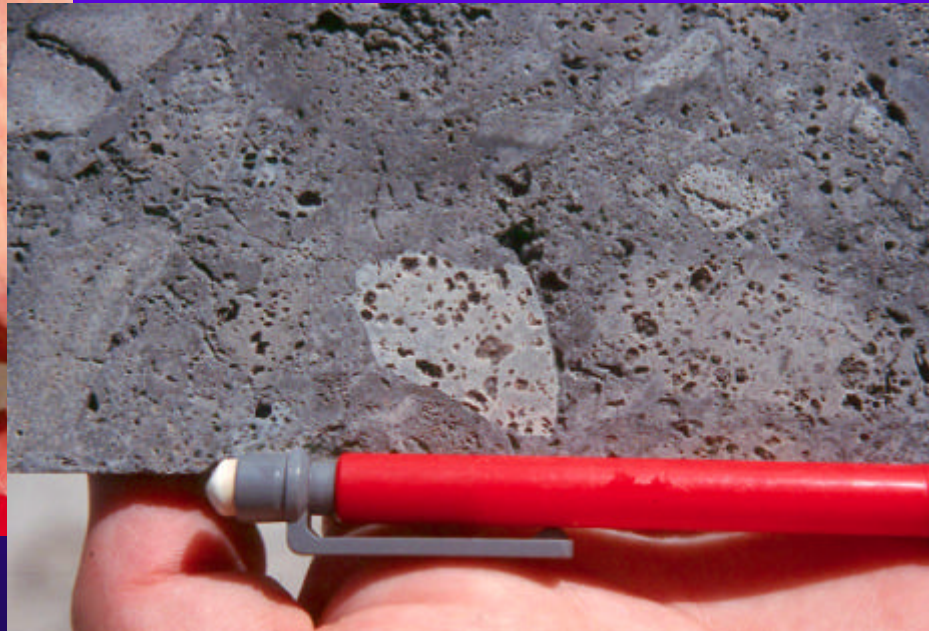
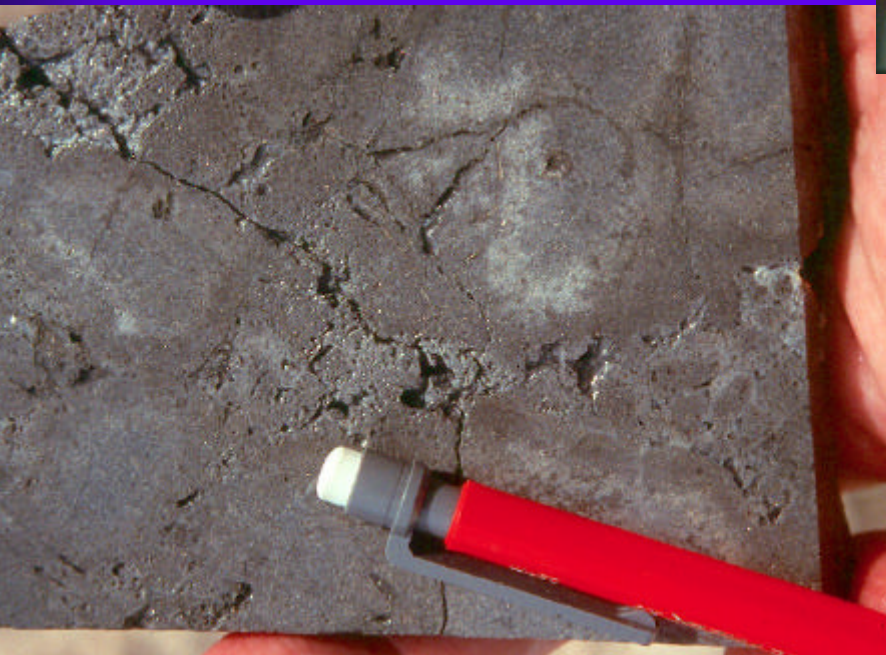
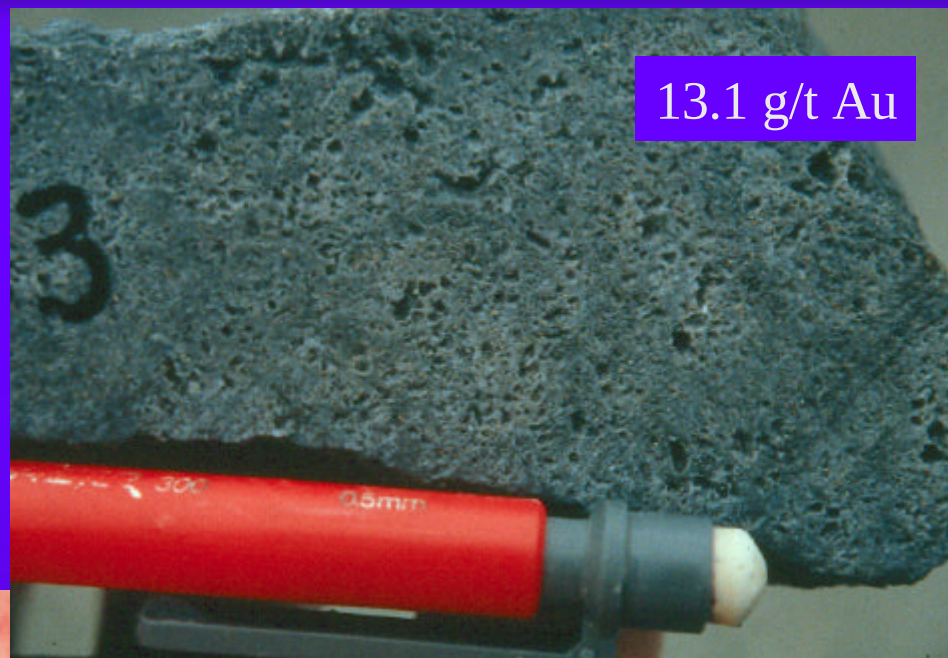
Lihir - structural control





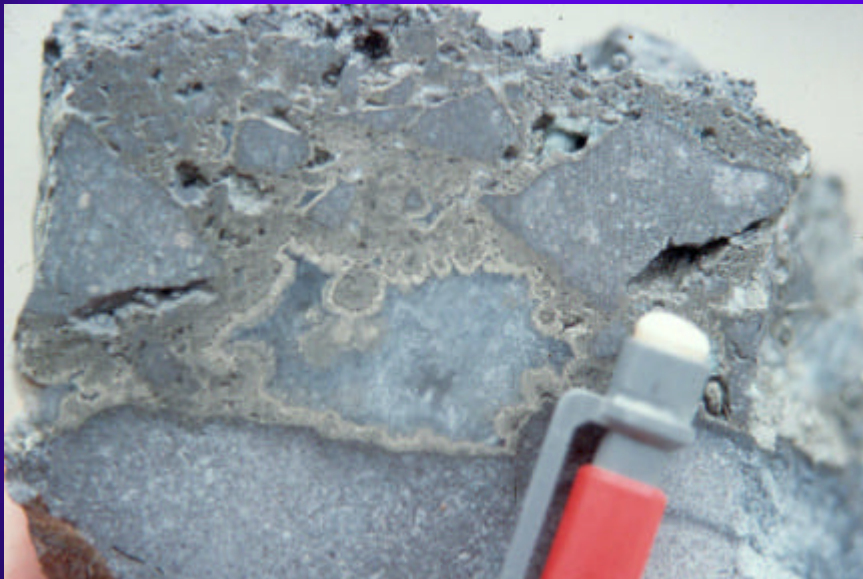
Lithological control

13.1 g/t Au



Lihir – epithermal event

123 g/t Au



Lihir – Active geothermal and AAA

Advanced argillic



Lihir Gold Mine



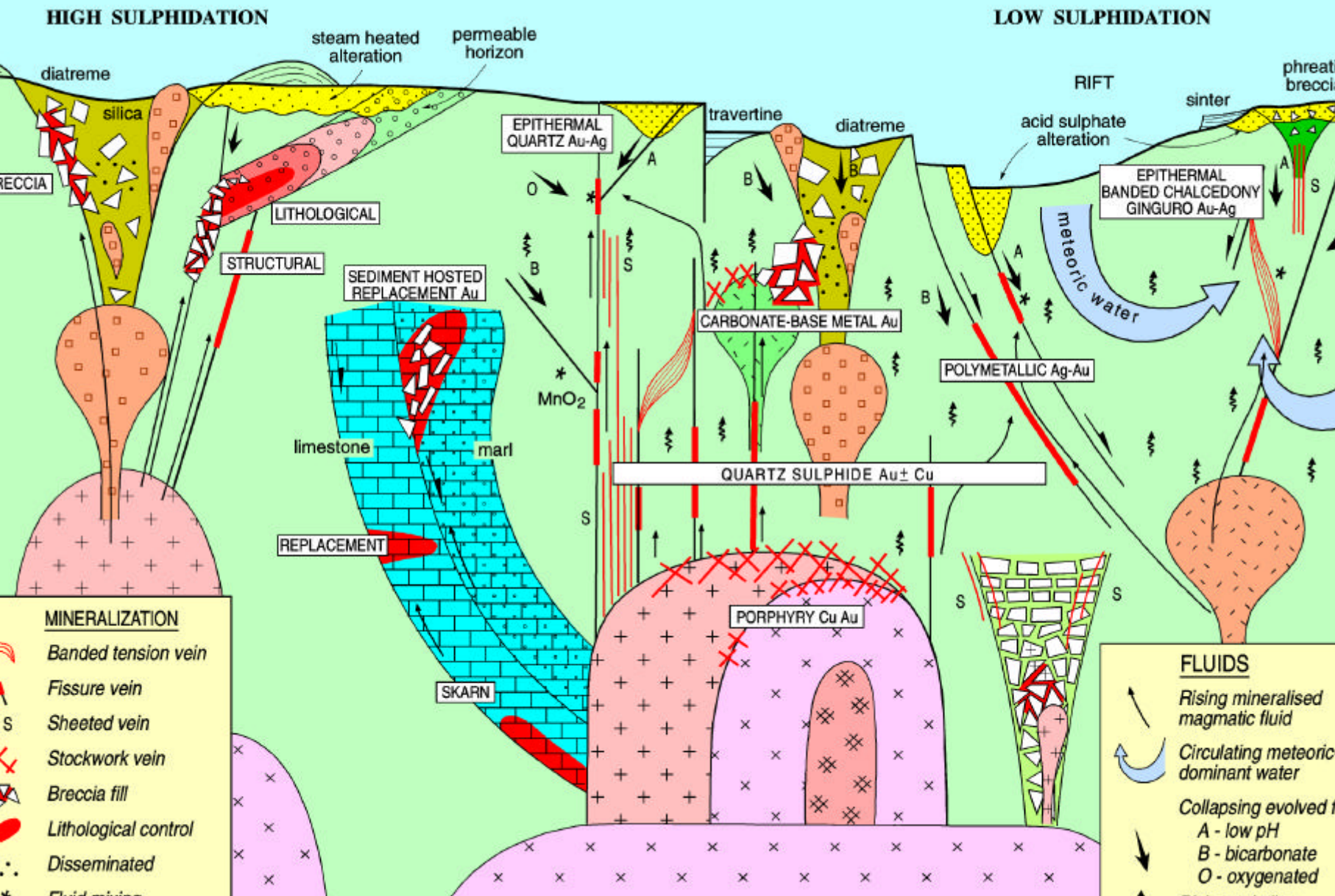
In 2003, 3.5 M oz Au production

163 Mt @3.88 g/t Au for 20.5 M oz Au resource

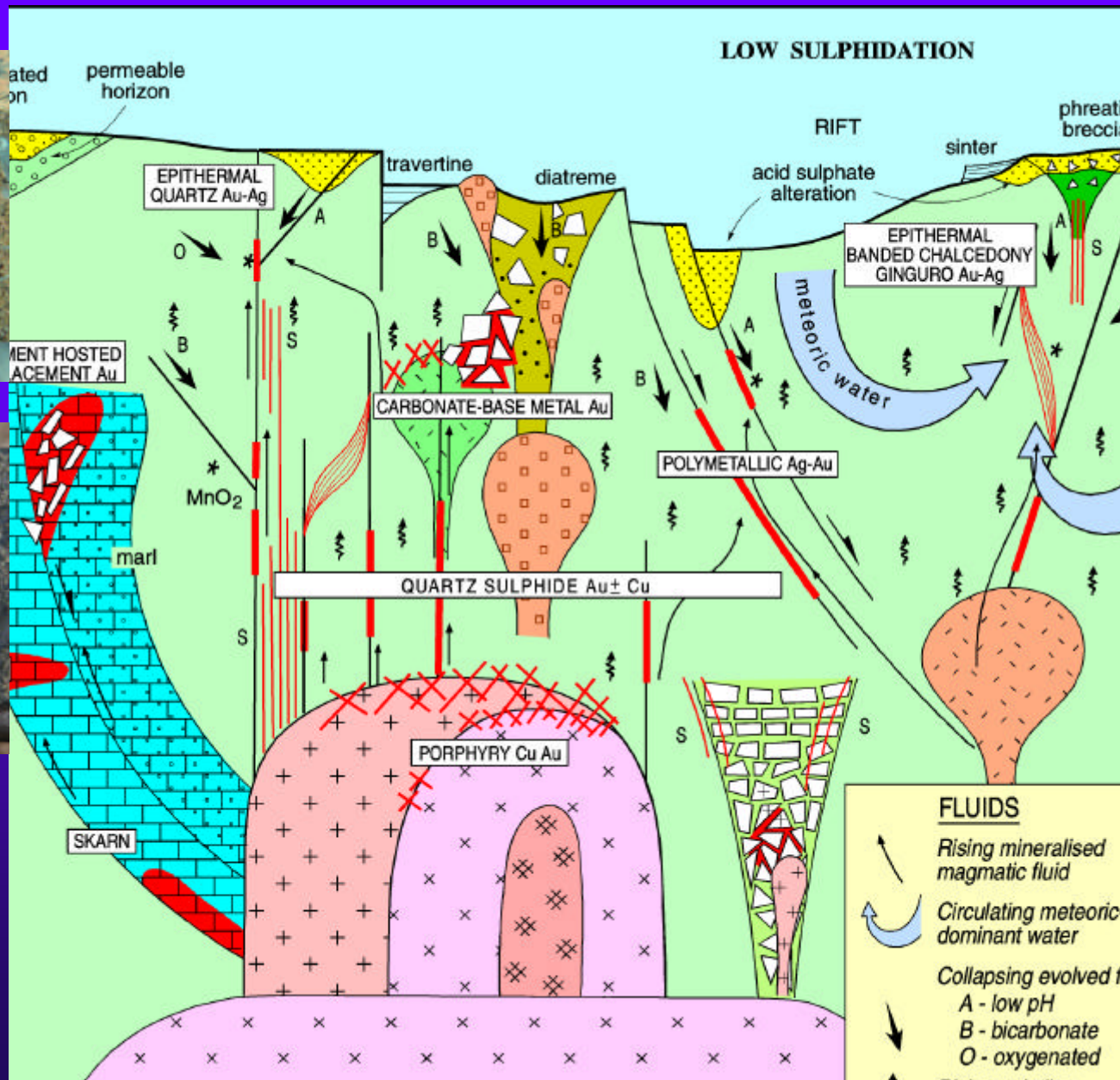
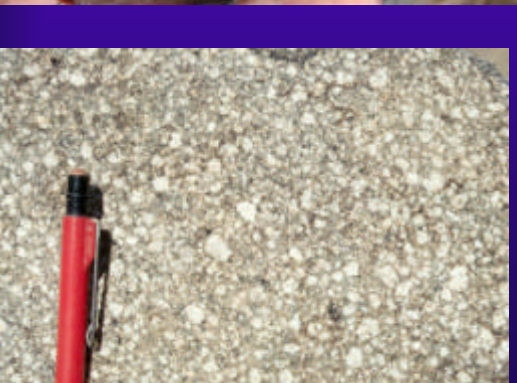
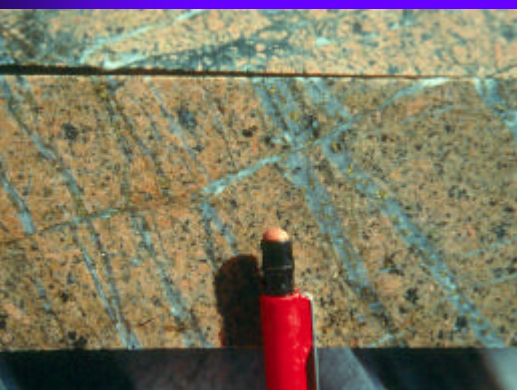
Since then Kapit zone

In 2008, 23.5 M oz resource

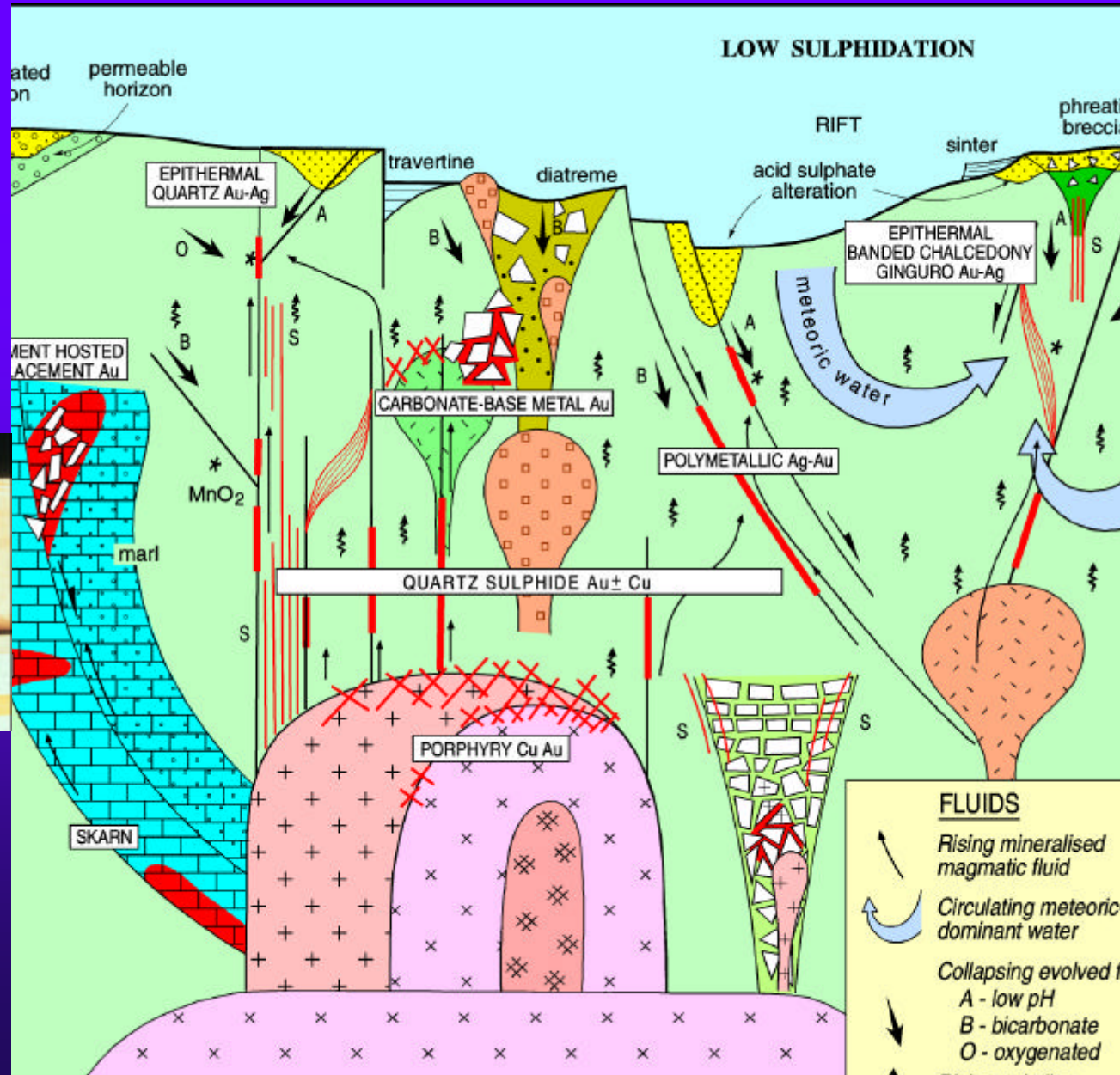
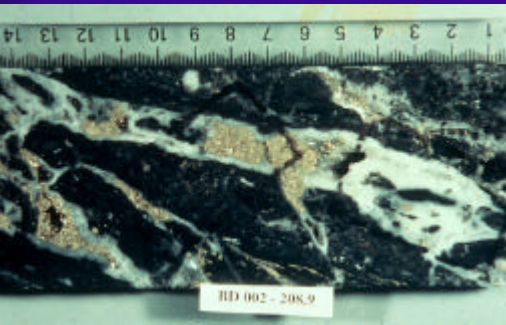
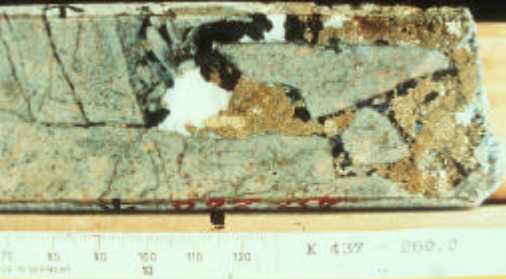
Styles of magmatic arc Cu-Au mineralisation



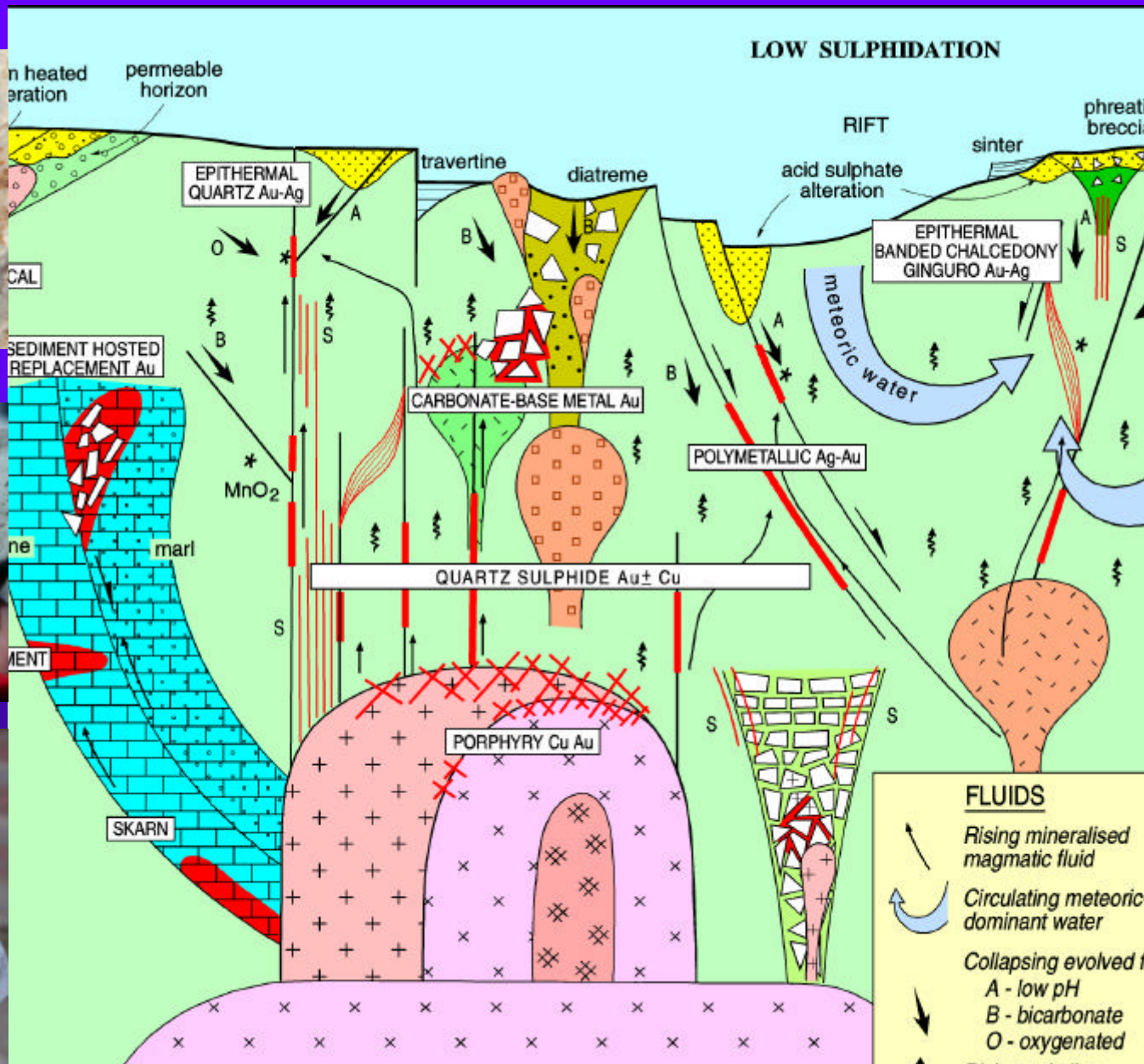
Styles of magmatic arc Cu-Au mineralisation



Styles of magmatic arc Cu-Au mineralisation



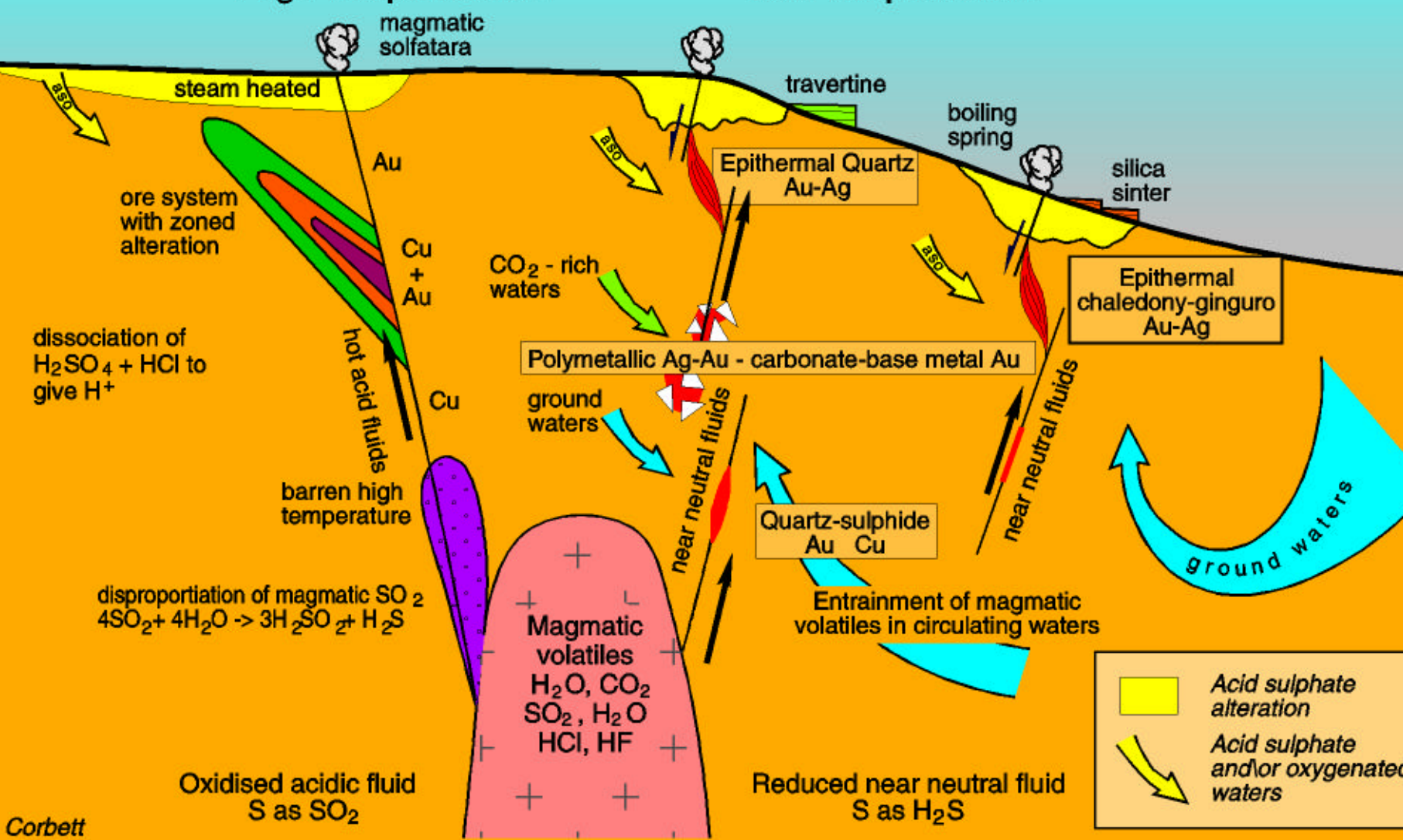
Styles of magmatic arc Cu-Au mineralisation



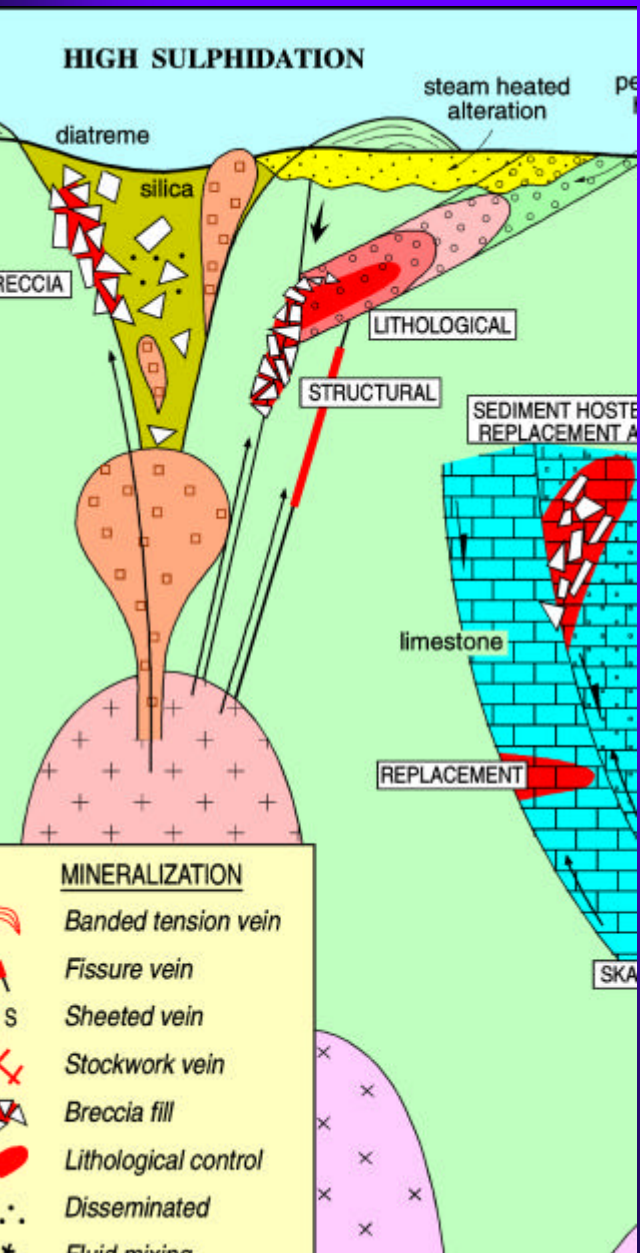
DISTINCTION BETWEEN HIGH & LOW SULPHIDATION FLUIDS

High Sulphidation

Low Sulphidation

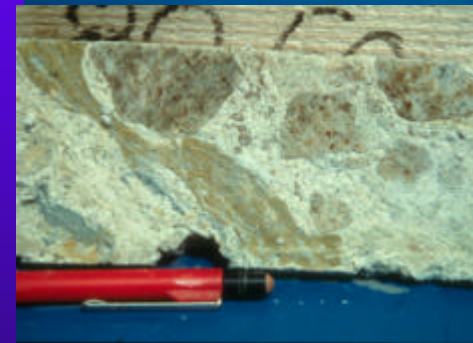
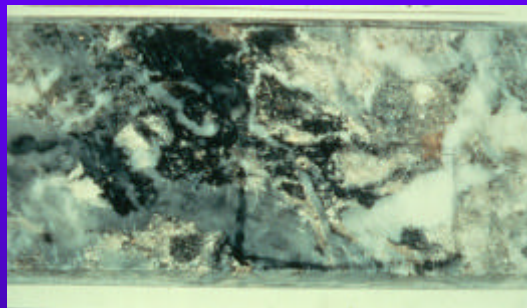


High Sulphidation epithermal Au



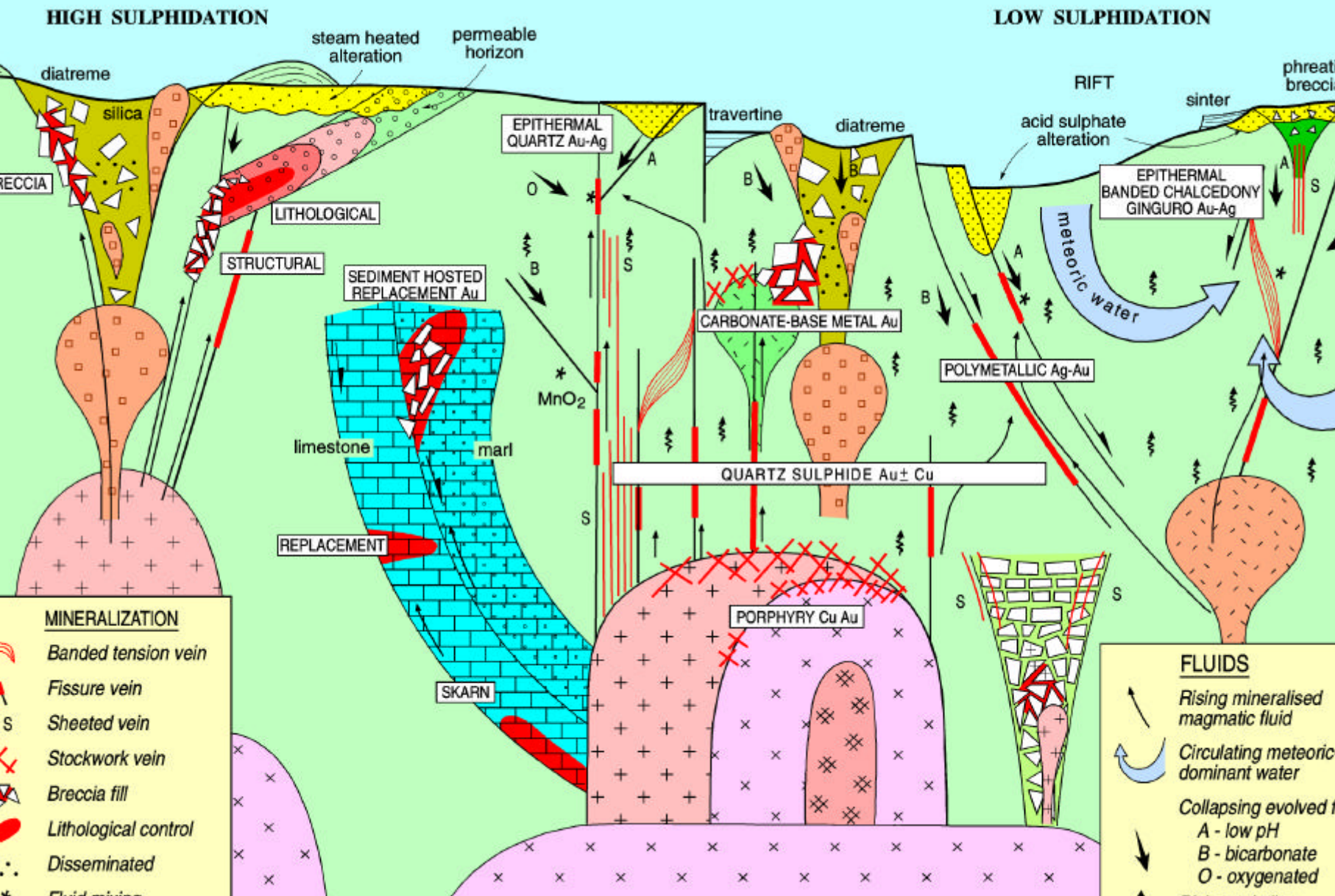
MOST
HOT ACID

enargite

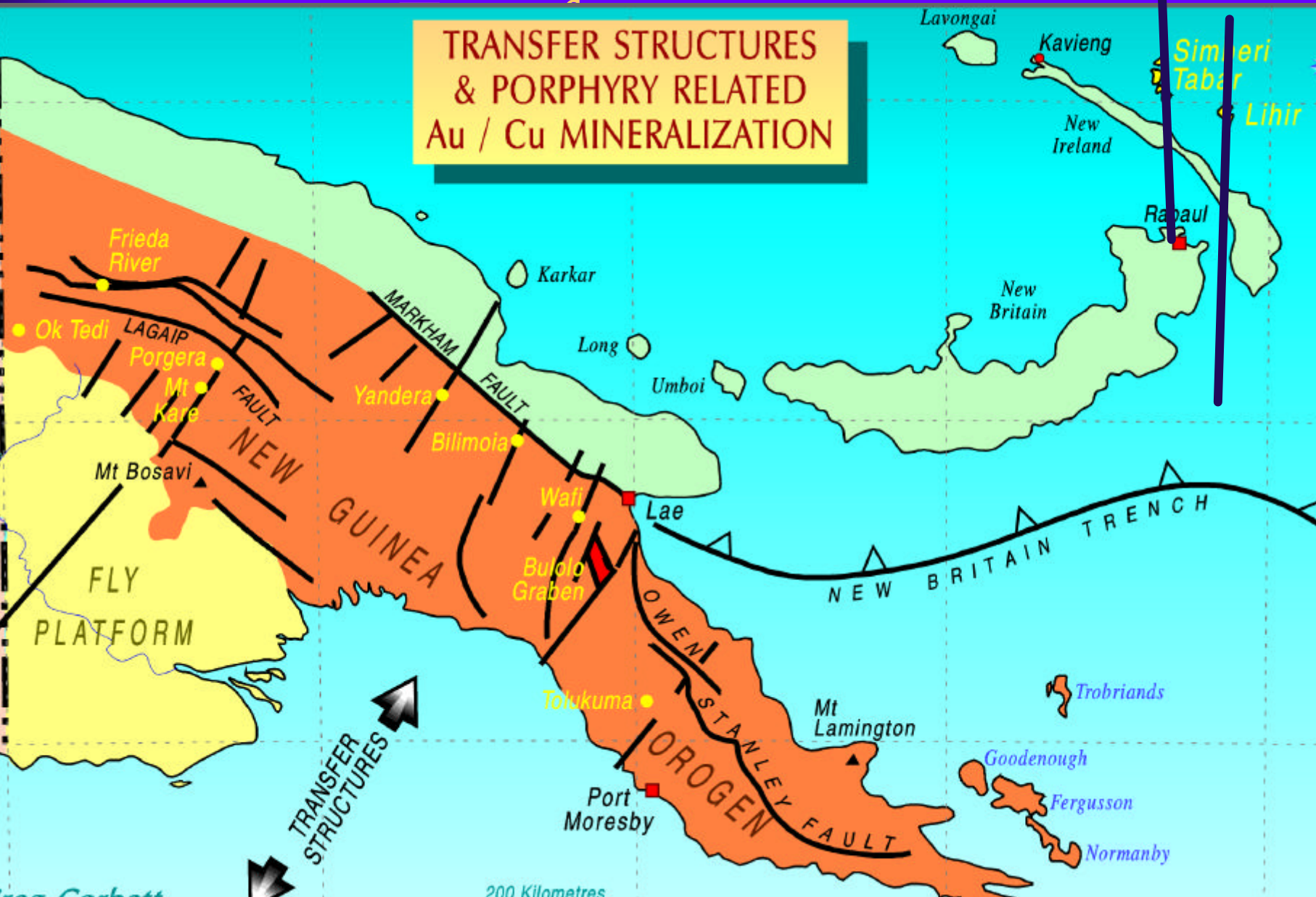


LESSER
HOT ACID

Styles of magmatic arc Cu-Au mineralisation

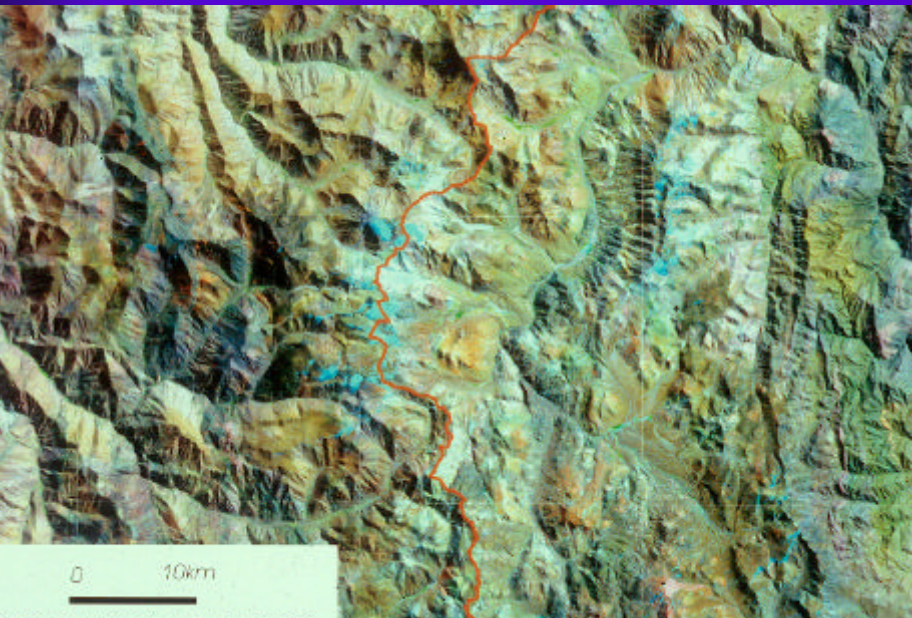


TRANSFER STRUCTURES & PORPHYRY RELATED Au / Cu MINERALIZATION

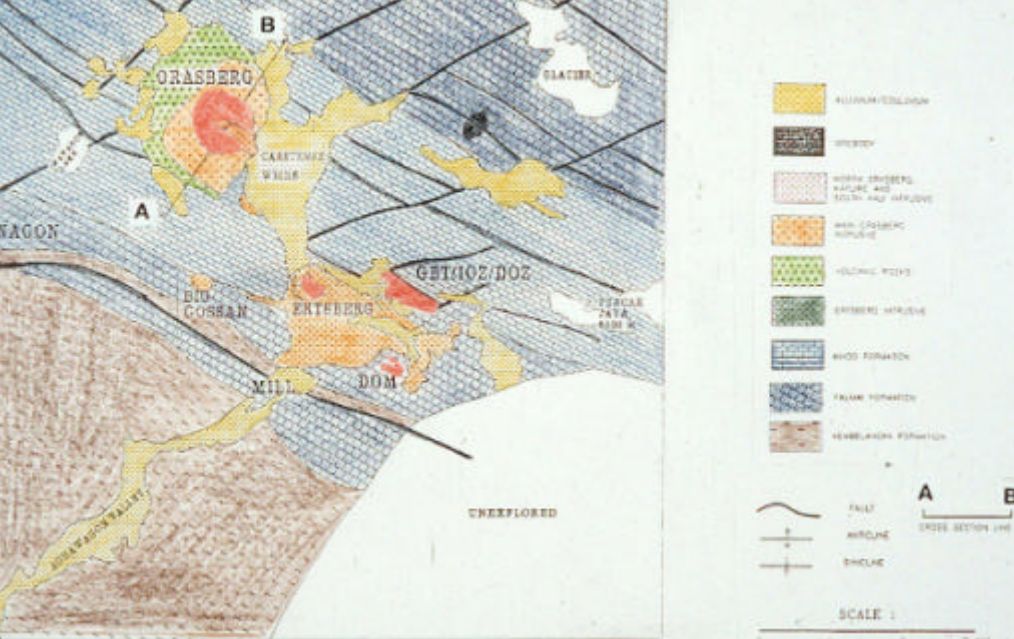


Cadia

Yanacocha, Peru

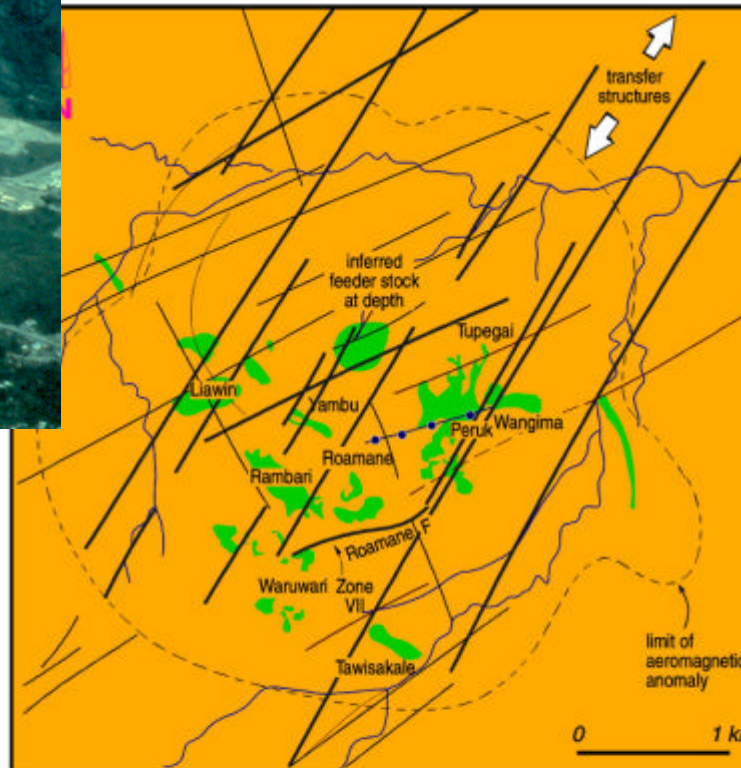
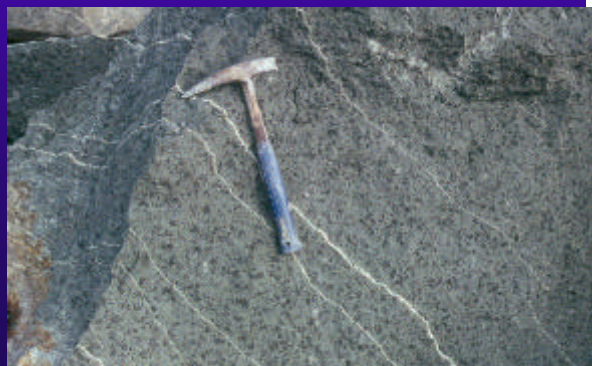


Grasberg





Porgera – Two intrusion events



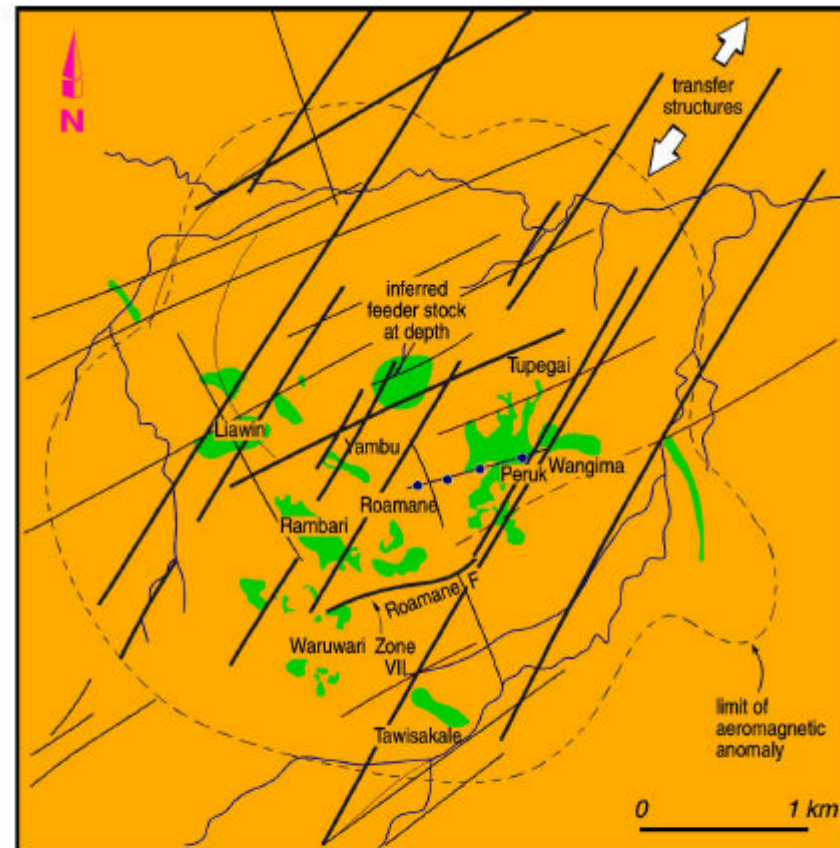
From Corbett (1981, 1994), Corbett et al. (1995)



Structure
Inferred structure
Intrusion



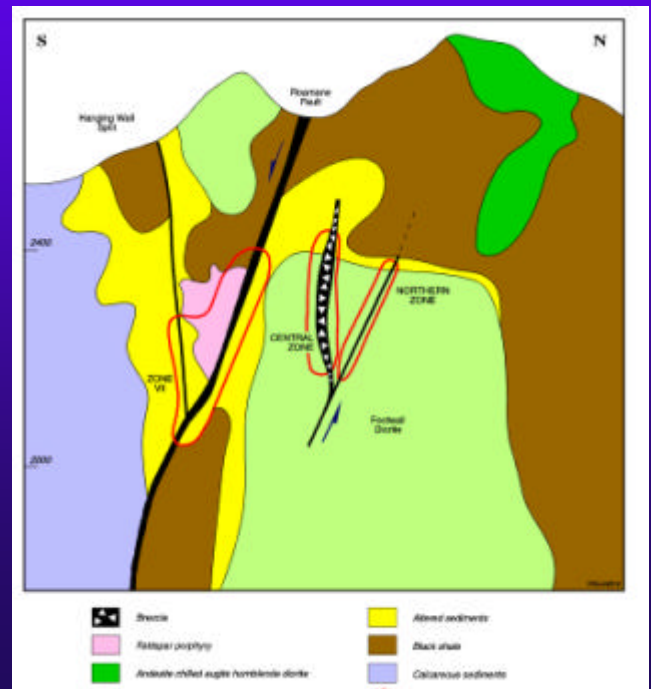
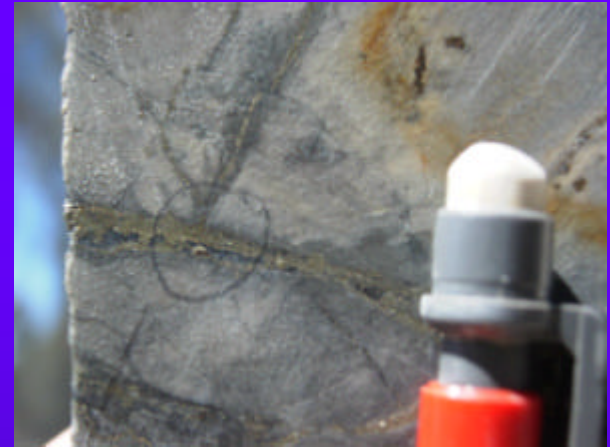
Early sulphide veins



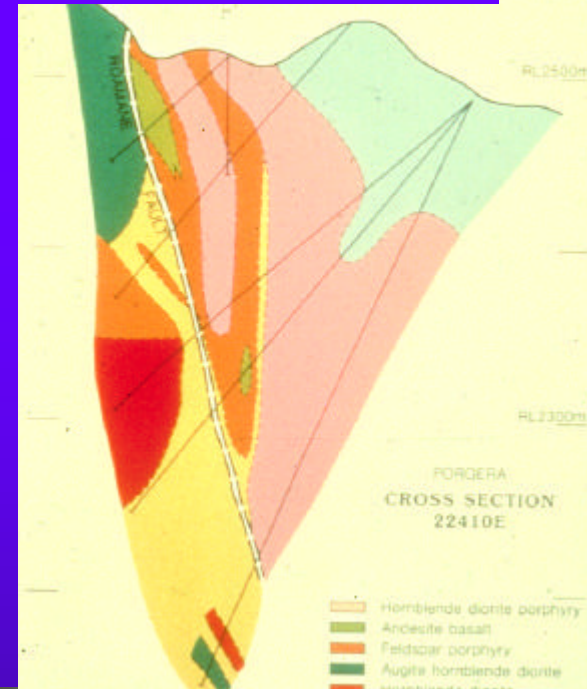
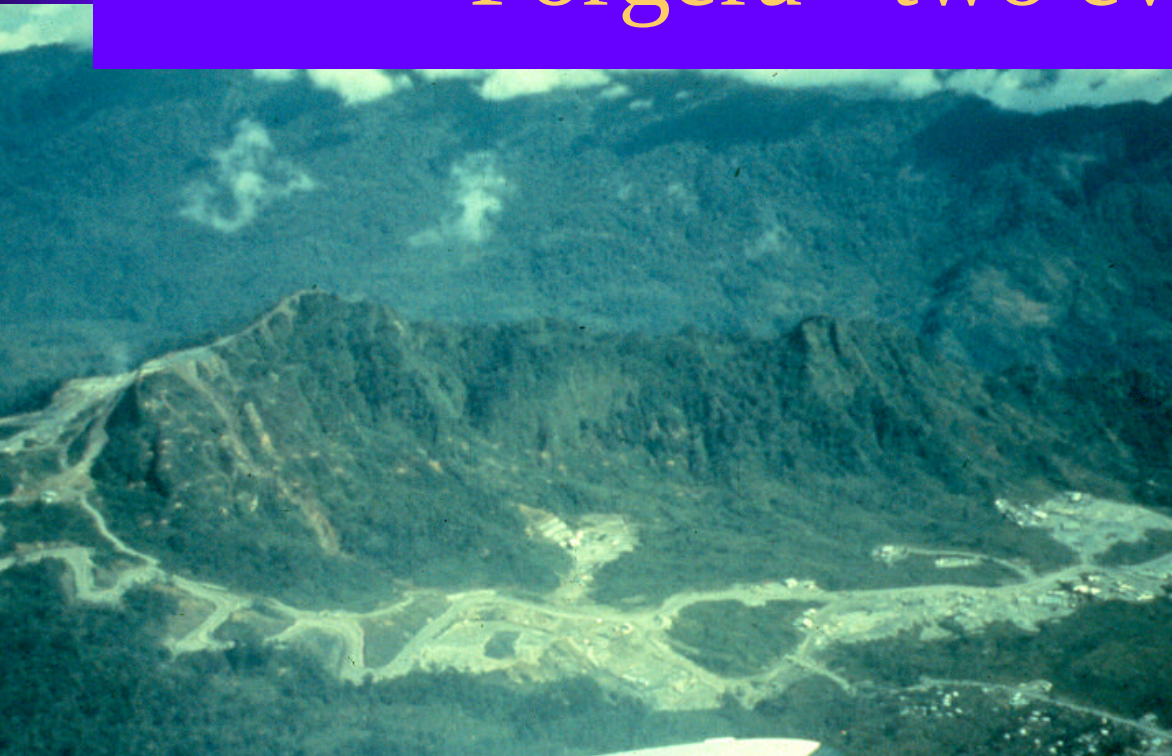
From Corbett (1981, 1994), Corbett et al. (1995)



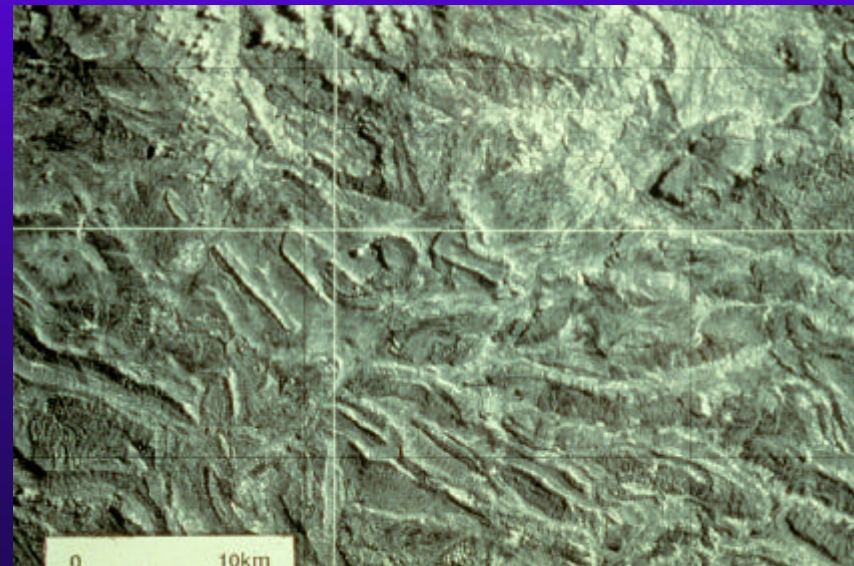
Porgera – Two mineralisation events



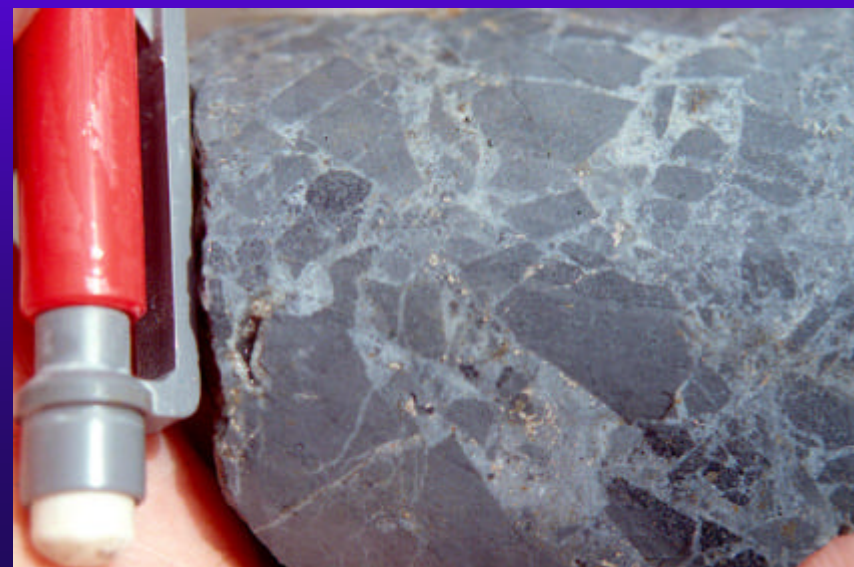
Porgera - two events



Porgera-Mt Kare



Mt Kare





Mt Kare – supergene Au

25.5 million t @
2.2/t Au and 29g/t Ag
1.8 M oz Au



Porgera



Before



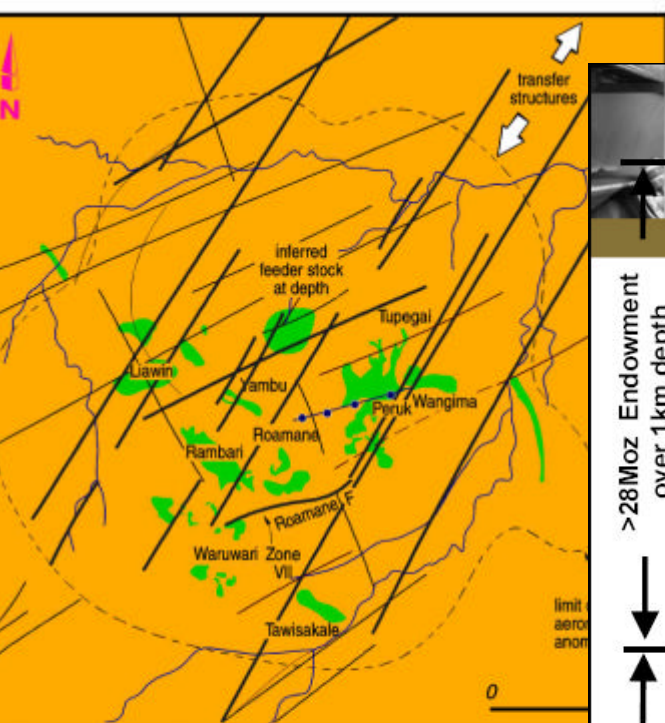
Now

1990-2003 – 12.22M oz Au 2.23M oz Ag

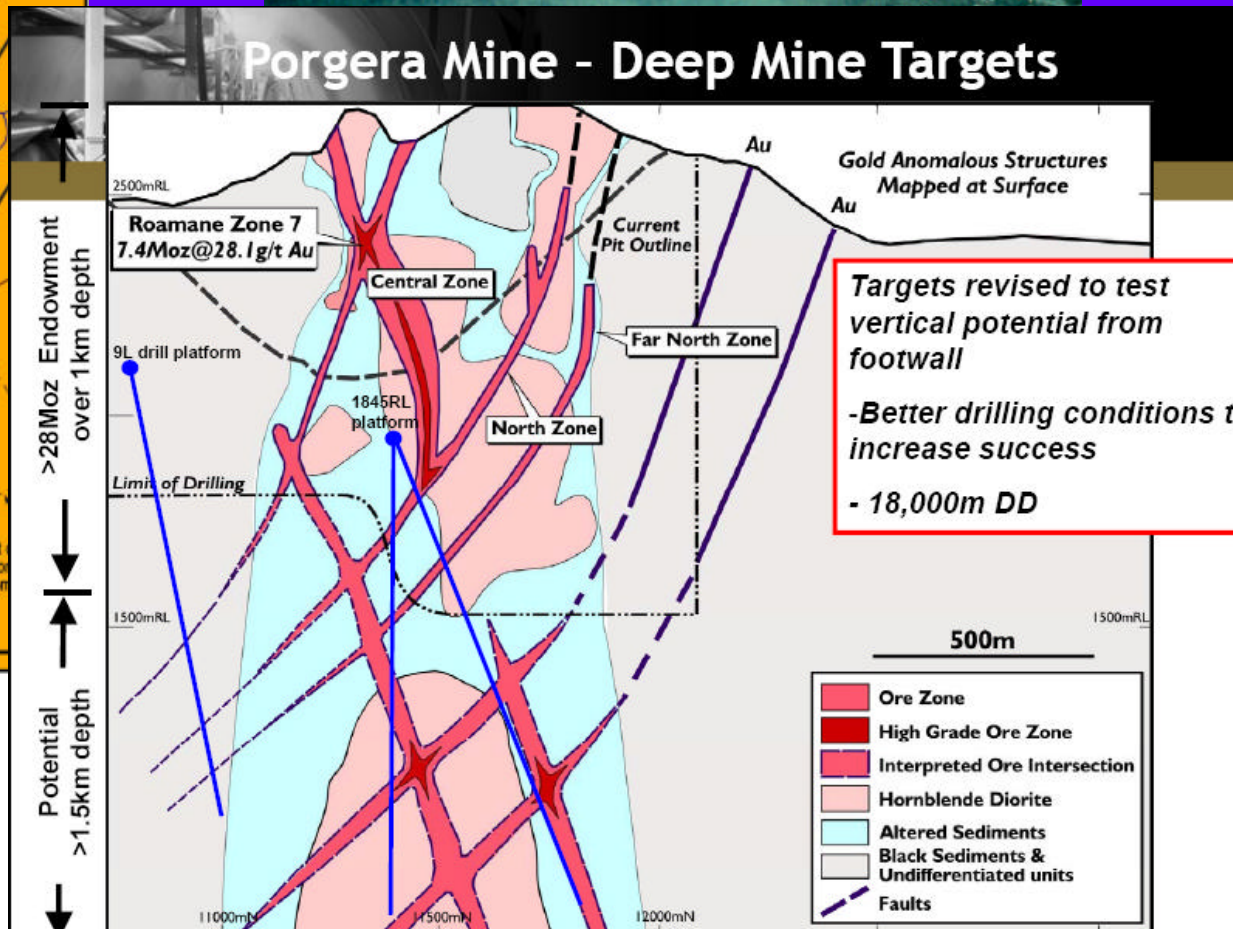
2006 reserves 77.26Mt @ 3.79g/t Au (9.4M oz)

Underground production increasing to 60% of Au

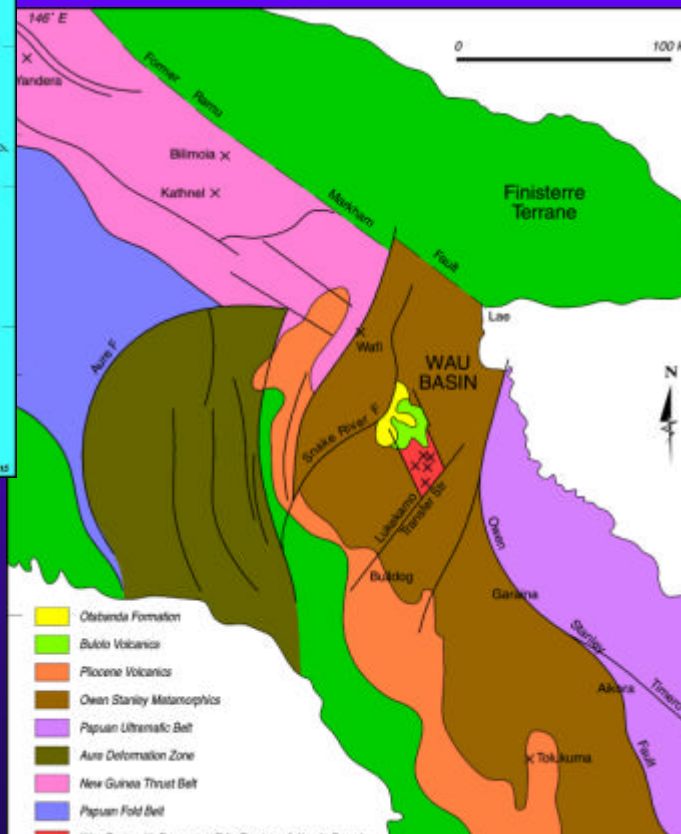
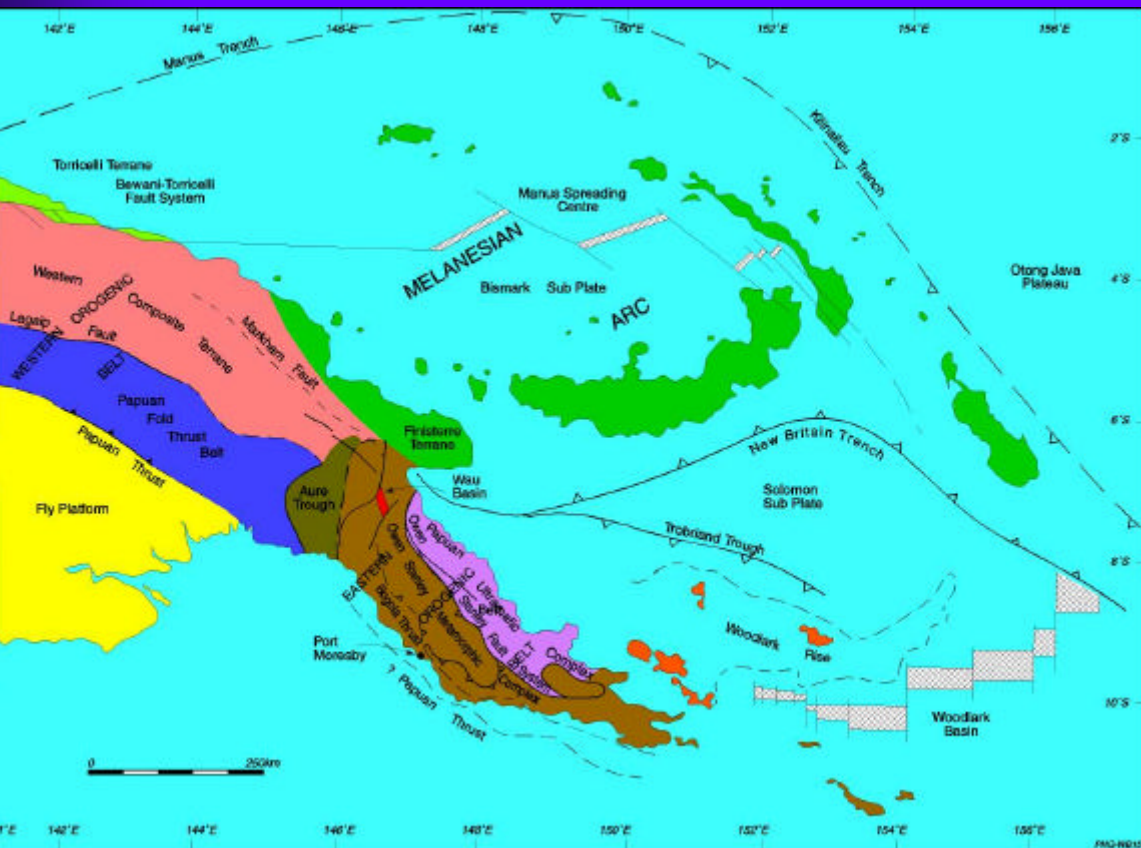
Porgera target generation



m Corbett (1981, 1994), Corbett et al. (1995)



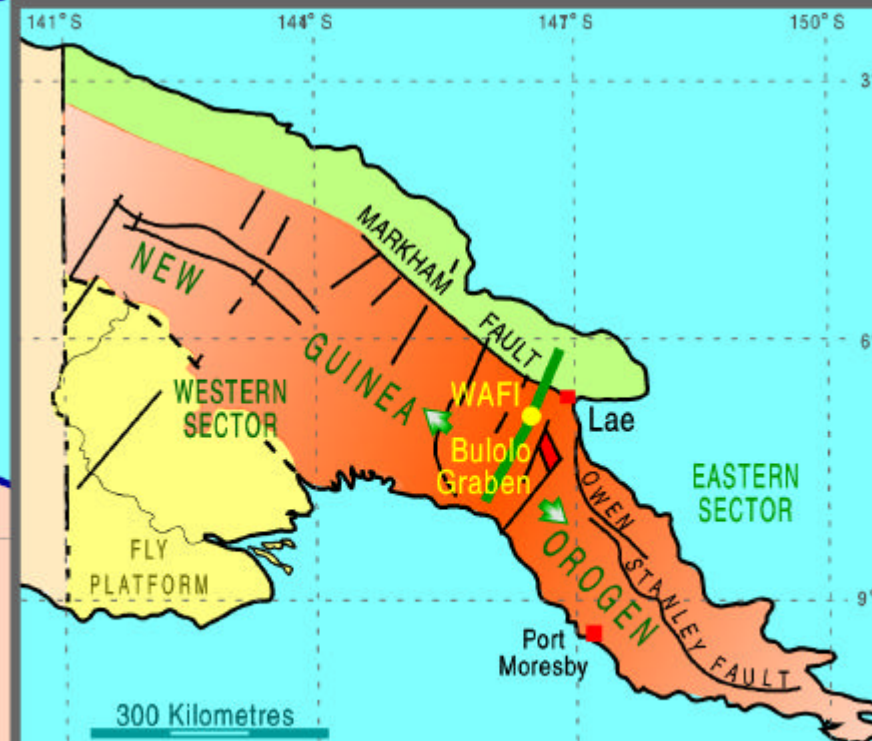
Morobe goldfield





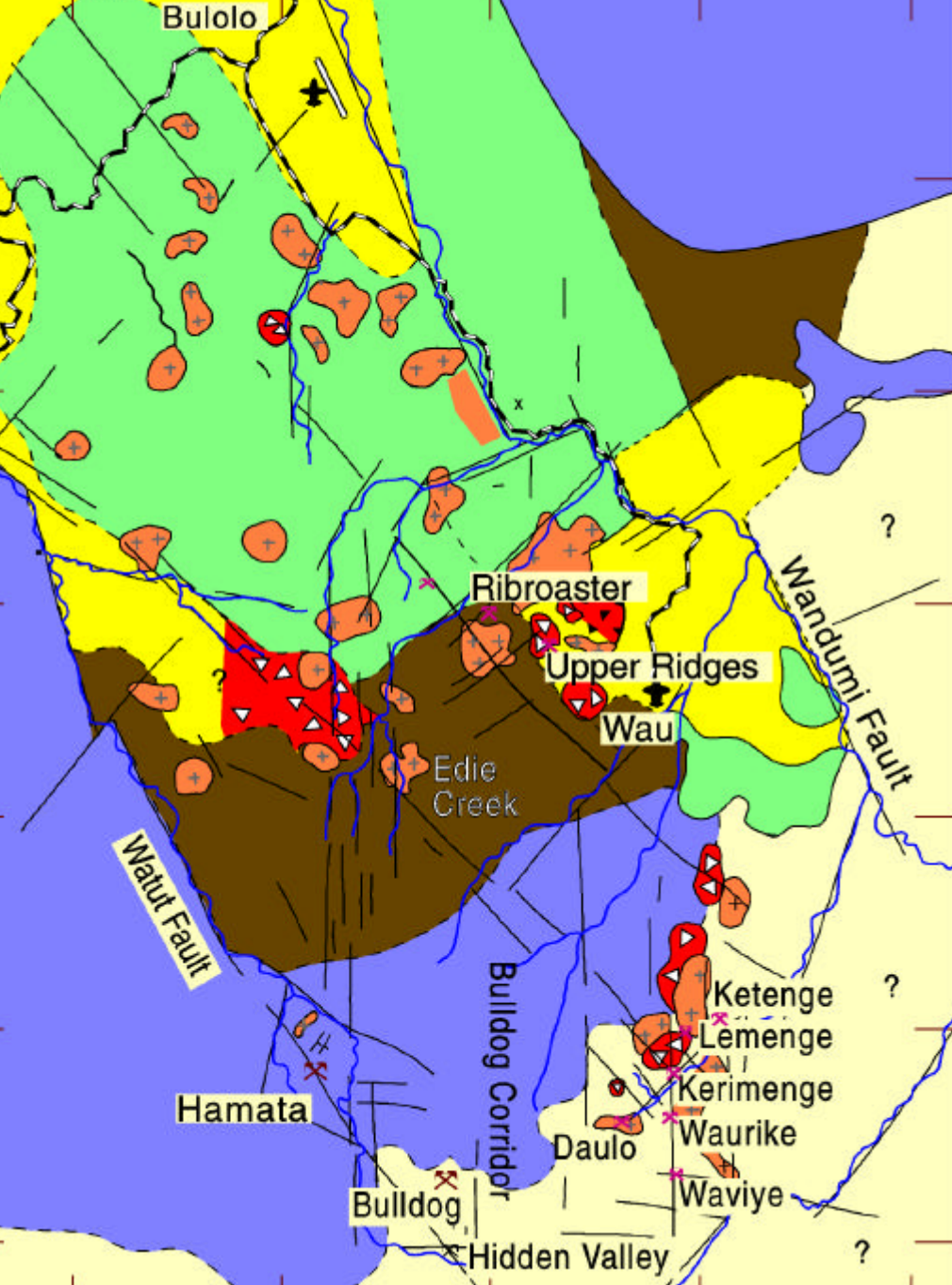
Bulolo Graben & Morobe Goldfield

Corbett 09/93



BULOLO GRABEN

Geology



Otibanda Formation



Bulolo Volcanics



Edie Porphyry



Diatreme breccia

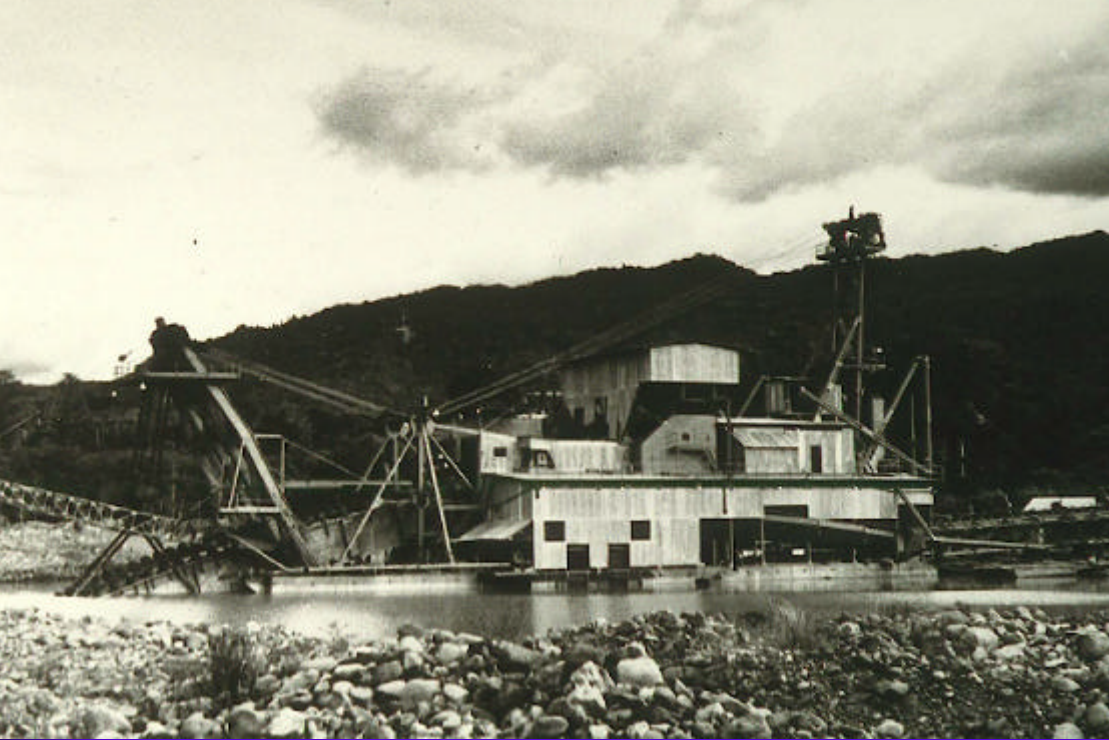


Morobe Granodiorite



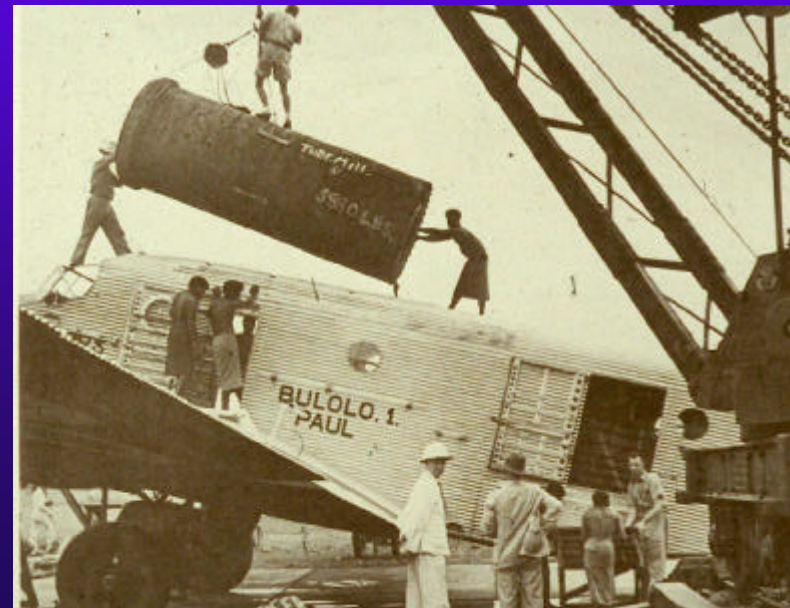
Kaindi Phyllite

0 10 km

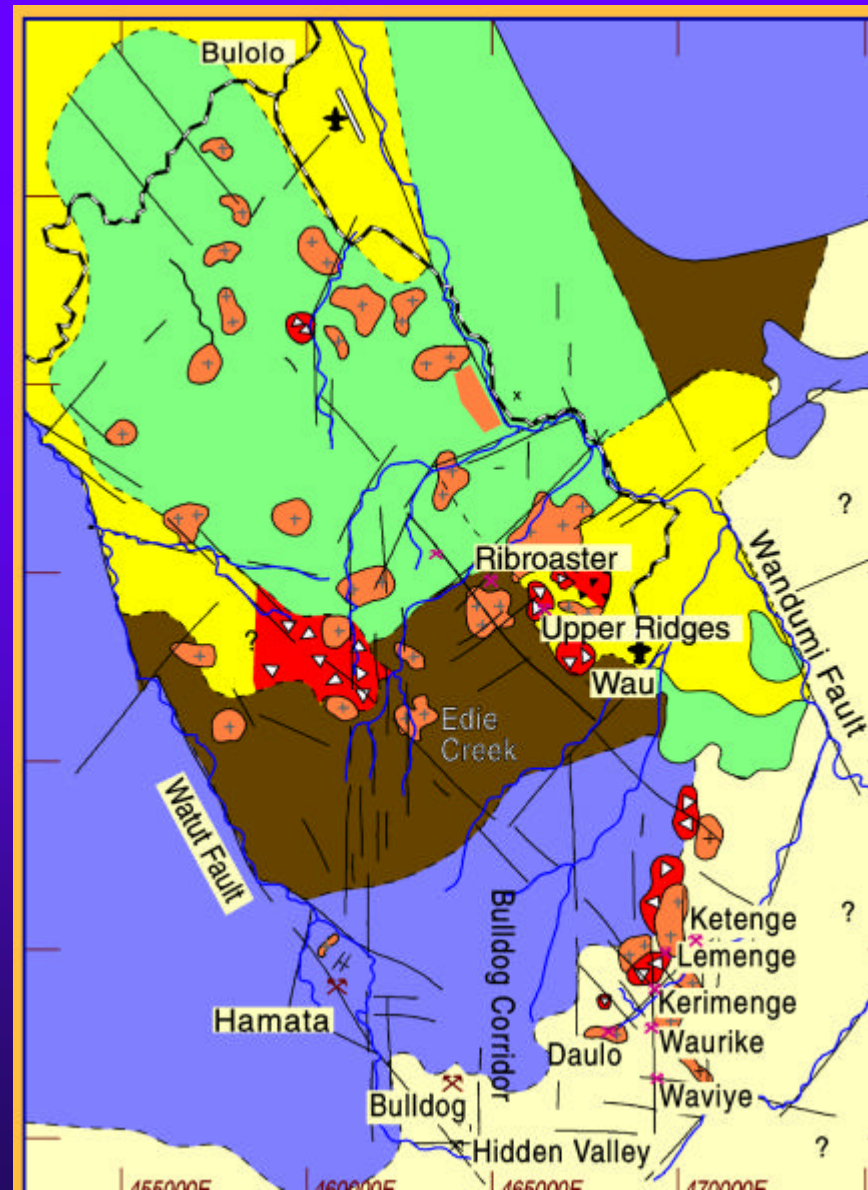
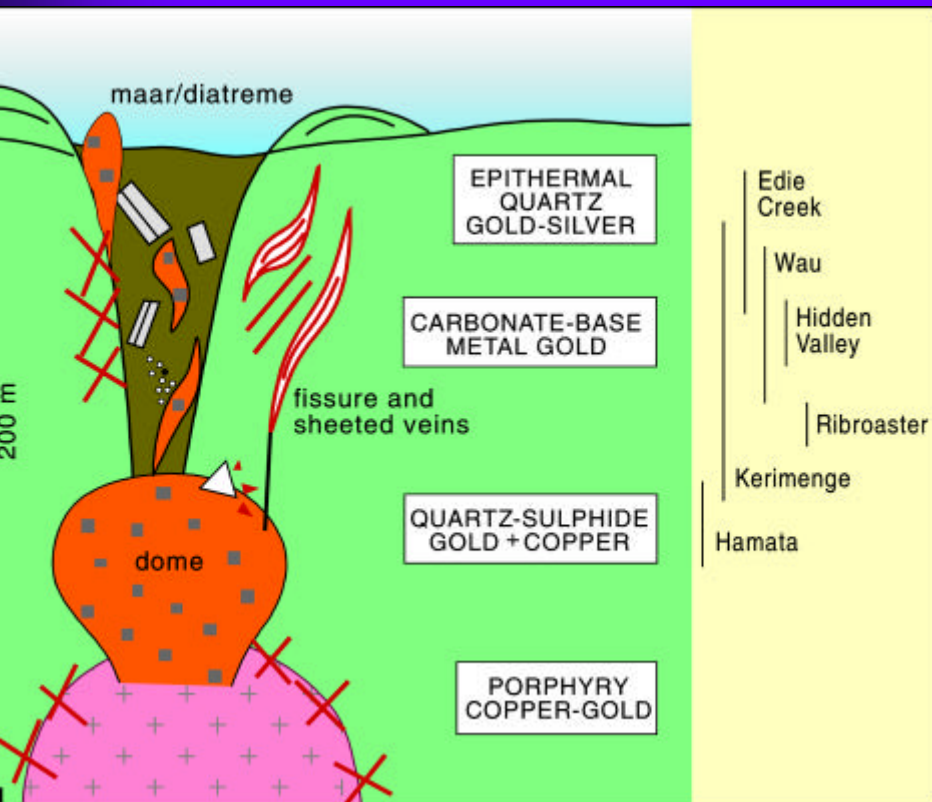


Bulolo Gold Dredging

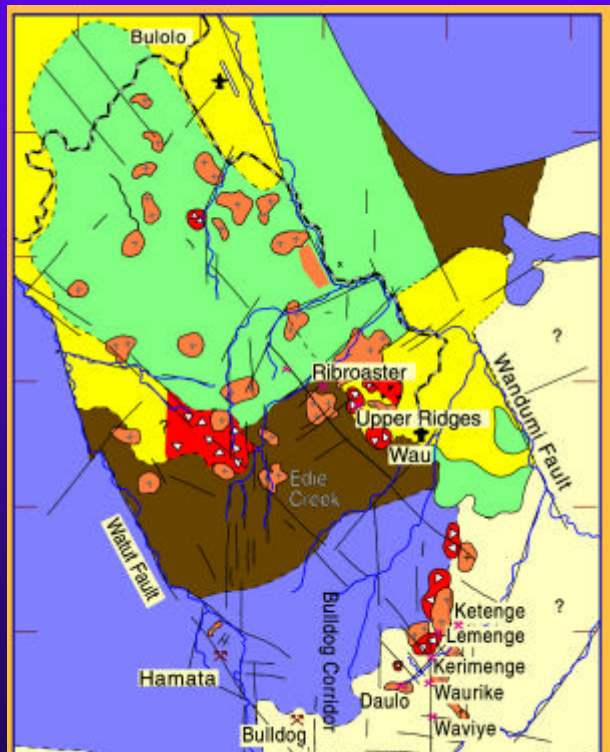
2.1 M oz Au @ 0.15 g/t Au
1932-65



Zoned mineralisation



Wandumi sinter



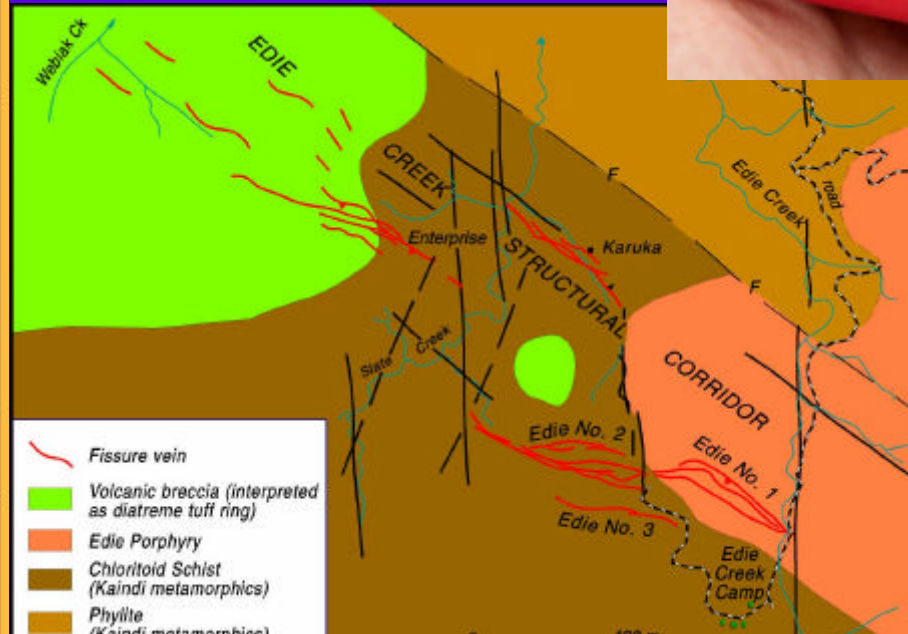
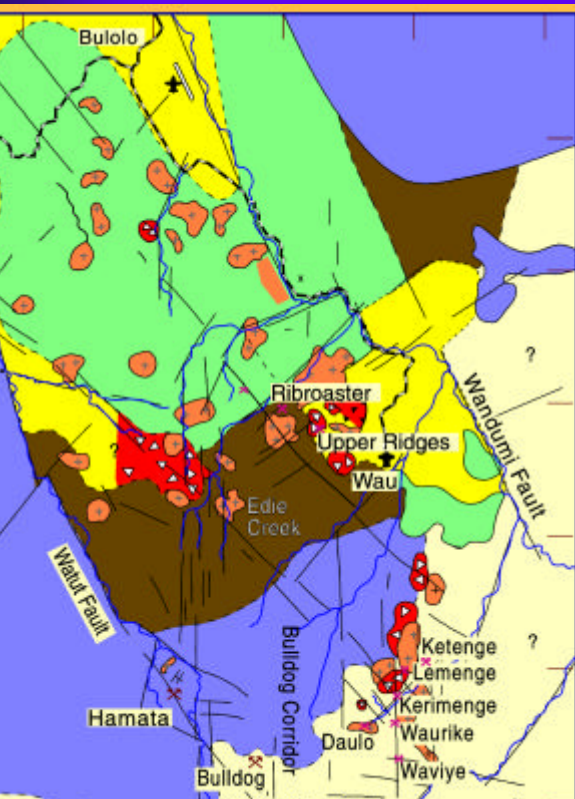
Wau-Namie-Ribroaster



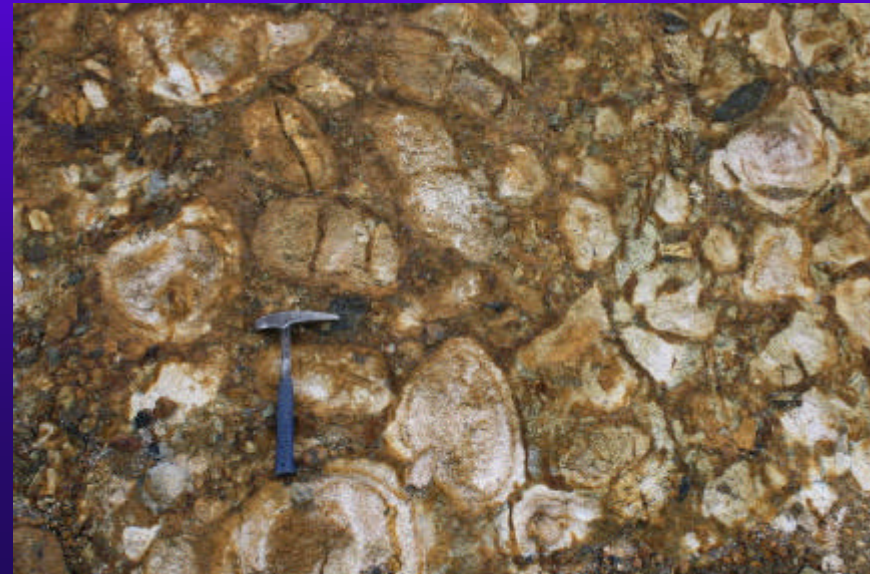
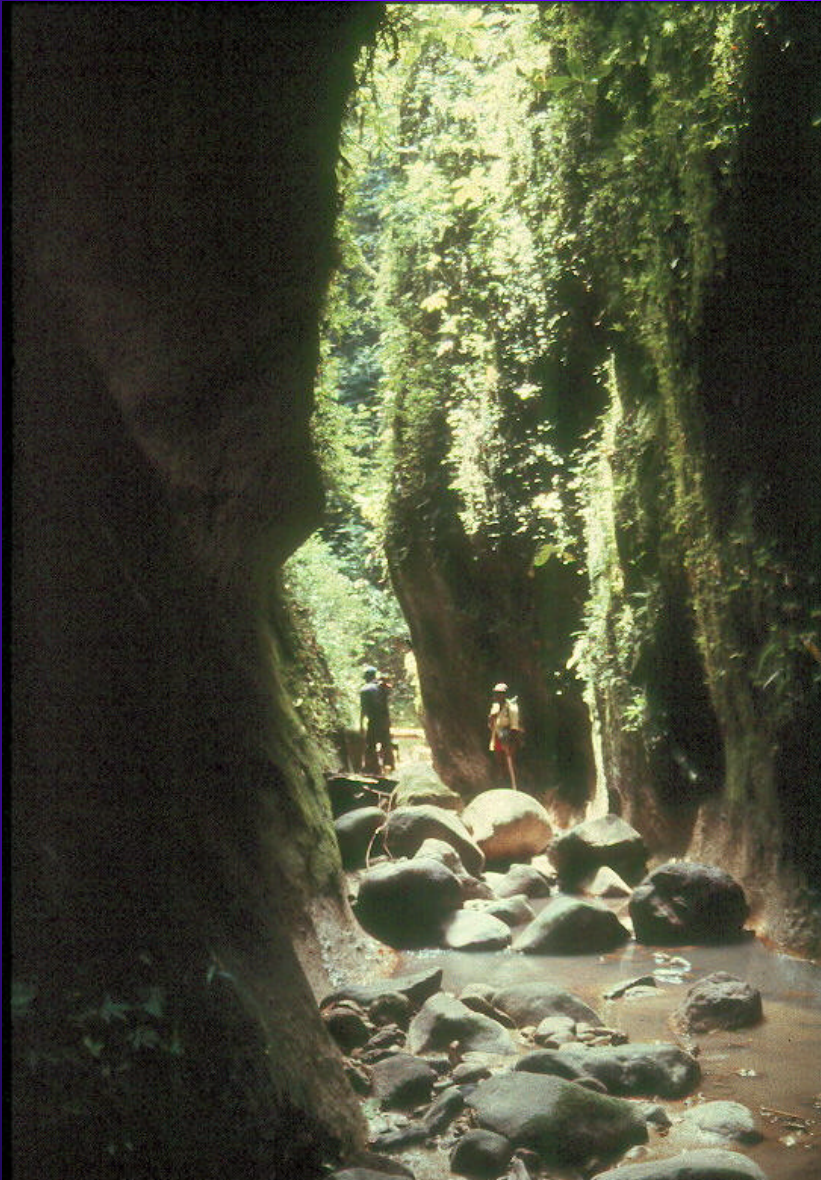
About 1 M oz Au
1923-90



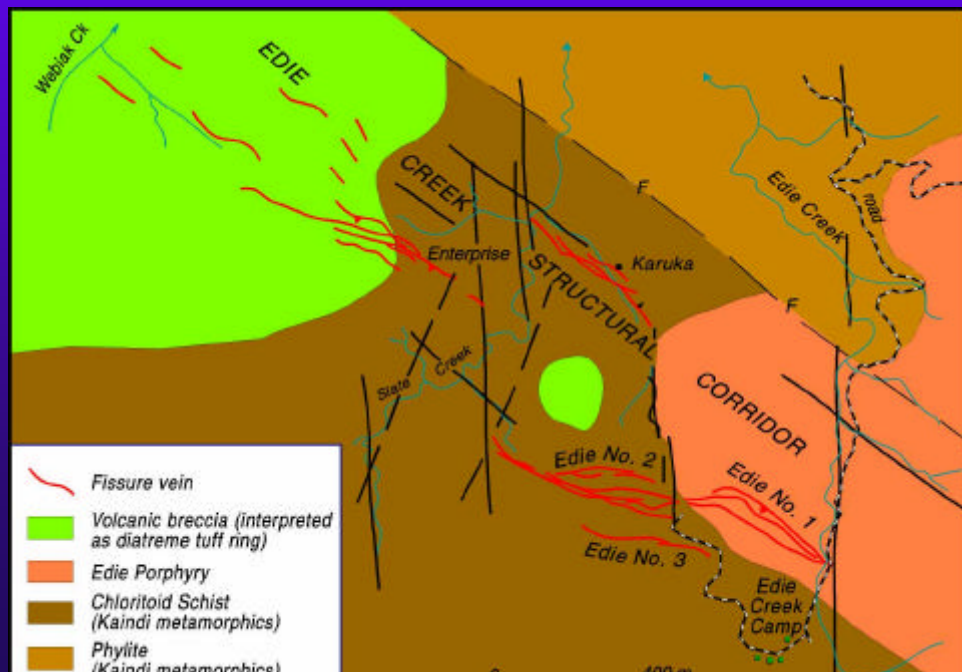
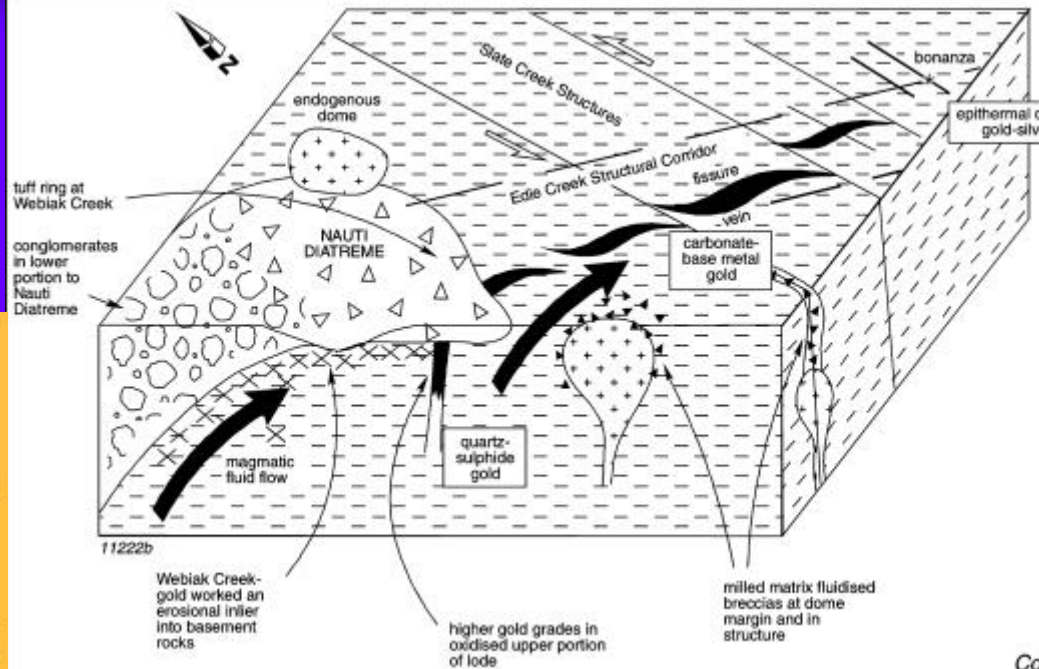
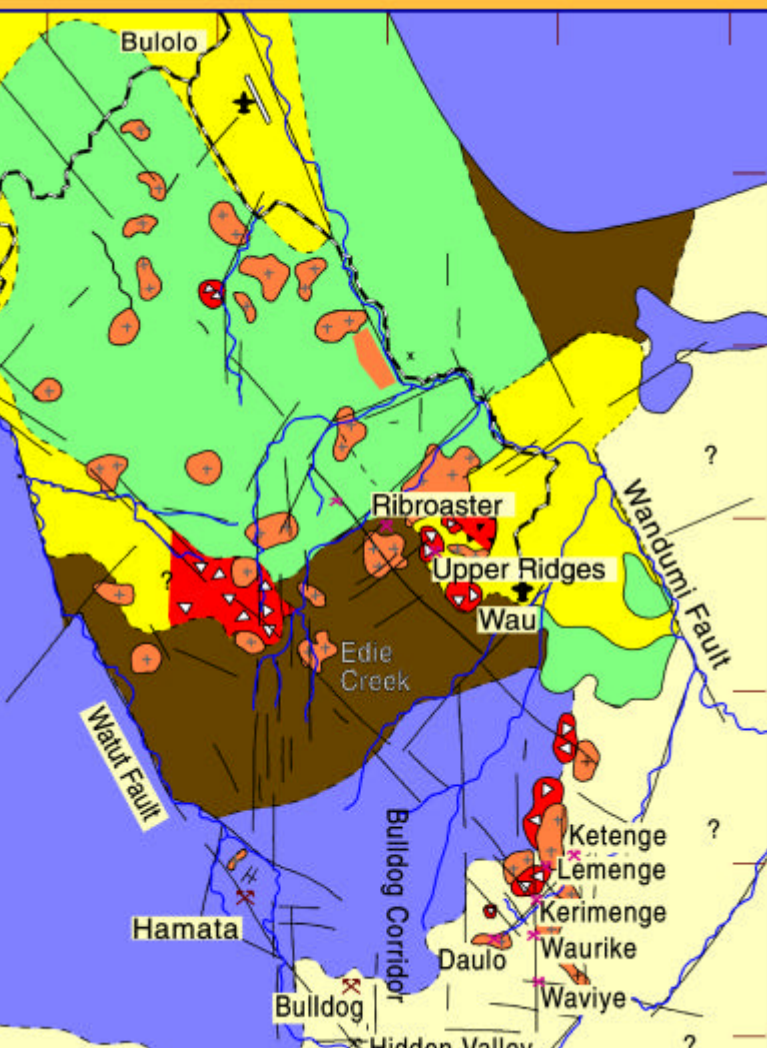
Edie Creek

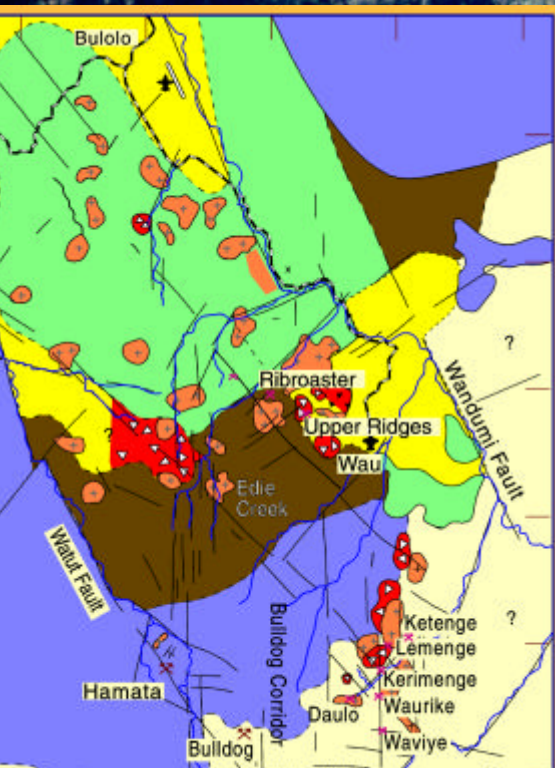


Nauti



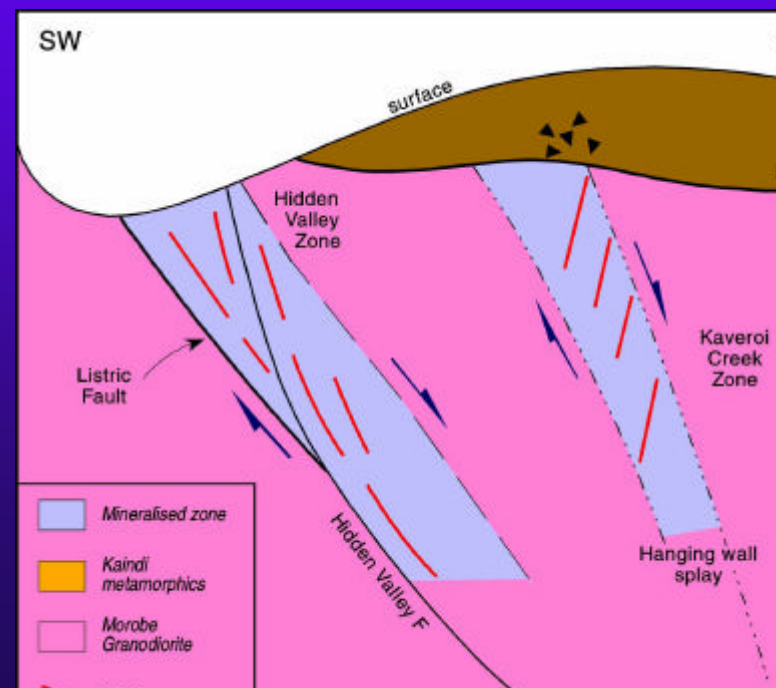
Nauti diatreme and Edie Creek





Hidden Valley

3.5 Mo oz Au
@ about 2 g/t Au



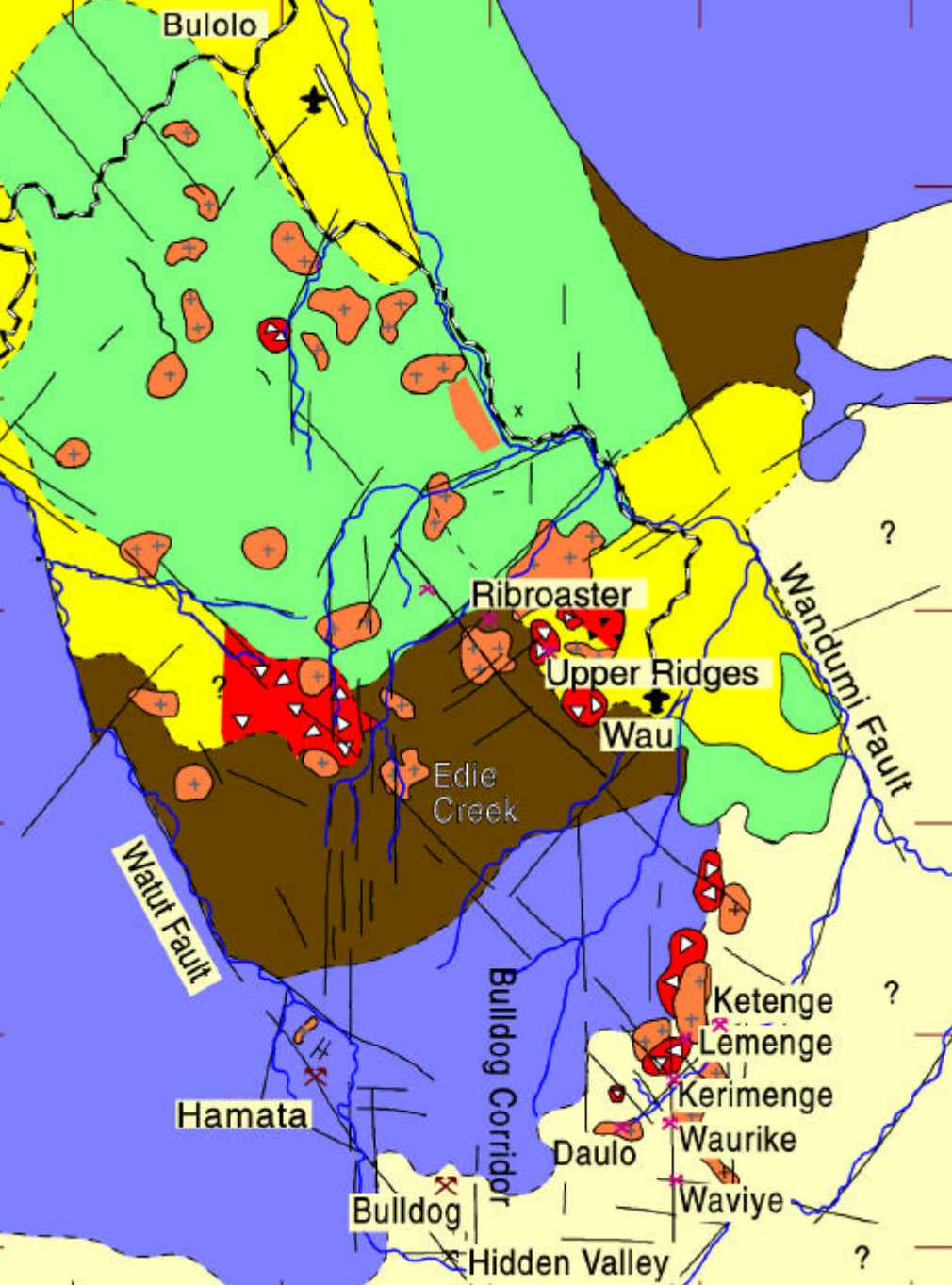
Hidden Valley looking south along the Upper Watut fault



Hidden Valley



Kerimenge



Otibanda Formation



Bulolo Volcanics



Edie Porphyry



Diatreme breccia



Morobe Granodiorite



Kaindi Phyllite

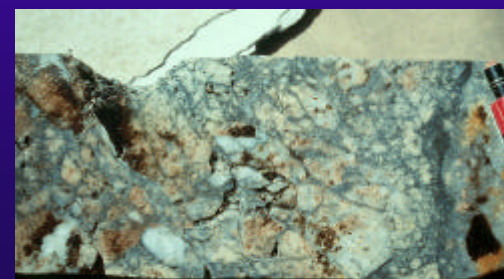
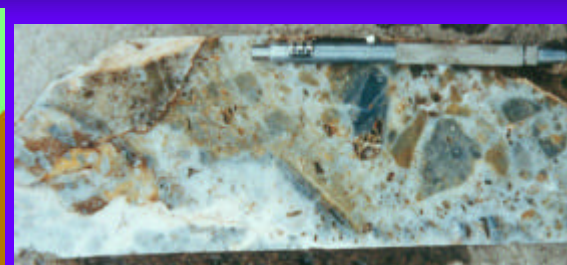
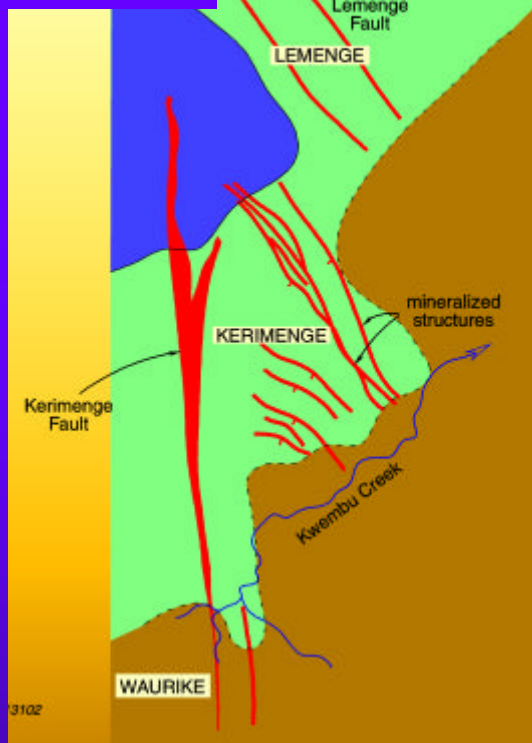
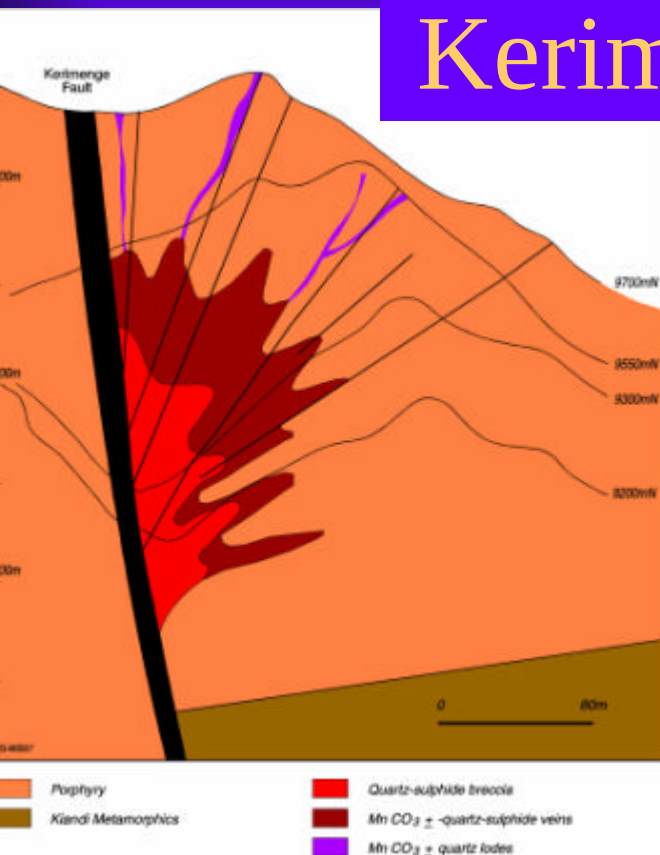
0 10 km



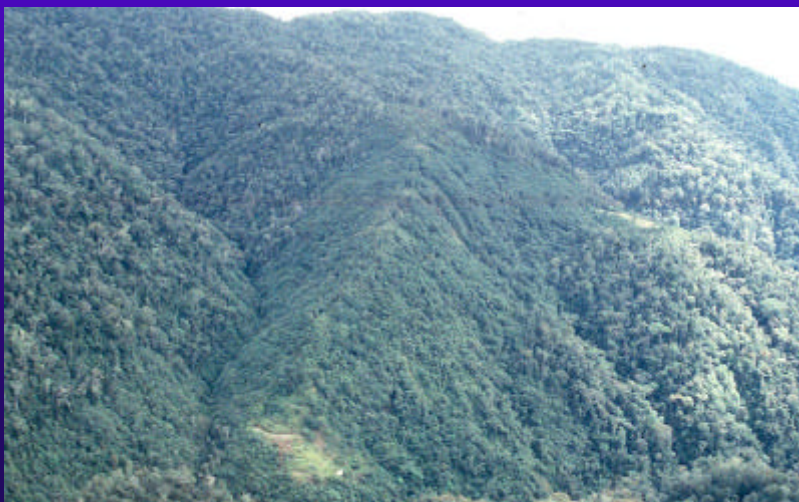
Kerimenge



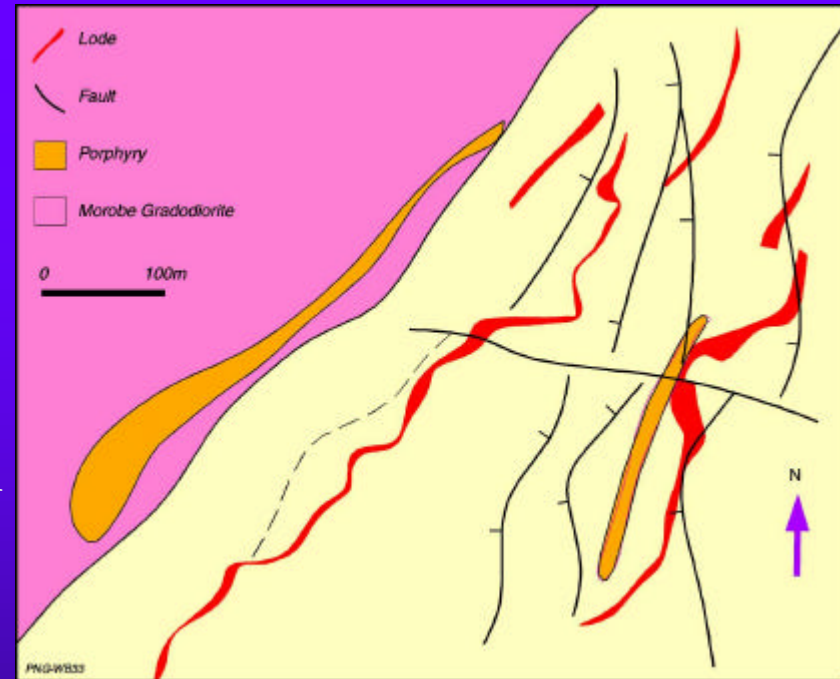
Kerimenge



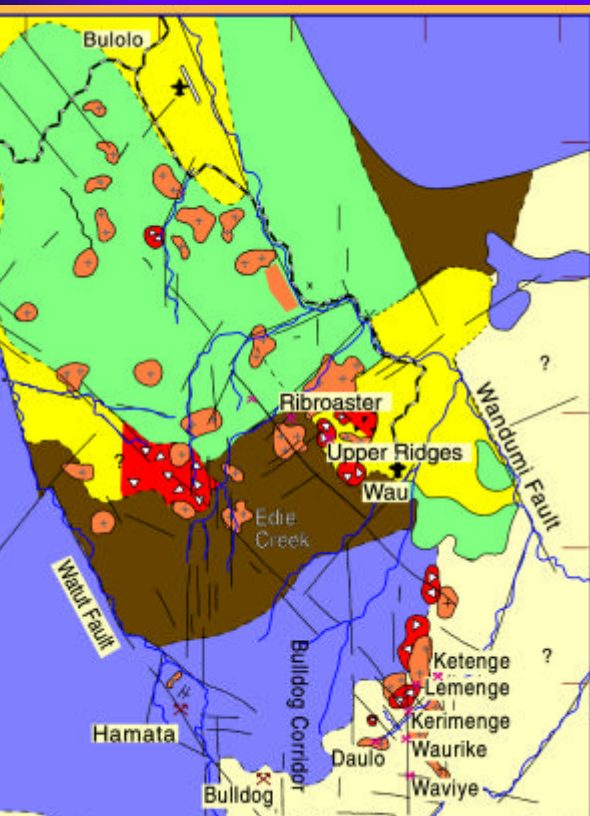
About
M oz Au



Hamata



0.41 M oz Au
@ 3.9 Au

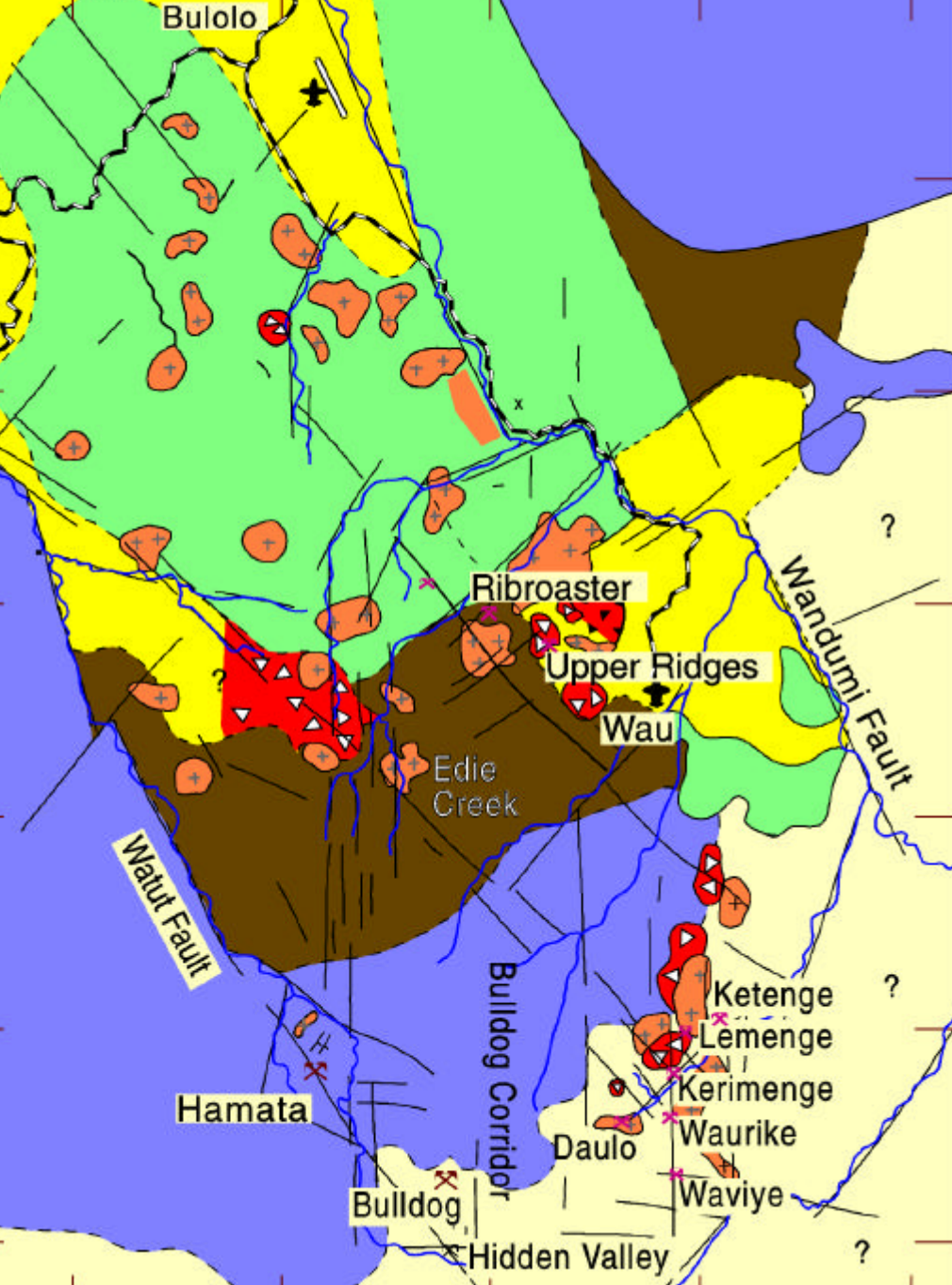


Hamata



BULOLO GRABEN

Geology



Otibanda Formation



Bulolo Volcanics



Edie Porphyry



Diatreme breccia



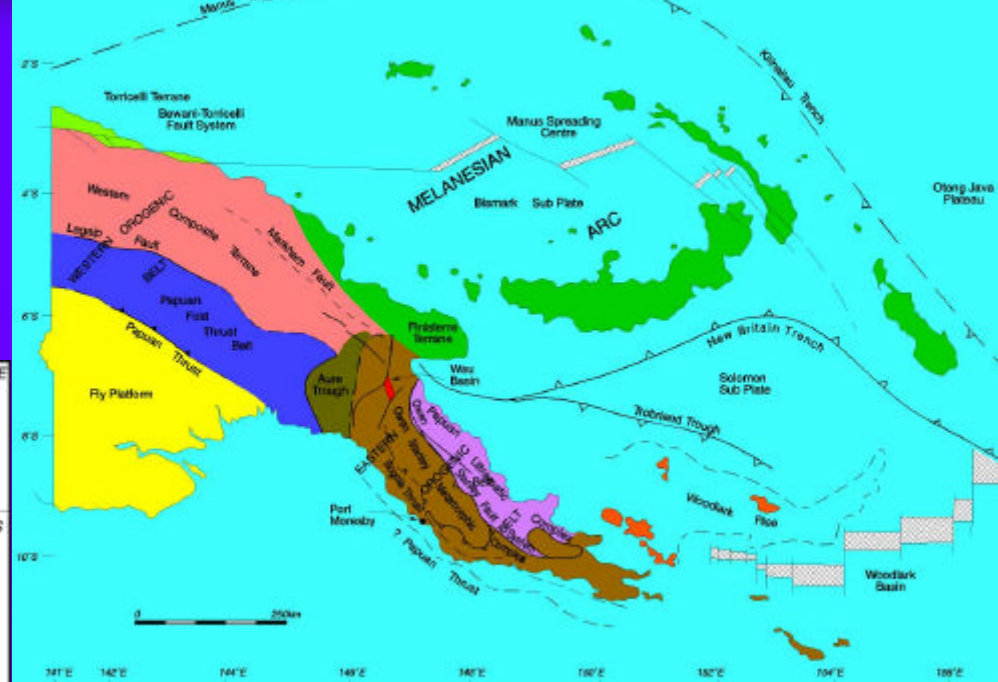
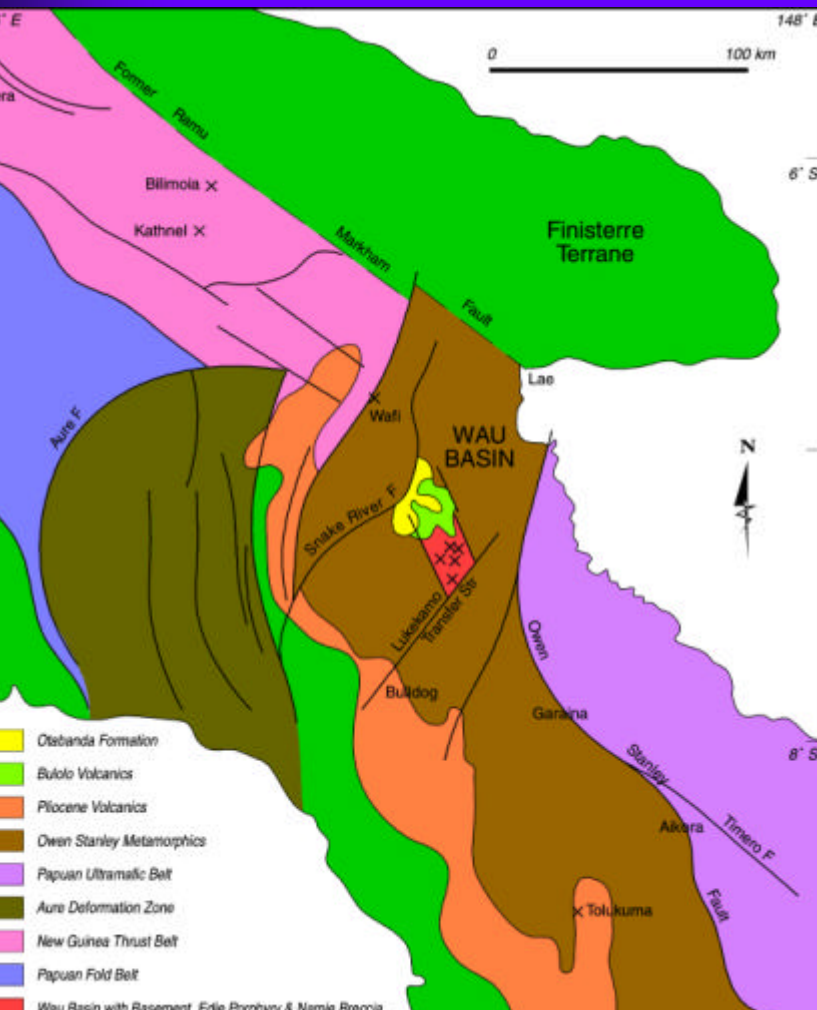
Morobe Granodiorite



Kaindi Phyllite

0 10 km

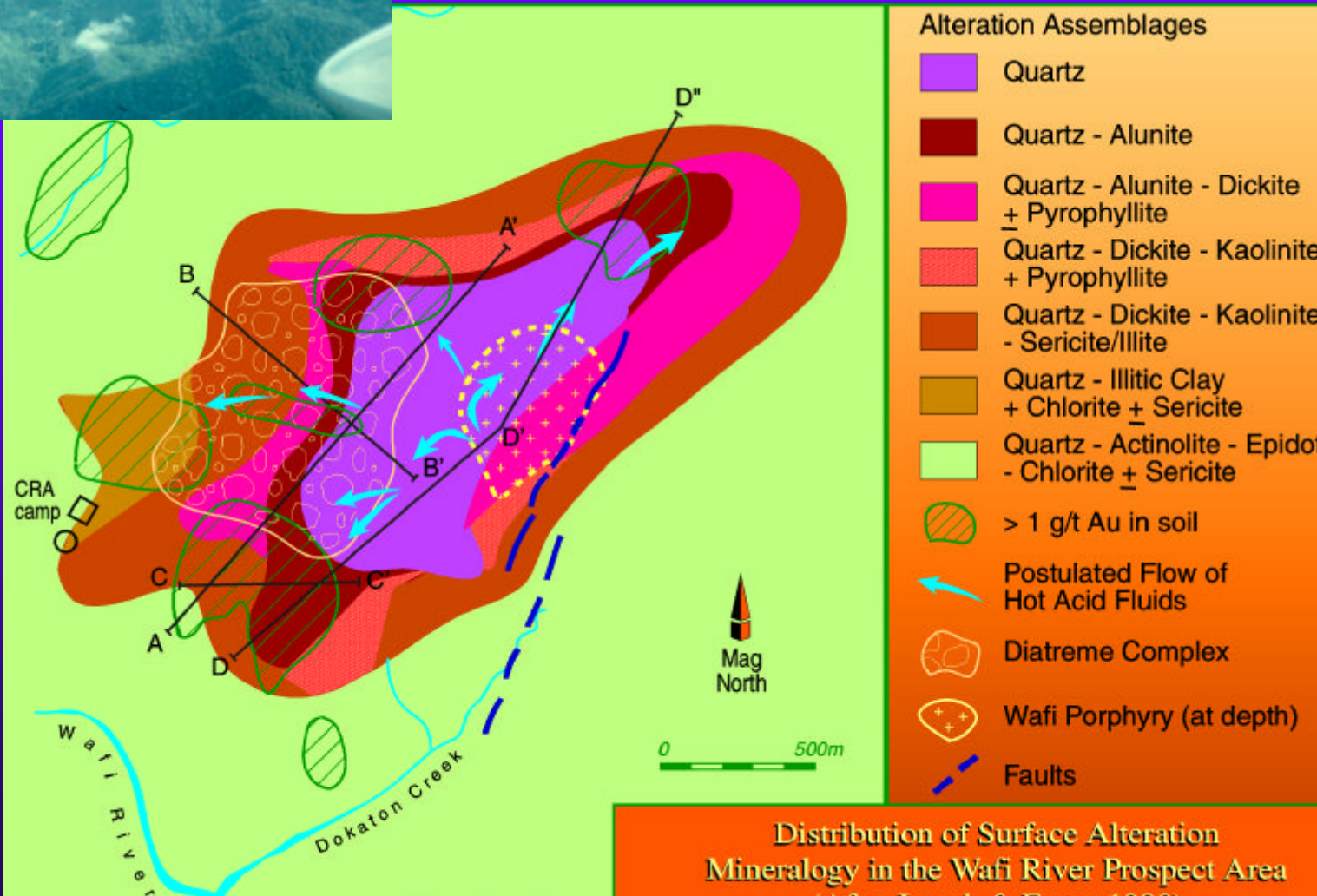
Wafi



Wafi



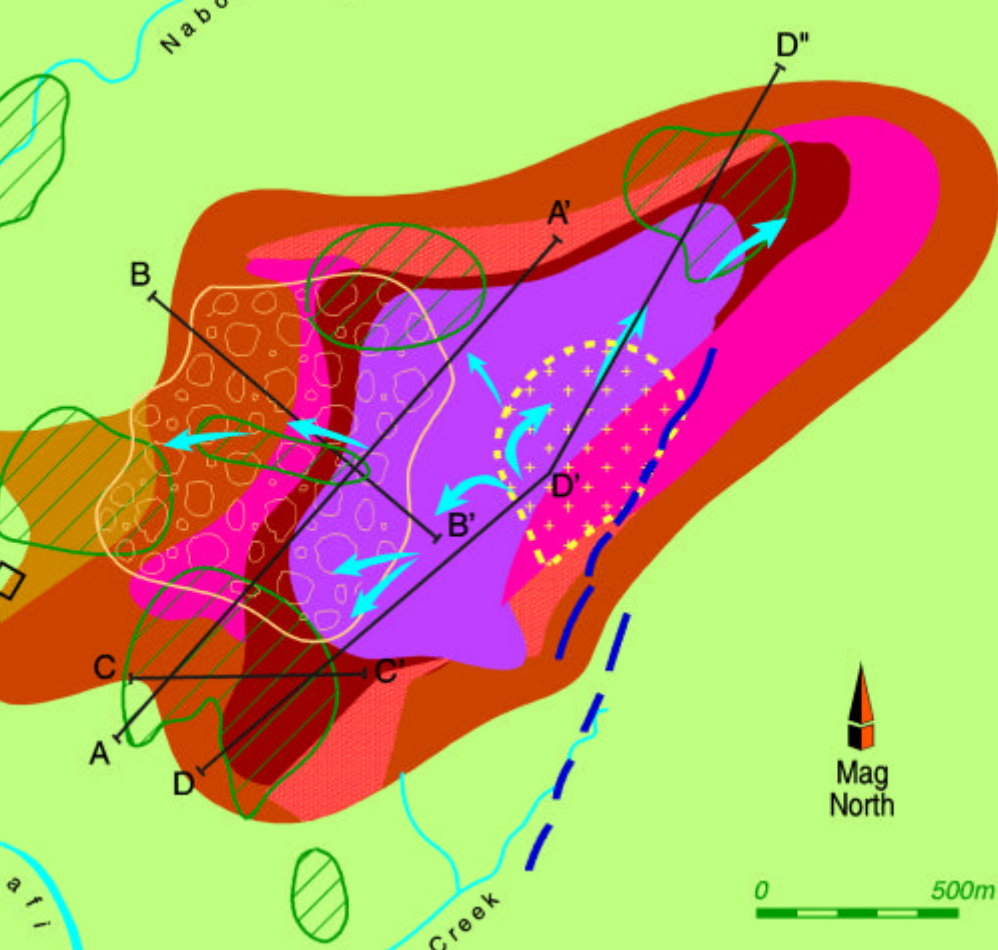
Wafi



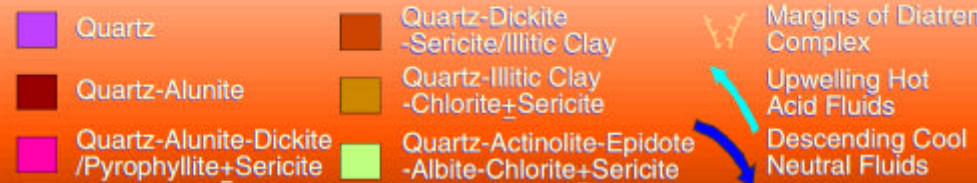
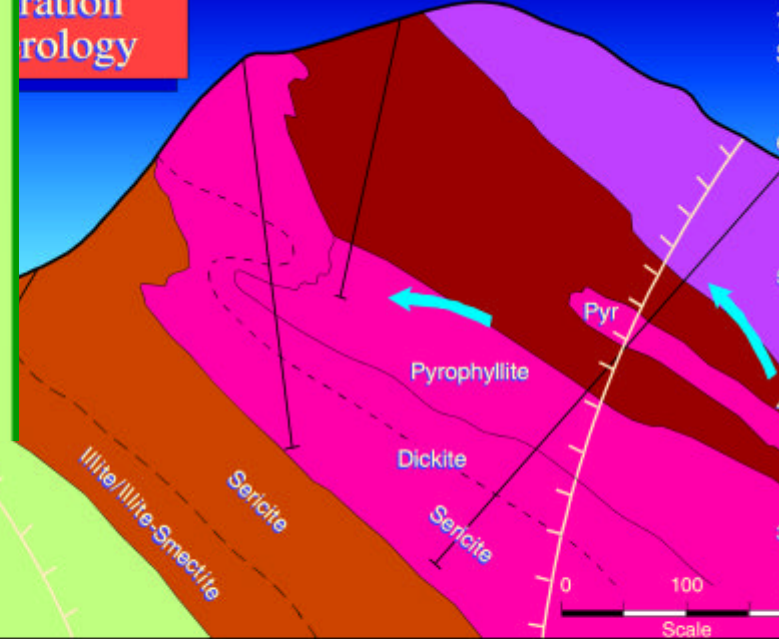
Wafi diatreme breccia



Wafi and geological models

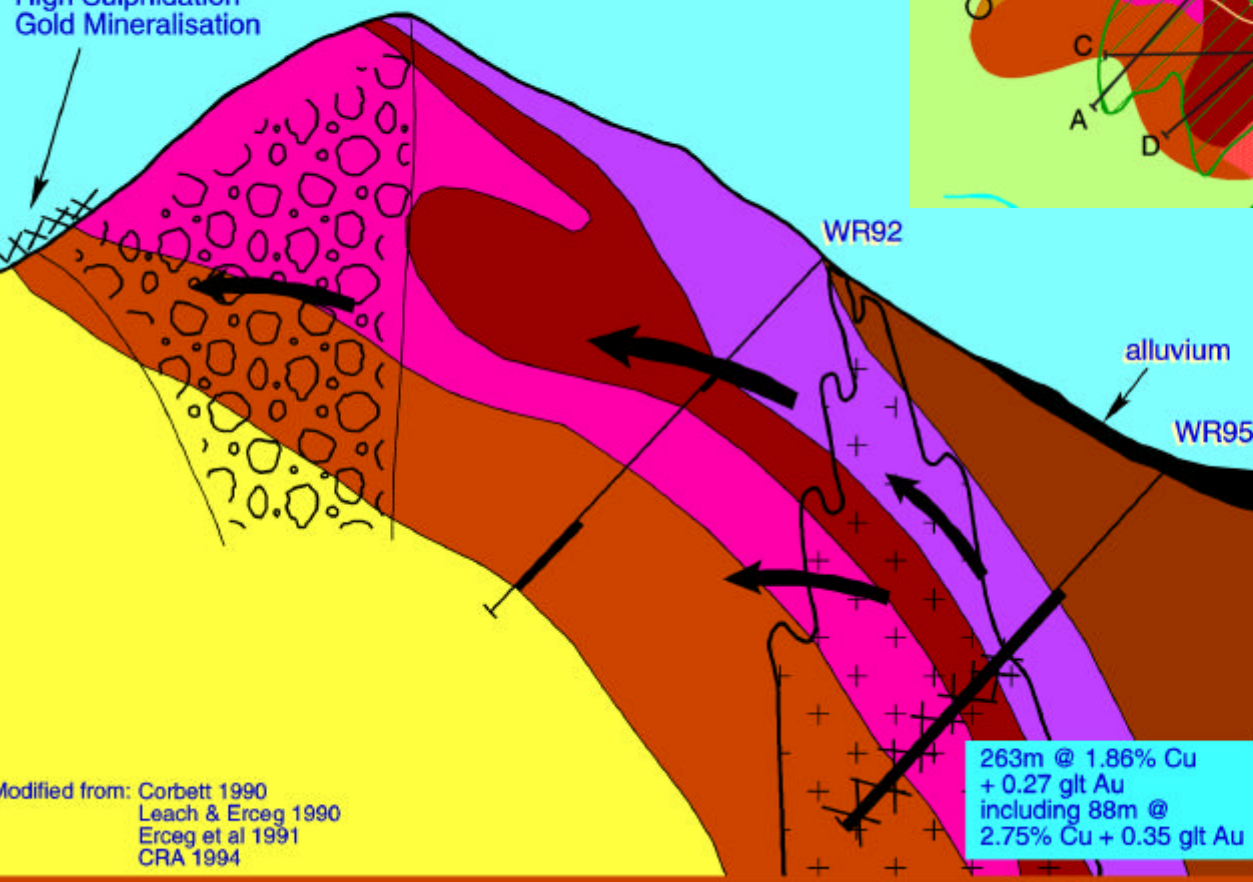


AFI
eration
rology

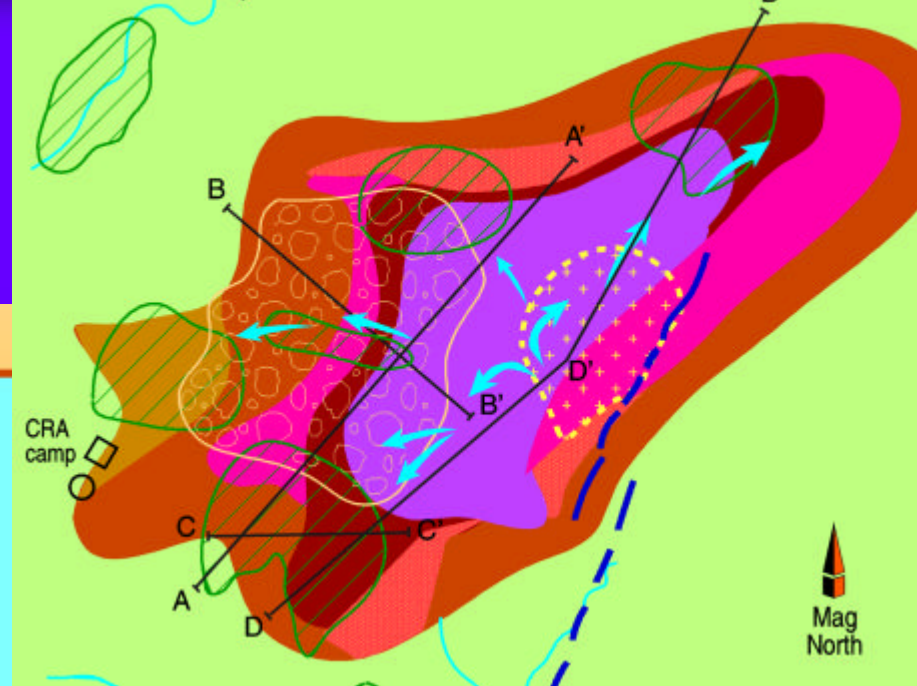


Golpu discovery

WEST
Zone B & C
High Sulphidation
Gold Mineralisation



Modified from: Corbett 1990
Leach & Erceg 1990
Erceg et al 1991
CRA 1994



+ Porphyry

 Diatreme breccia

SIMPLIFIED ALTERATION

 Quartz

 Quartz-alunite

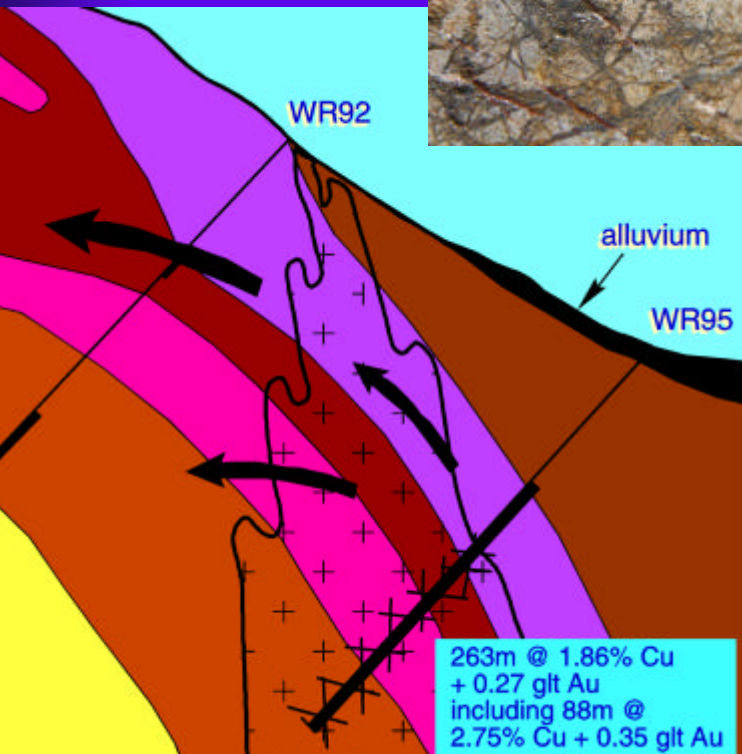
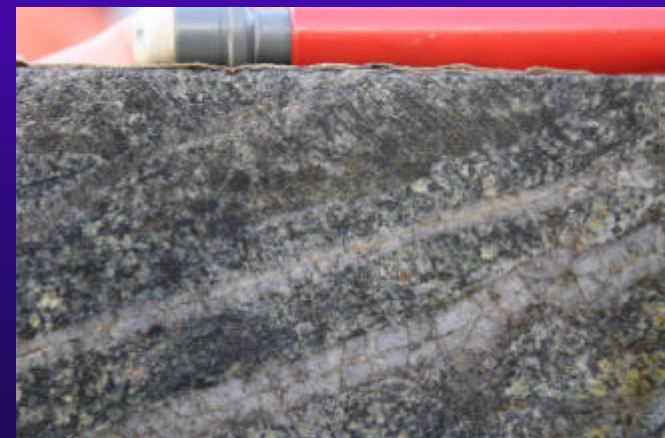
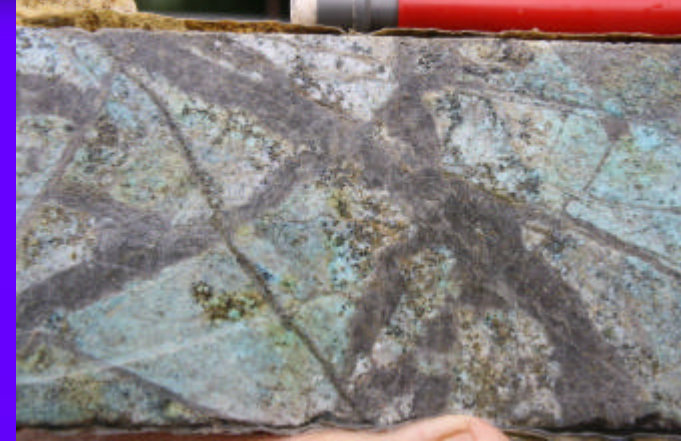
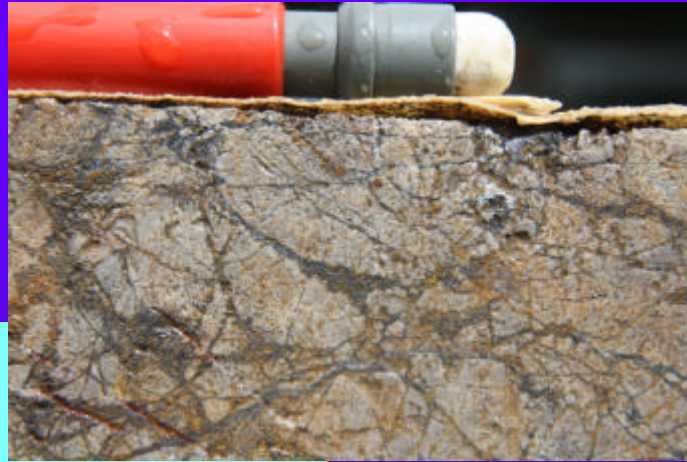
 Quartz-pyrophyllite

 Quartz dickite/kaolinite sericite

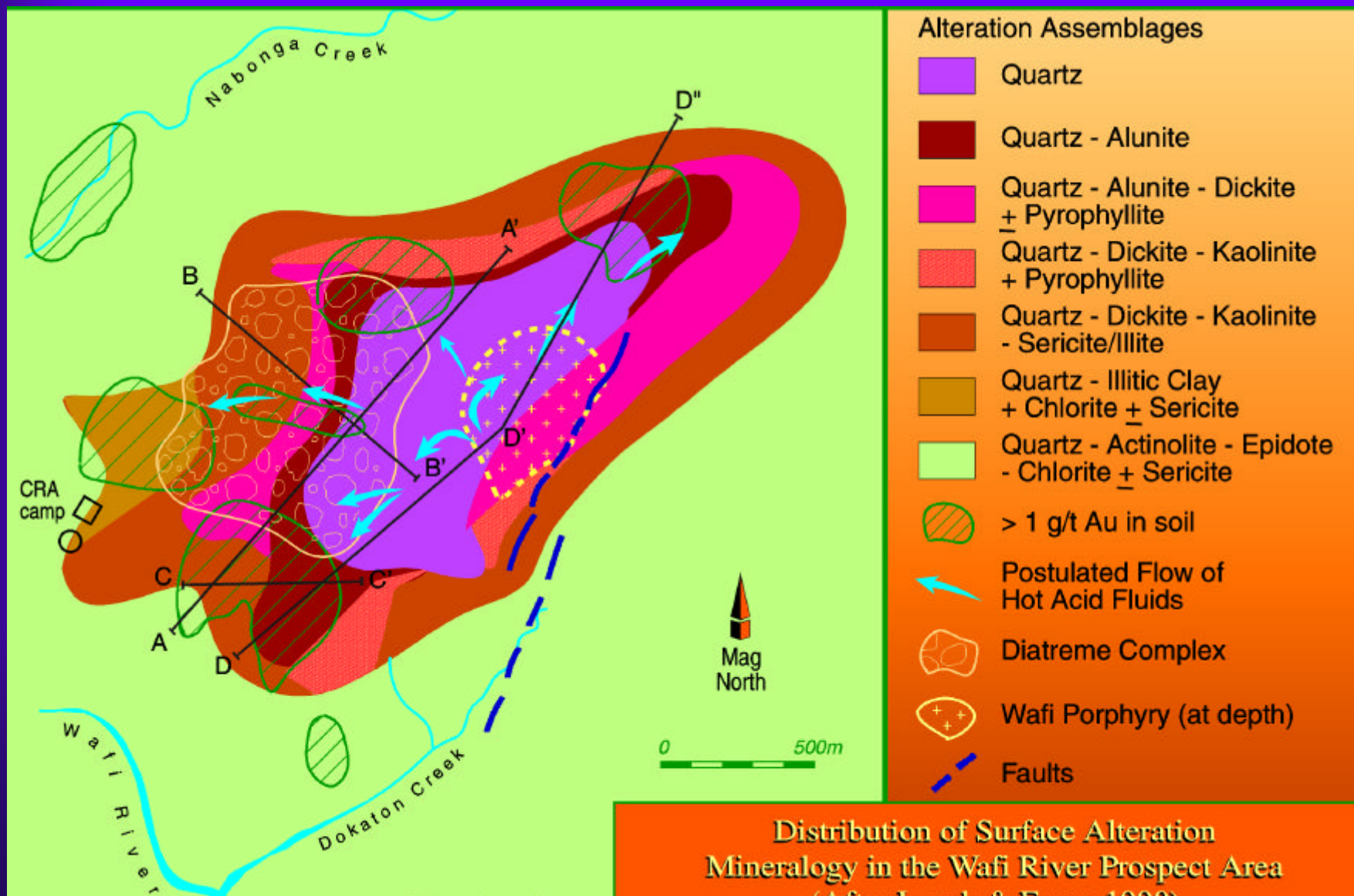
 Quartz illitic clay

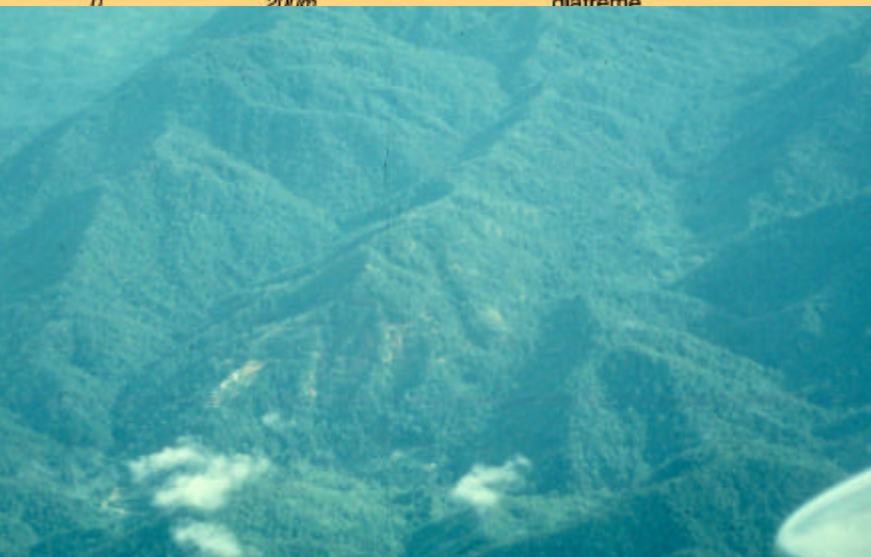
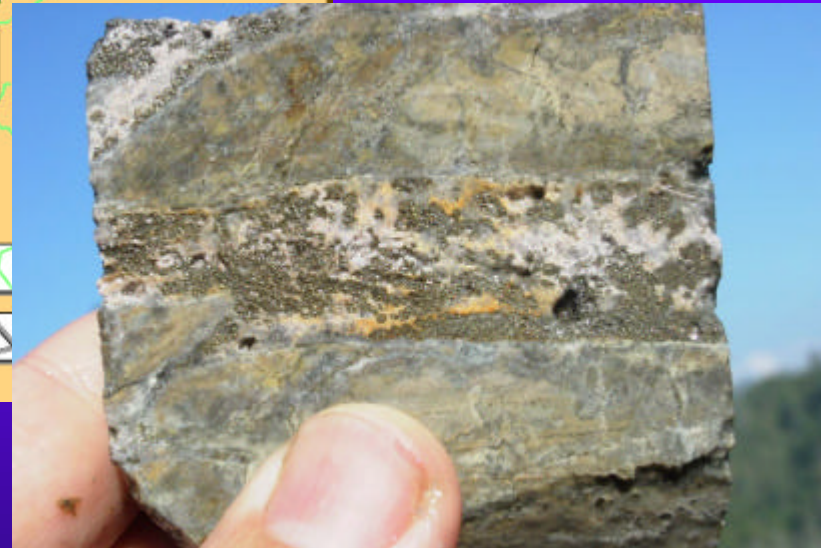
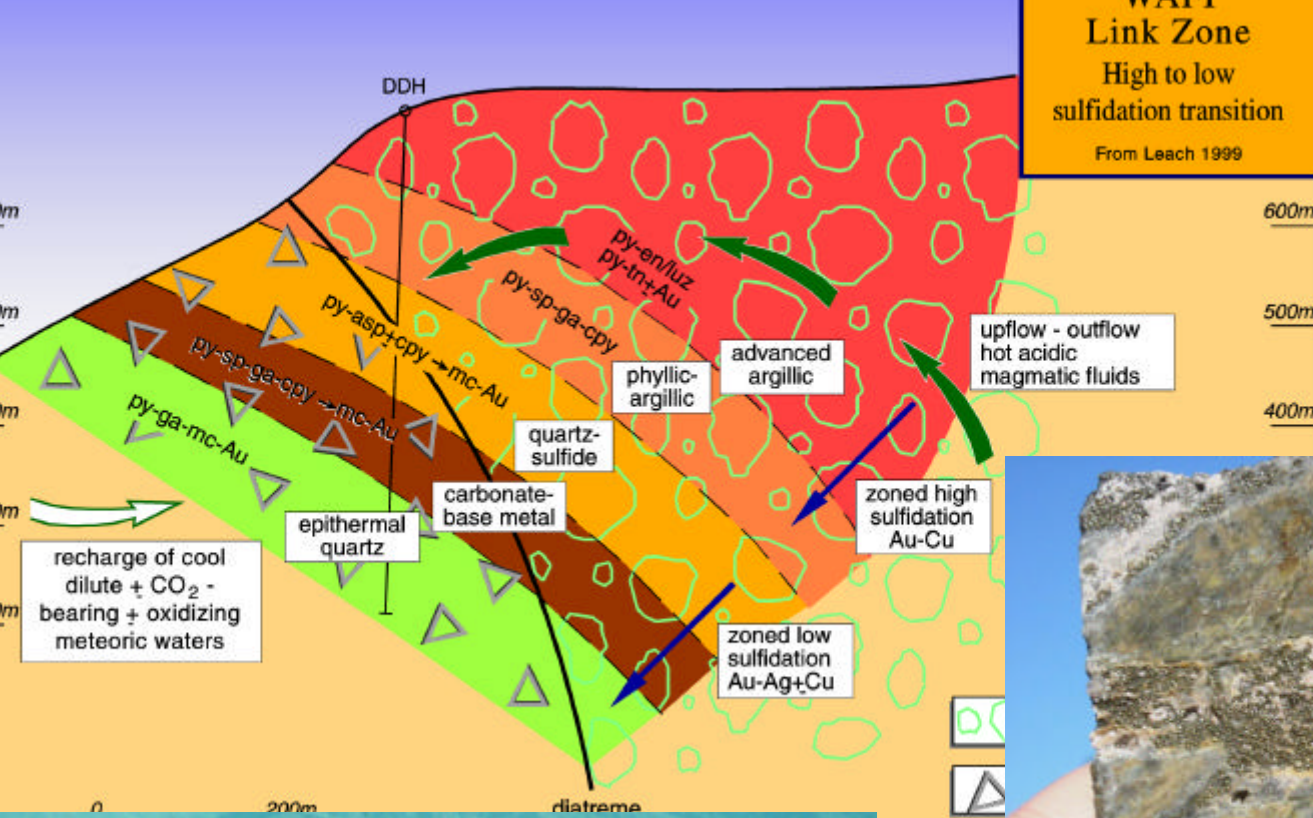
0 200m

Golpu vertical Cu zonation



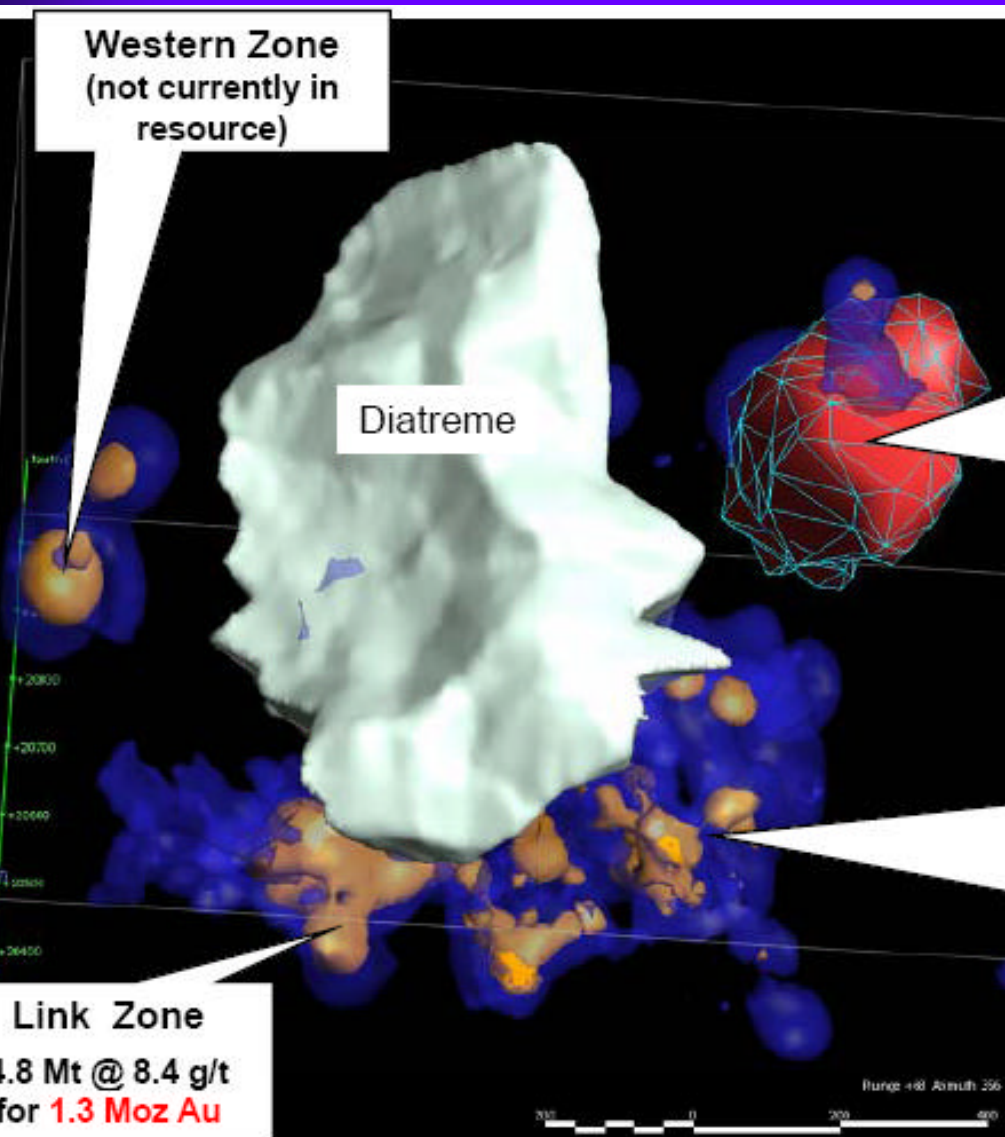
Wafi Au setting





Wafi
 Link zone

Wafi



A porphyry Cu/Au system
with high sulphidation
epithermal Au overprint

Golpu Porphyry*

163 Mt @ 1.1% Cu, 0.57 g/t Au, 132 ppm Mo

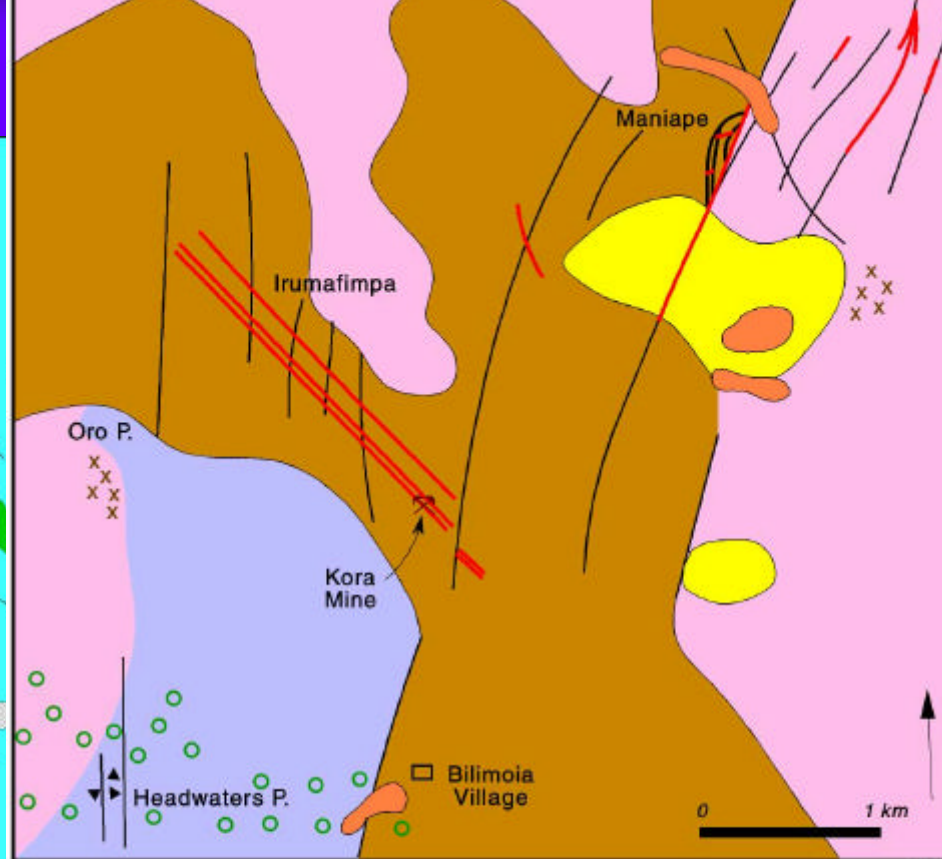
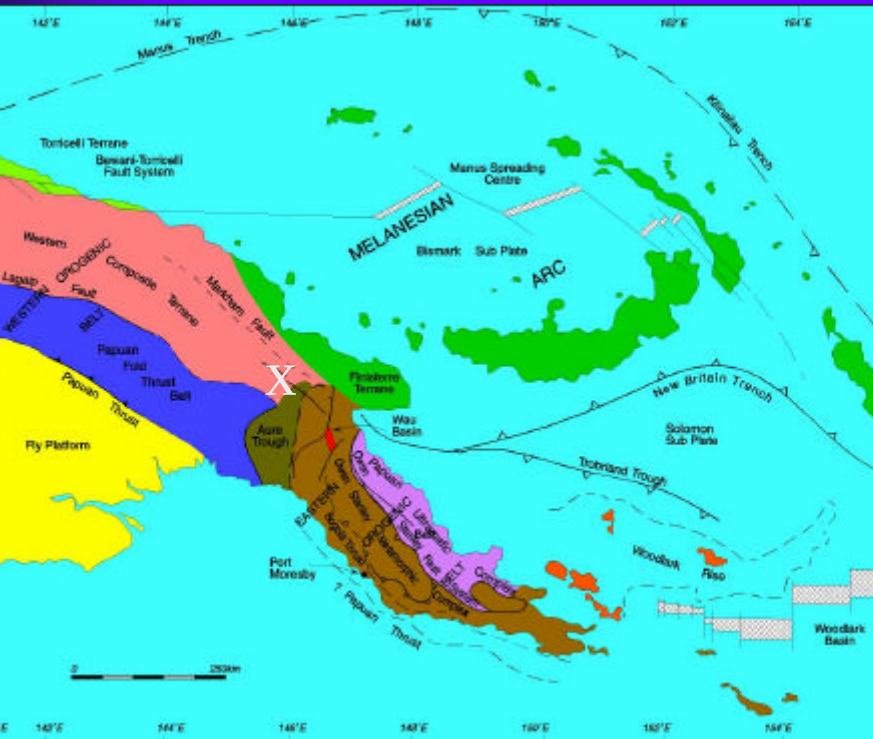
3.9B lb Cu, 47M lb Mo **2.96 Moz Au**

Wafi Au Resource*

- 1 g/t grade shell (Blue)
- 2.5 g/t grade shell (Yellow)

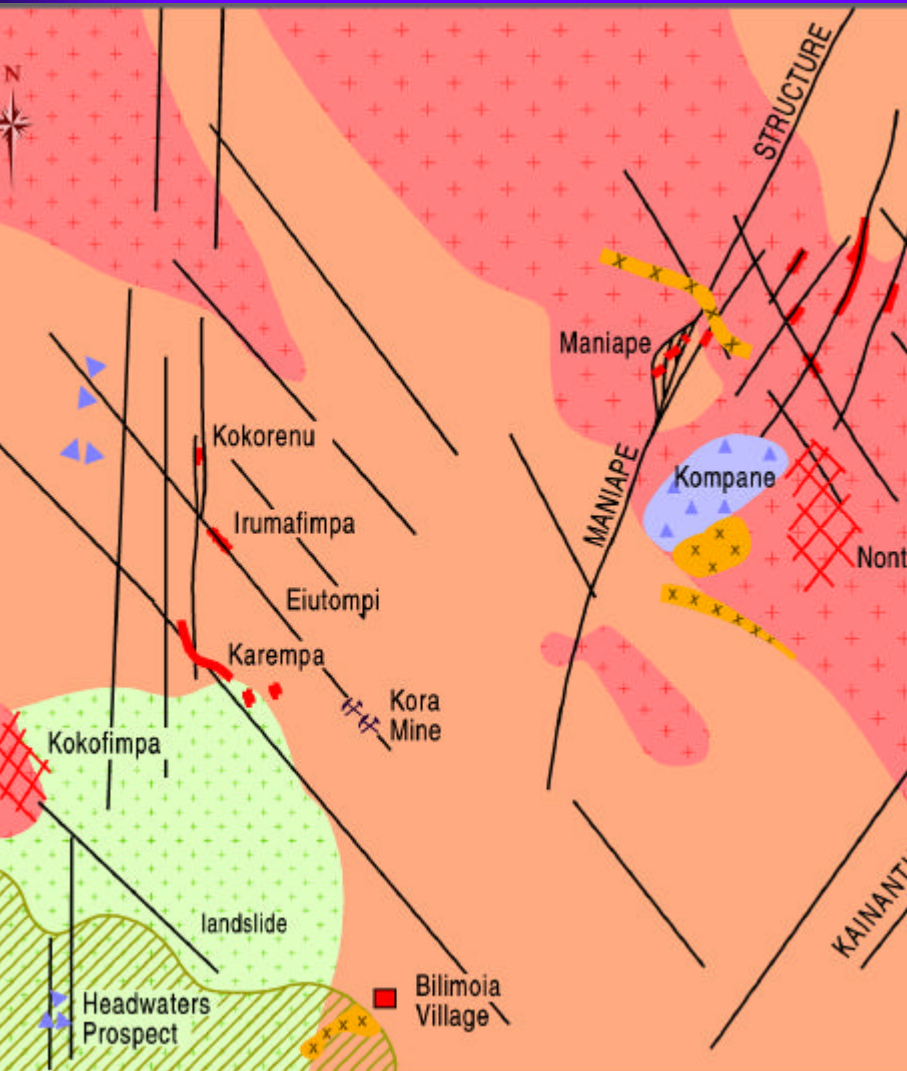
110Mt @ 1.85 g/t for **6.51 Moz Au**

Bilimoia



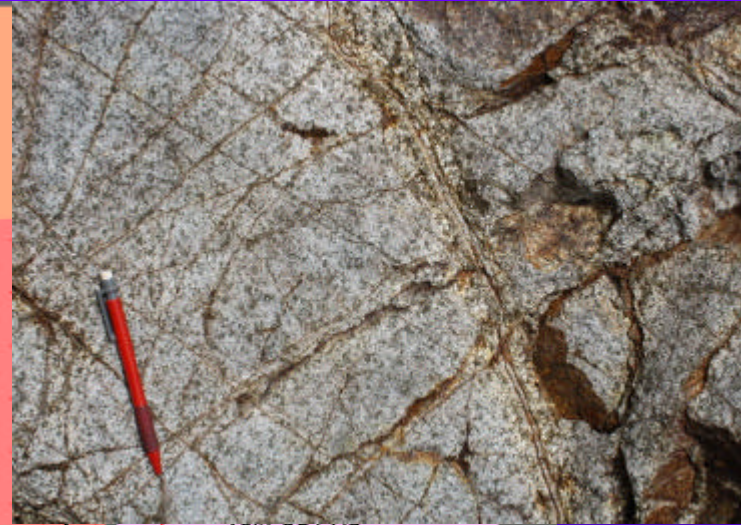
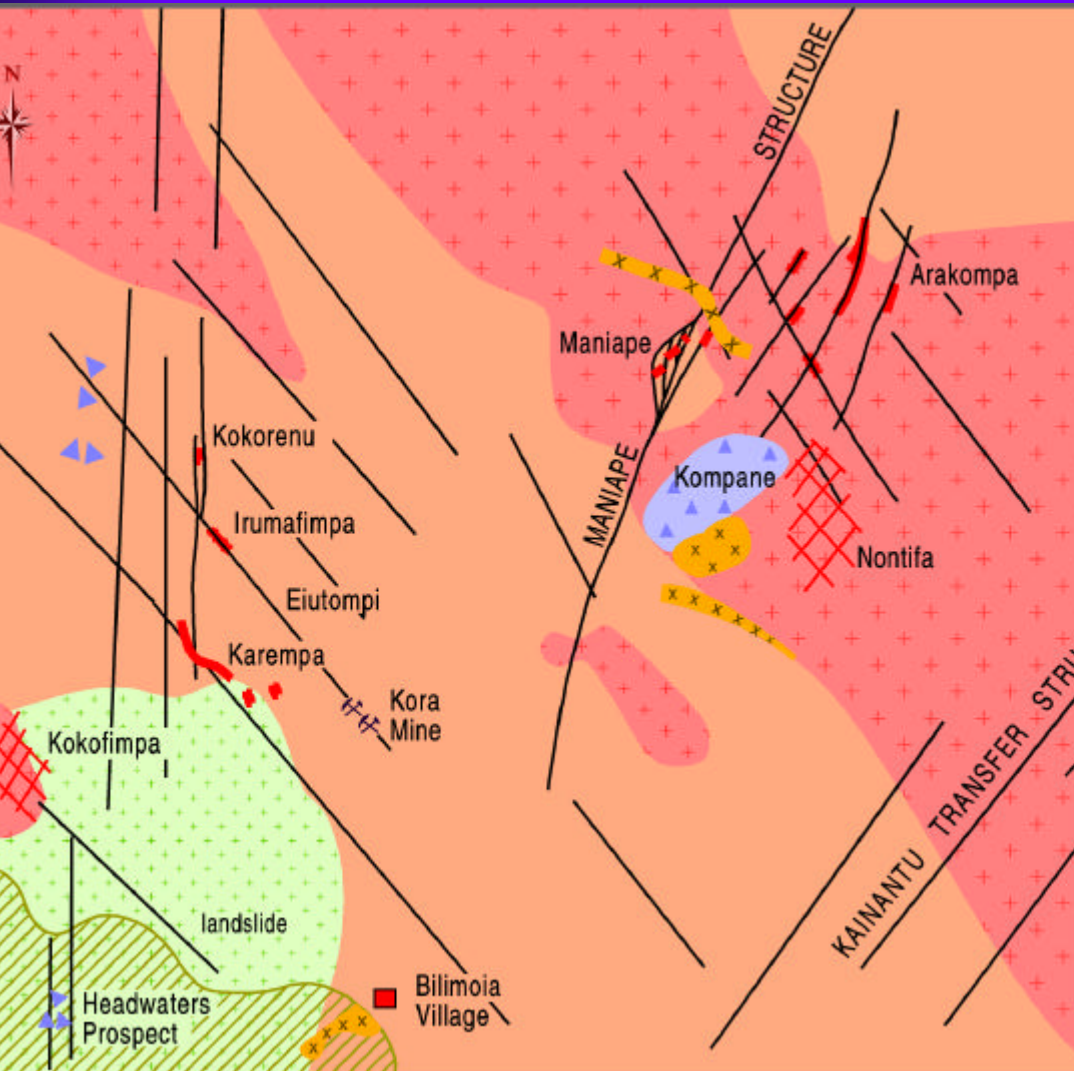
- Diatreme breccia
- Elandora Porphyry
- Akuna Granodiorite
- Karmantina Gneiss
- Bena Bena metamorphics
- Advanced argillic alteration
- Cu-Au Lode
- Porphyry Cu-Au occurrence

Headwaters prospect

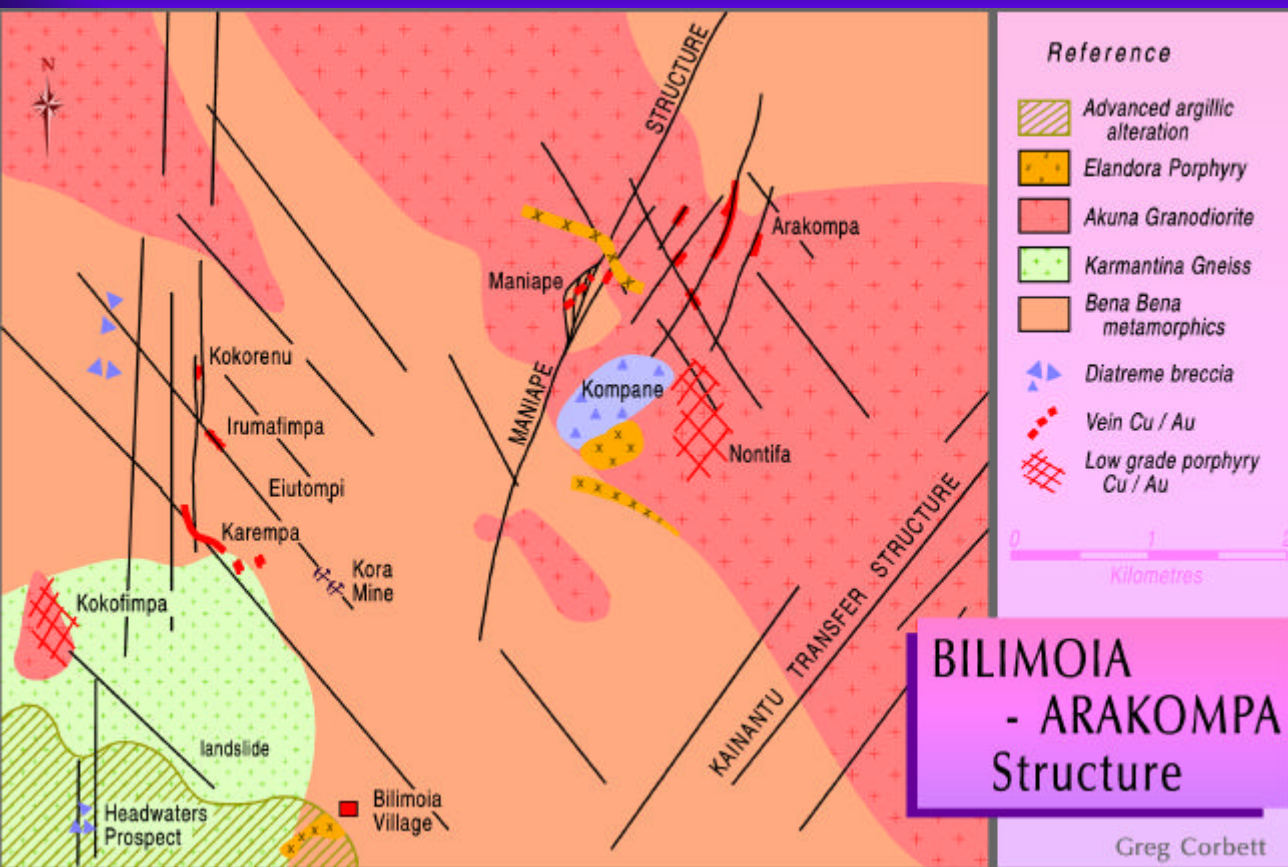


Greg Corbett

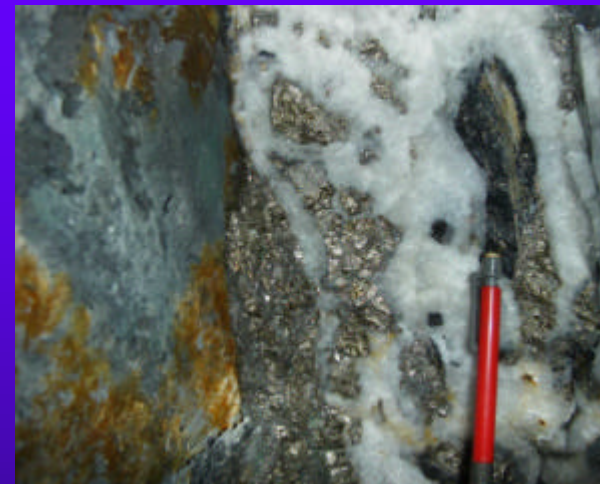
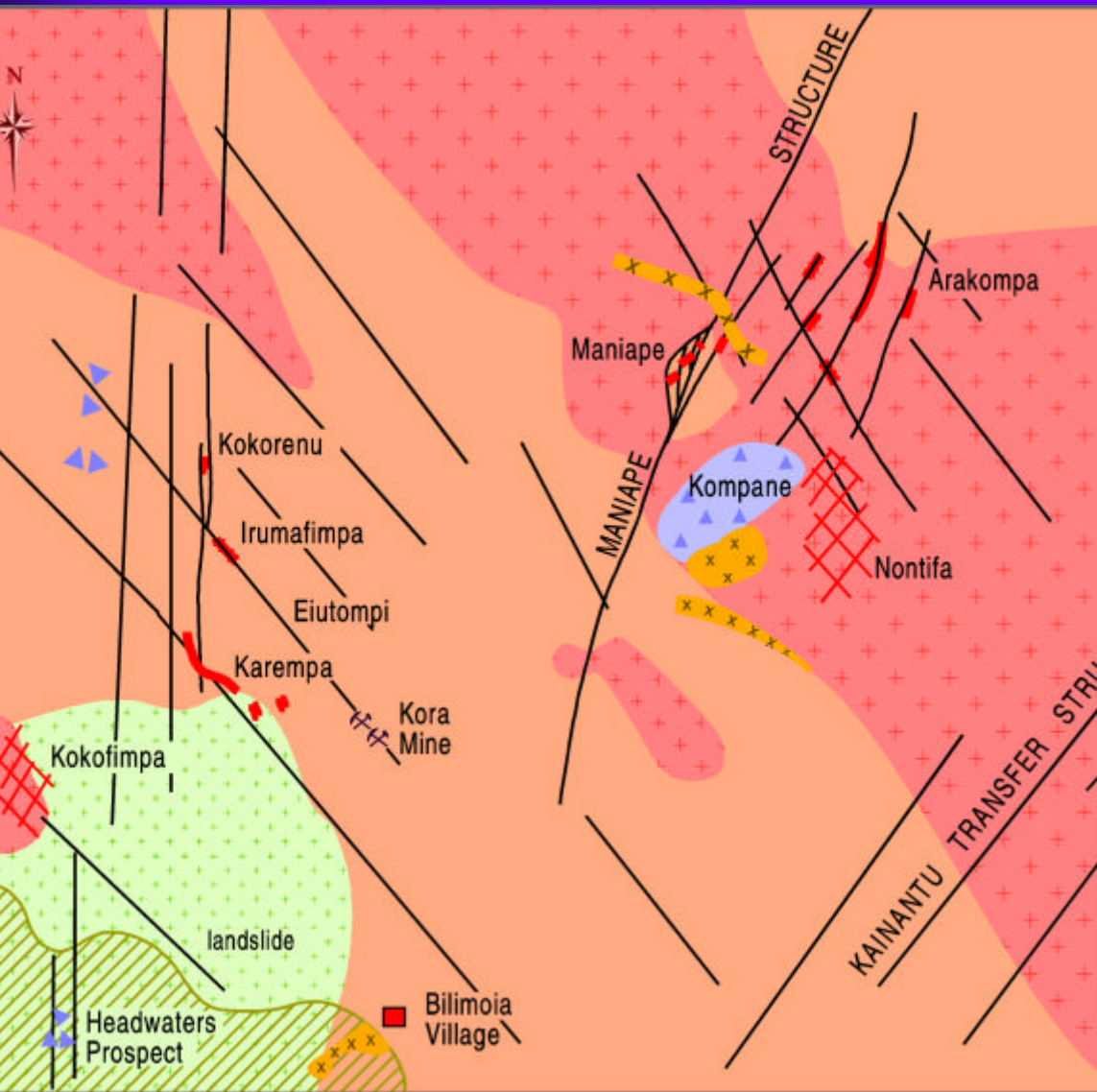
Bilimoia porphyry-epithermal



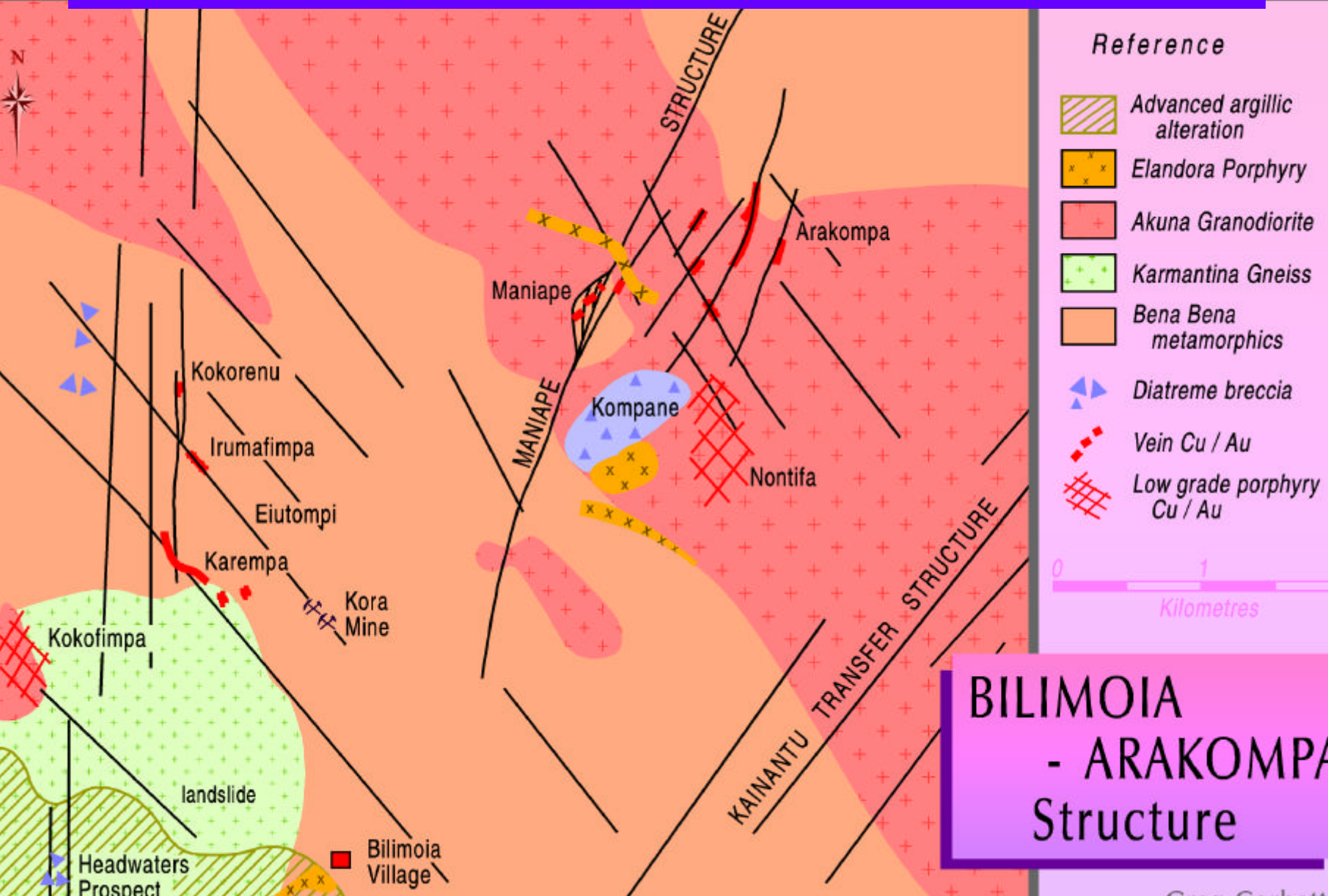
Kora mine

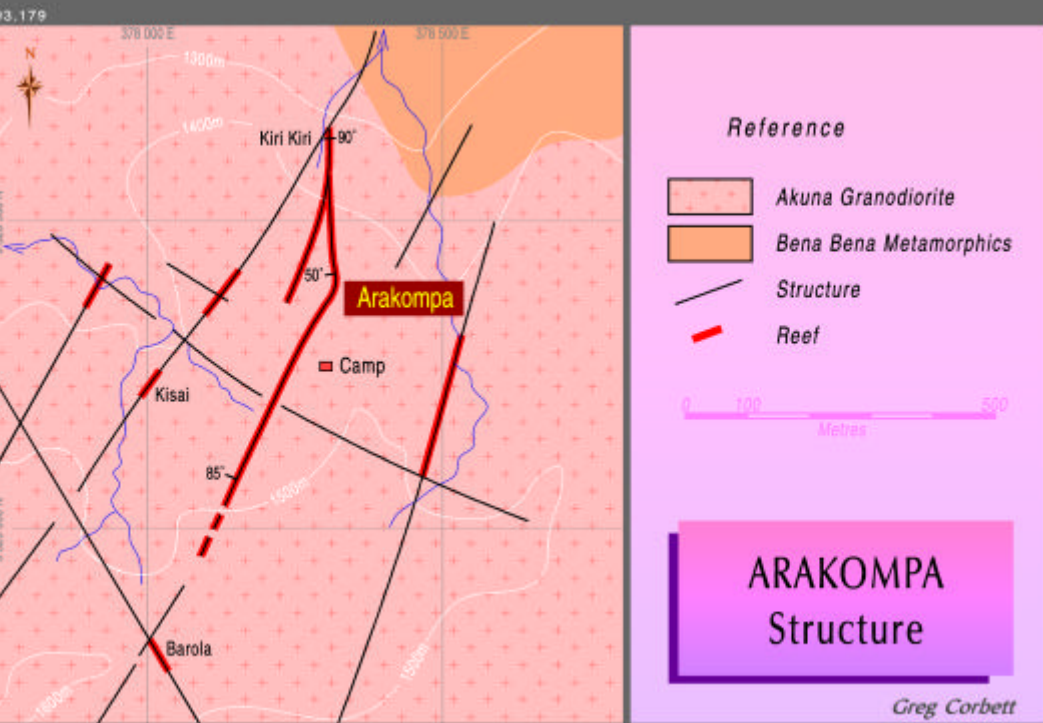


Irumafimpa



Bilimoia - Arakompa

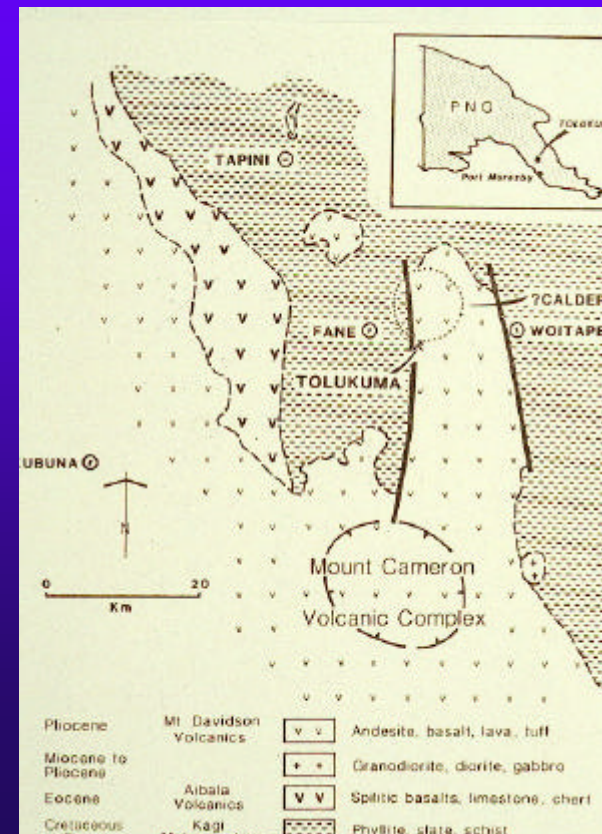




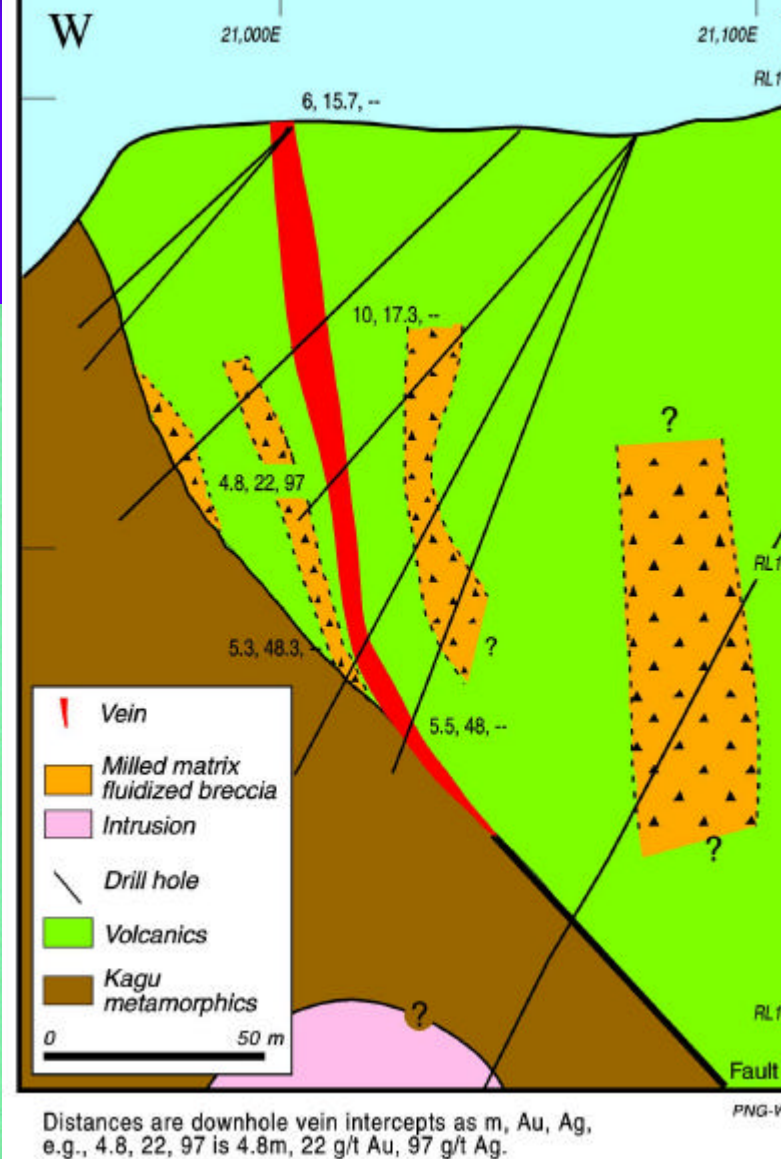
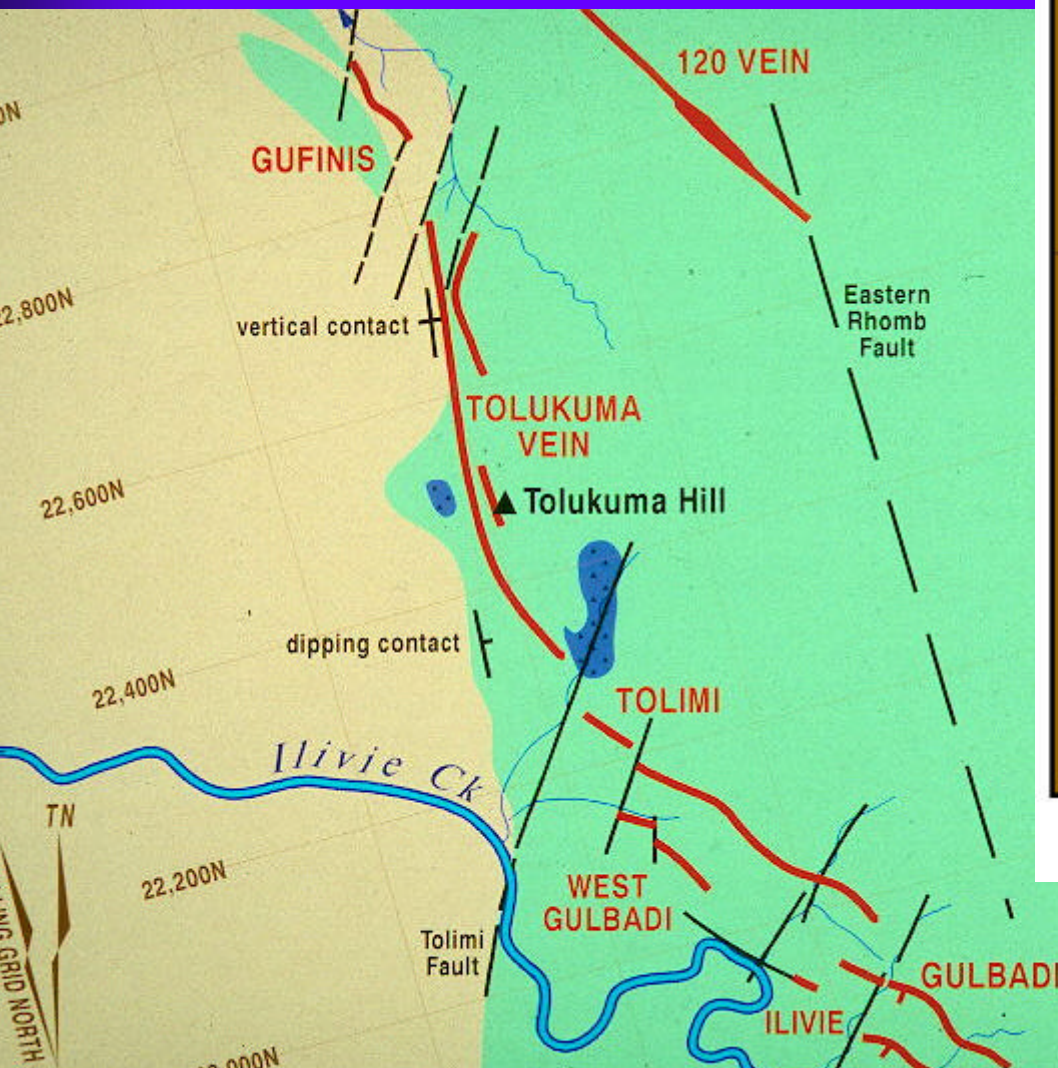
Arakompa



Tolukuma gold mine

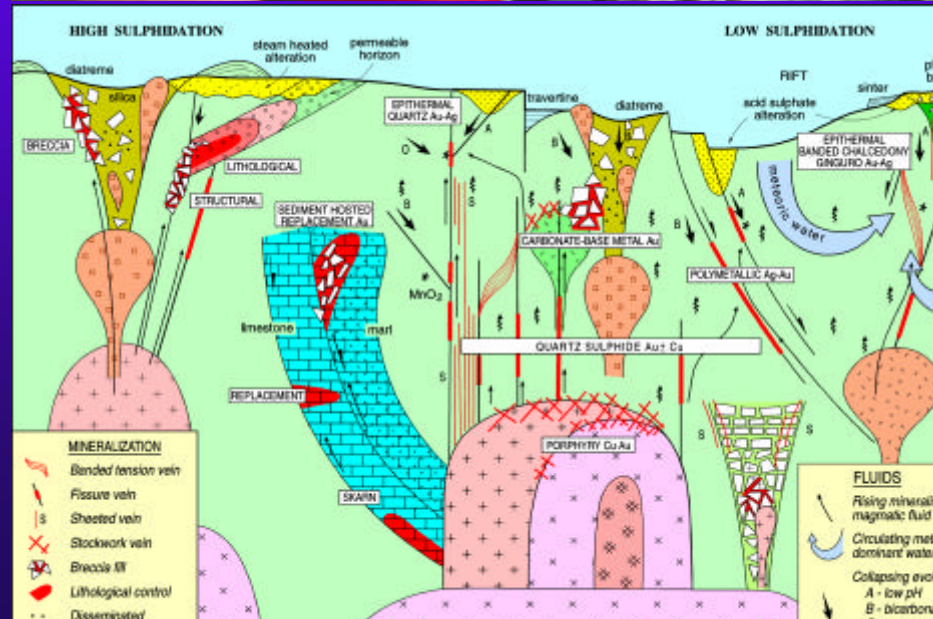
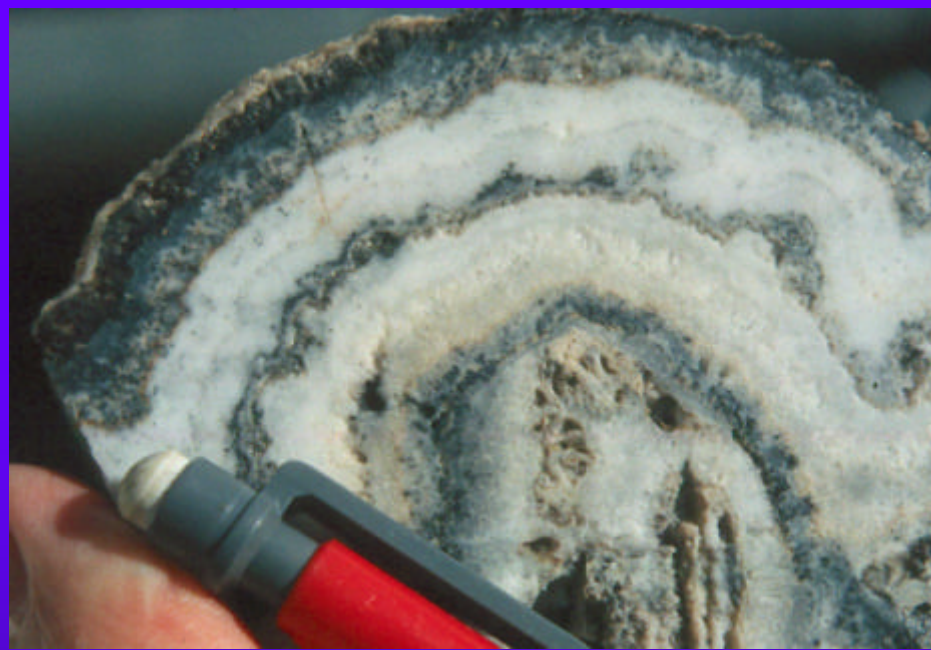


Tolukuma gold mine



400 METRES

Tolukuma



Production > 1 M oz Au

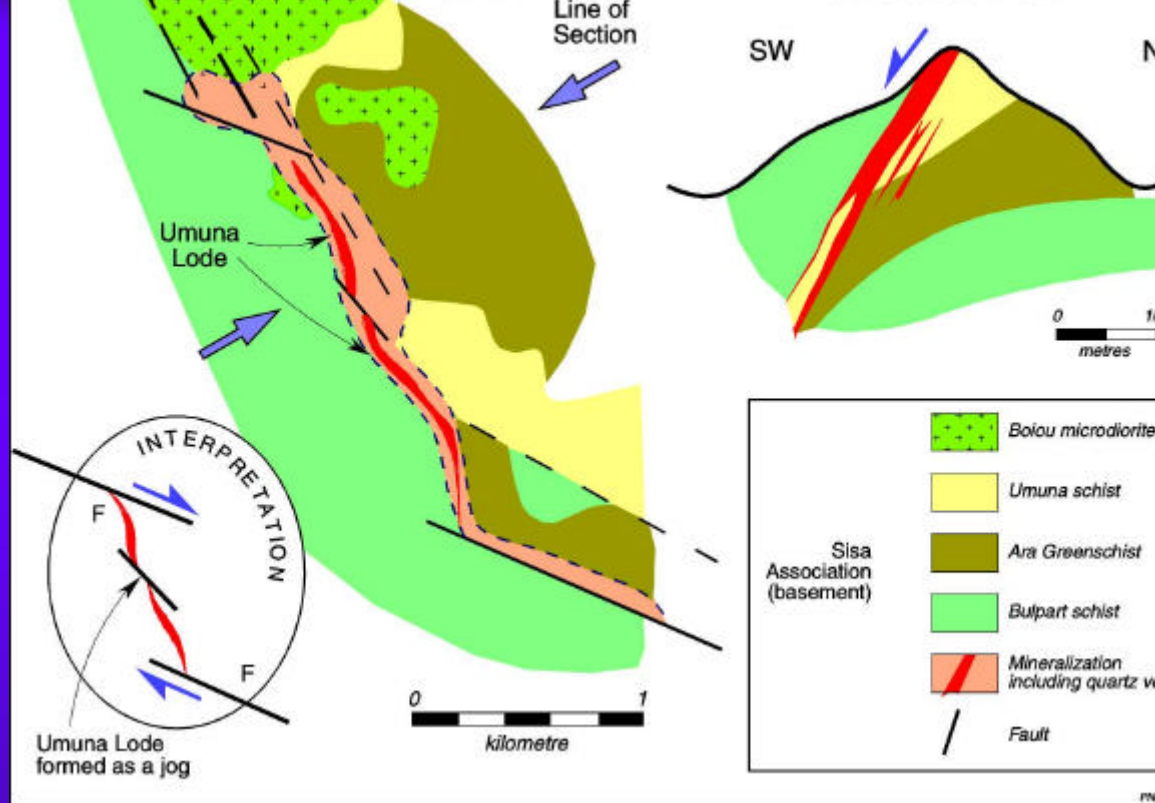
Tolukuma



142°E 144°E 146°E 148°E 150°E 152°E 154°E 156°E



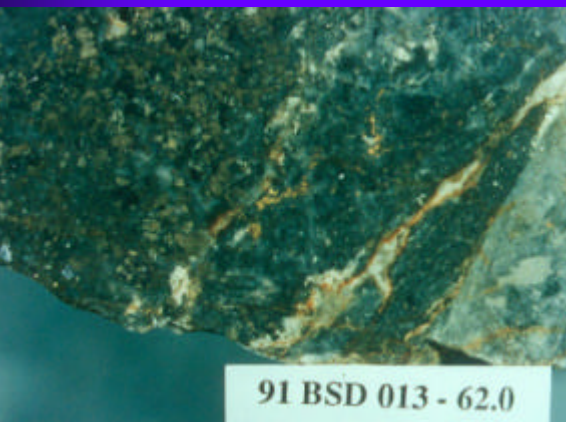
Misima



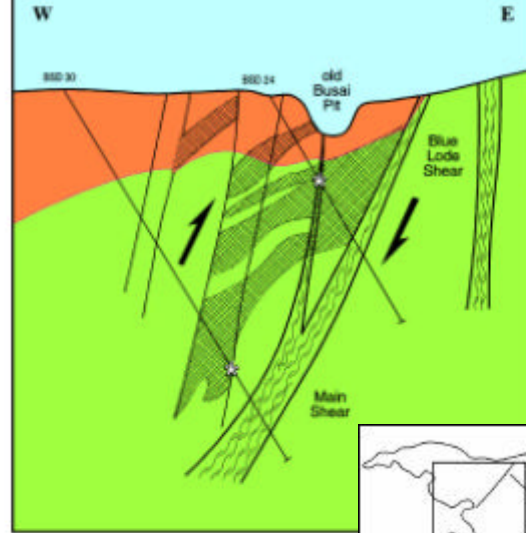
3.7 Moz Au
production



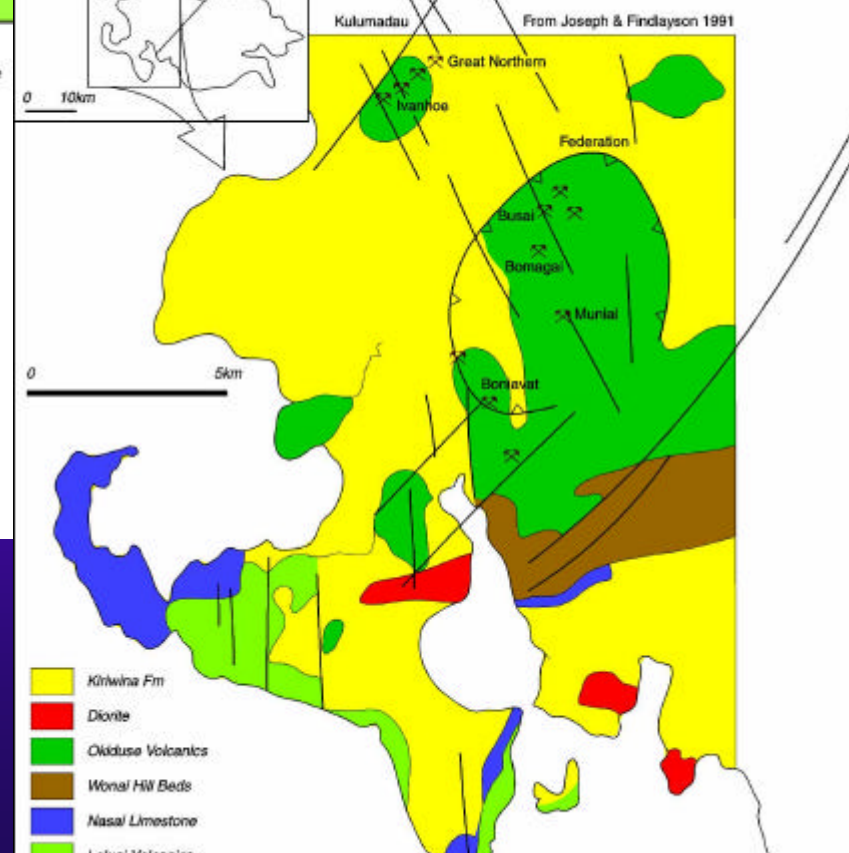
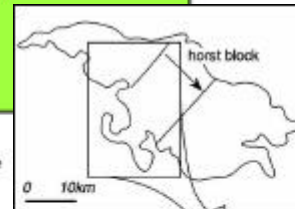
Woodlark

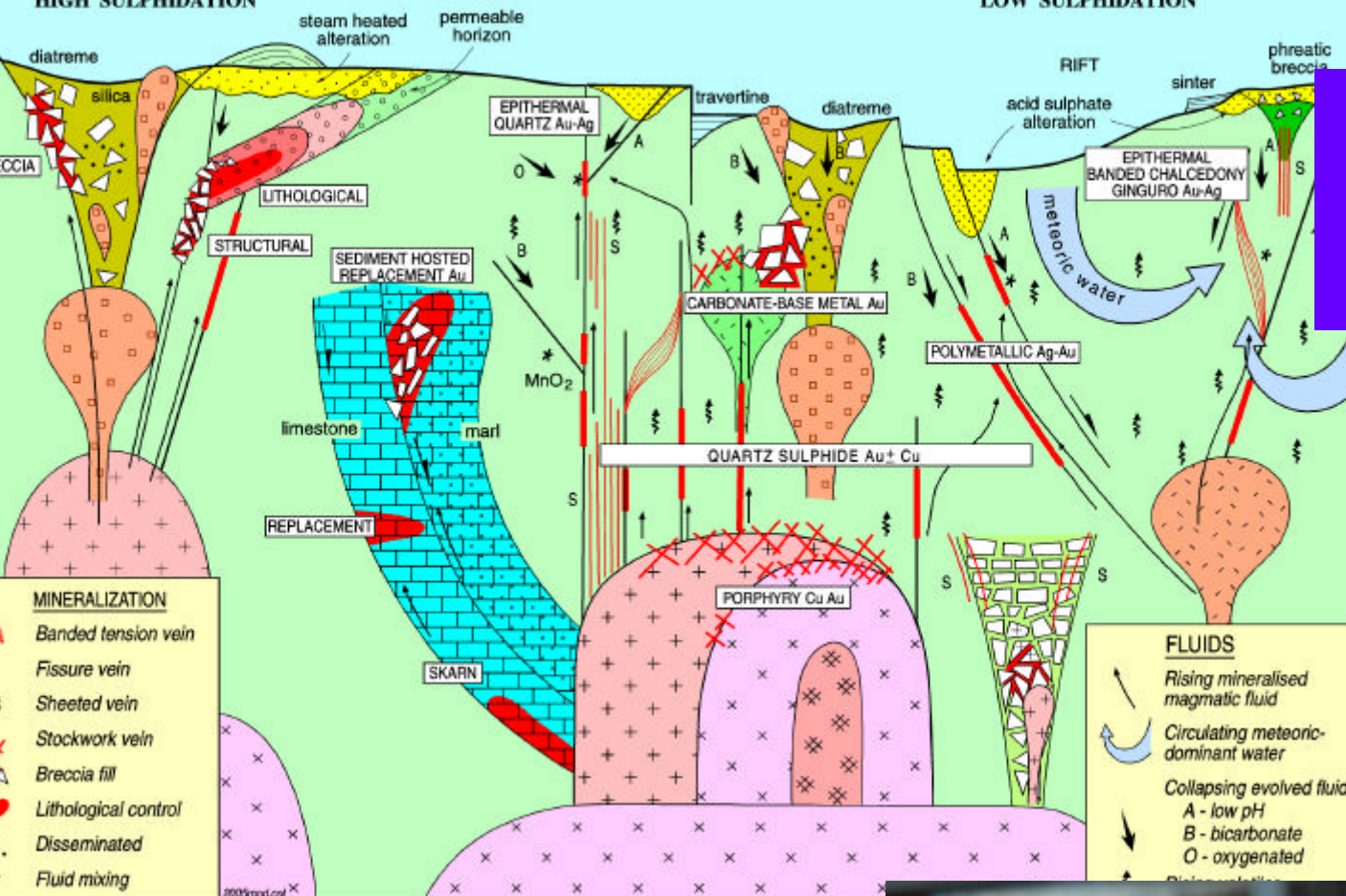


91 BSD 013 - 62.0

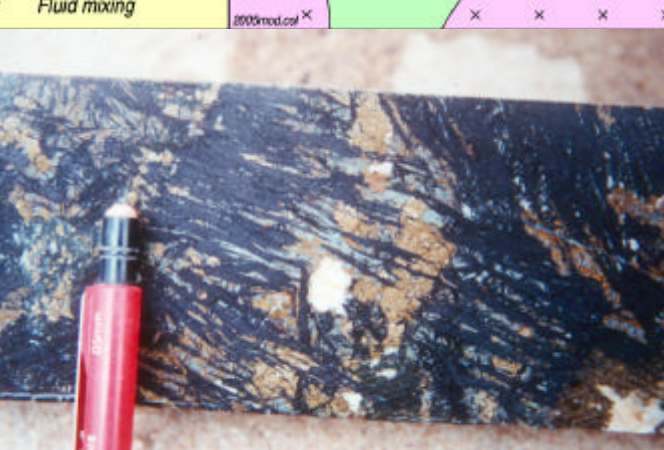


- Lode mineralization along strike
 - Structure
 - Shear
 - Low grade bulk ore
 - Feldspar porphyry
 - Okiduse volcanics
- 0 50m

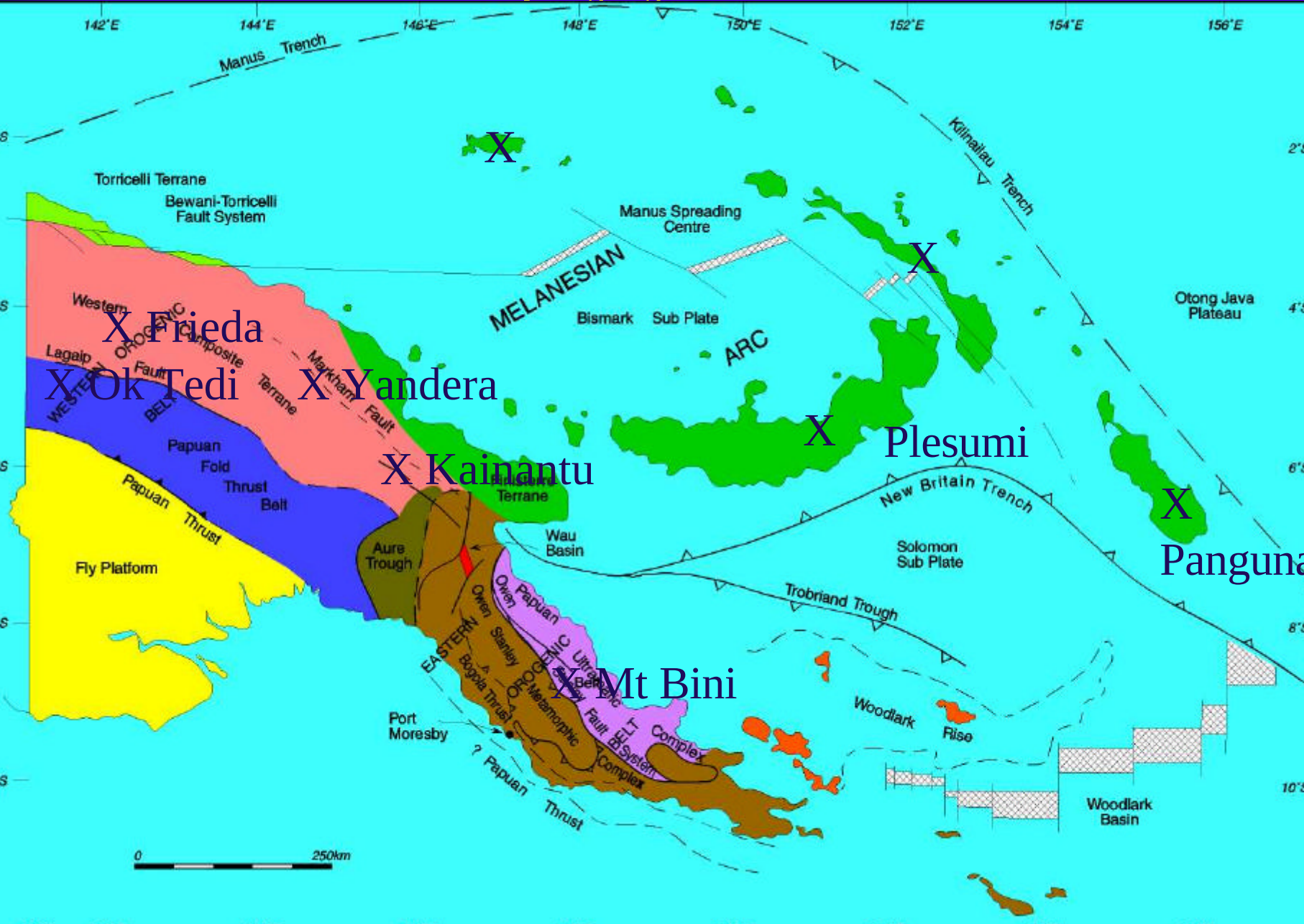




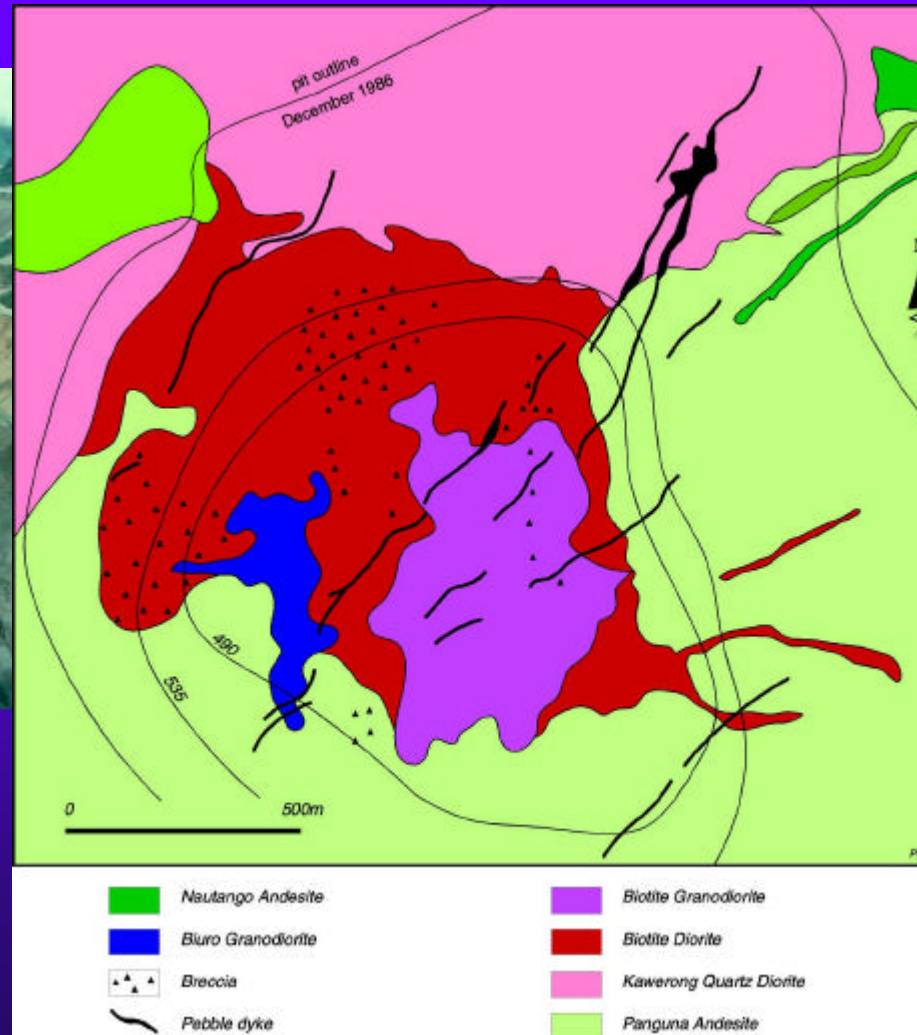
Porphyry Au-Cu-Mo



Porphyry Cu-Au



Porphyry Cu-Au – Panguna

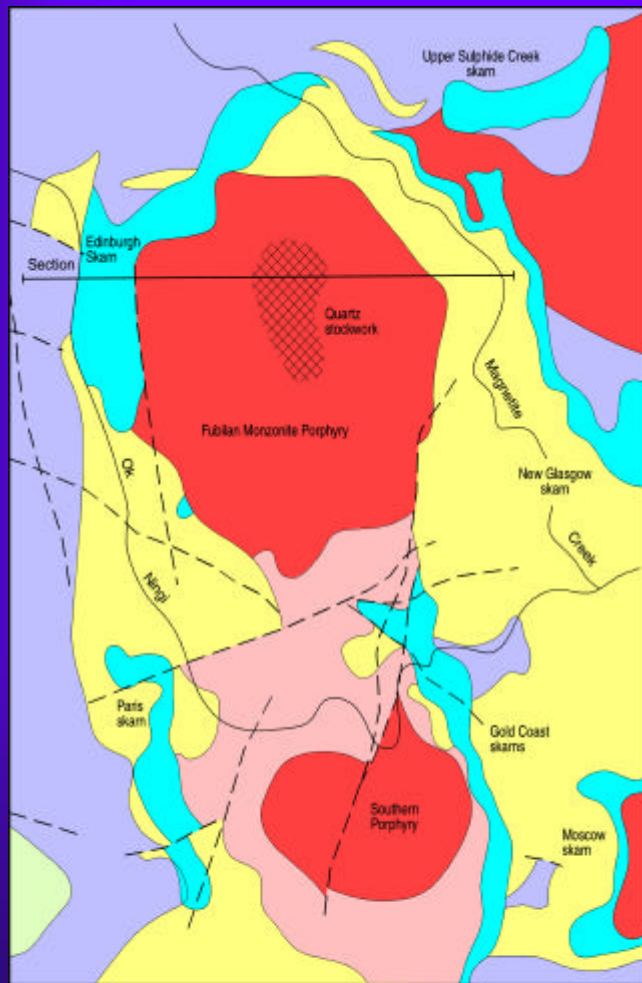


In 1972
944 Mt @ 0.48% Cu, 0.56 g/t Au
To 1988 produced
3 Mt Cu, 9.6 M oz Au

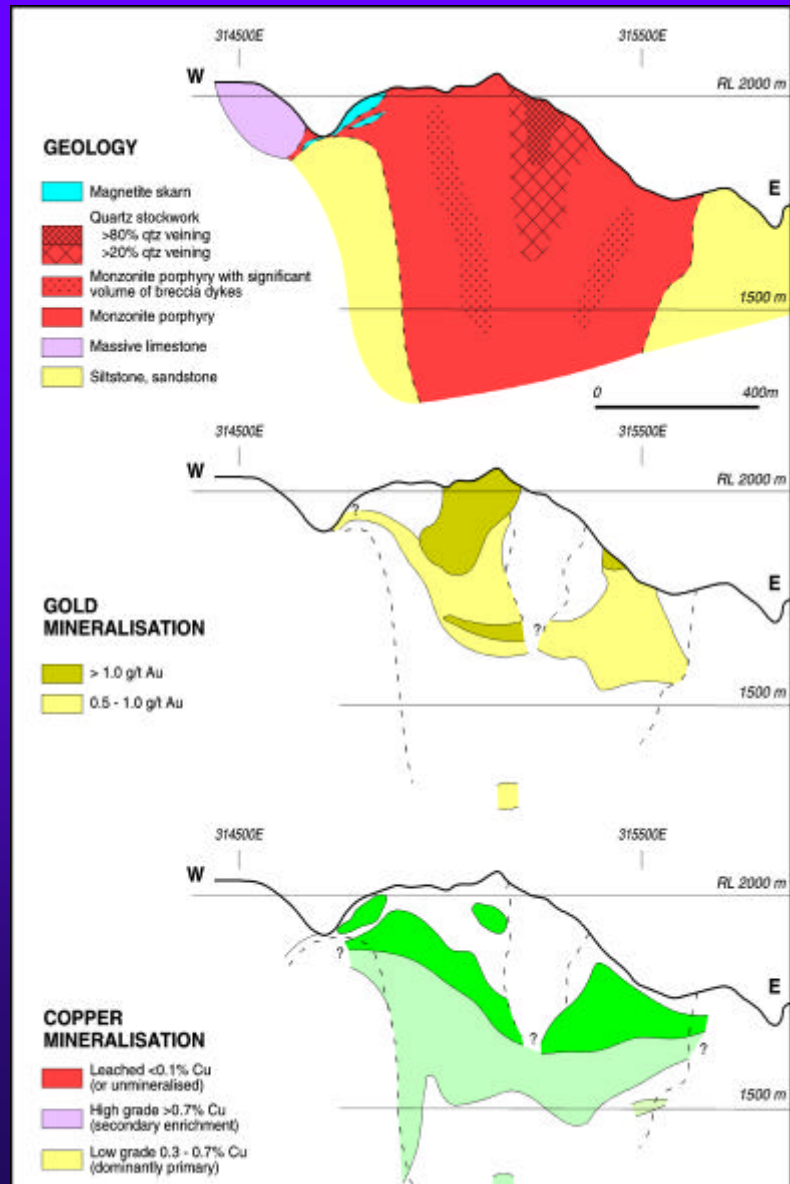
Since 1984 produced
1.8 Mt Cu, 10.6 M oz Au 13 M oz Ag
Due to close 2013



Ok Tedi – Porphyry Cu Au



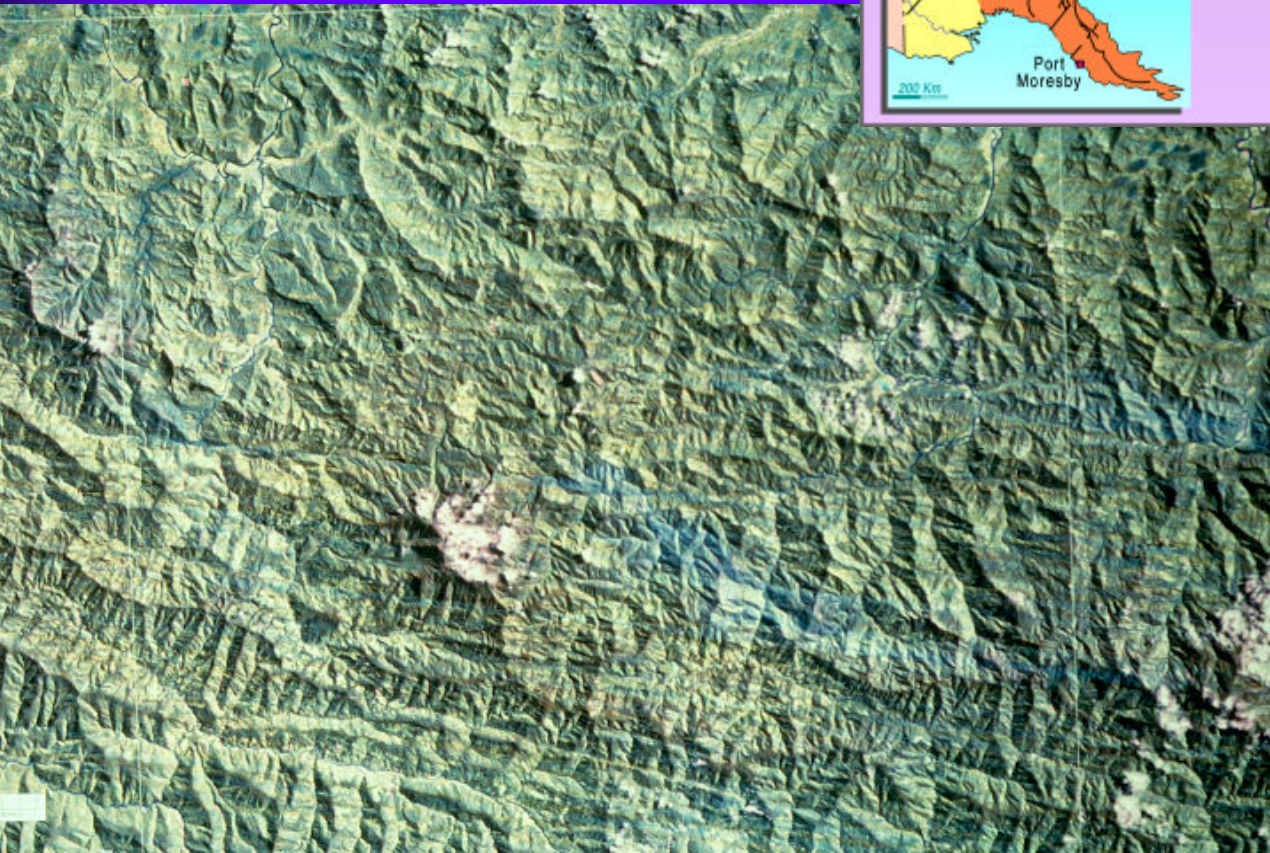
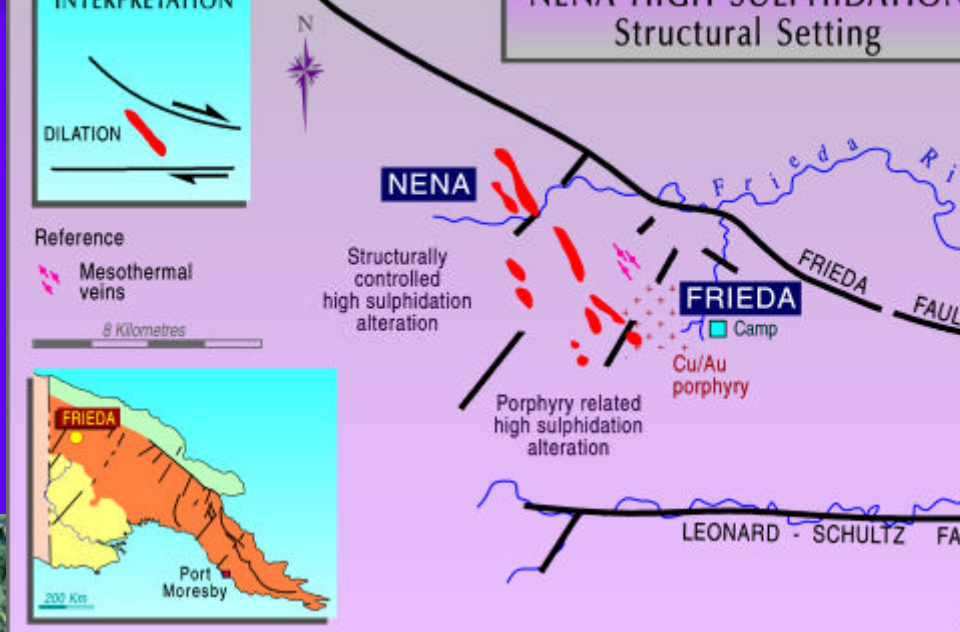
- Pnyang Formation (Siltst/Sst)
- Darai Limestone
- Ireu Formation (Siltst/Sst)
- Fubilan Monzonite Porphyry
- Sydney monzoniorite



Au cap
2.87 g/t

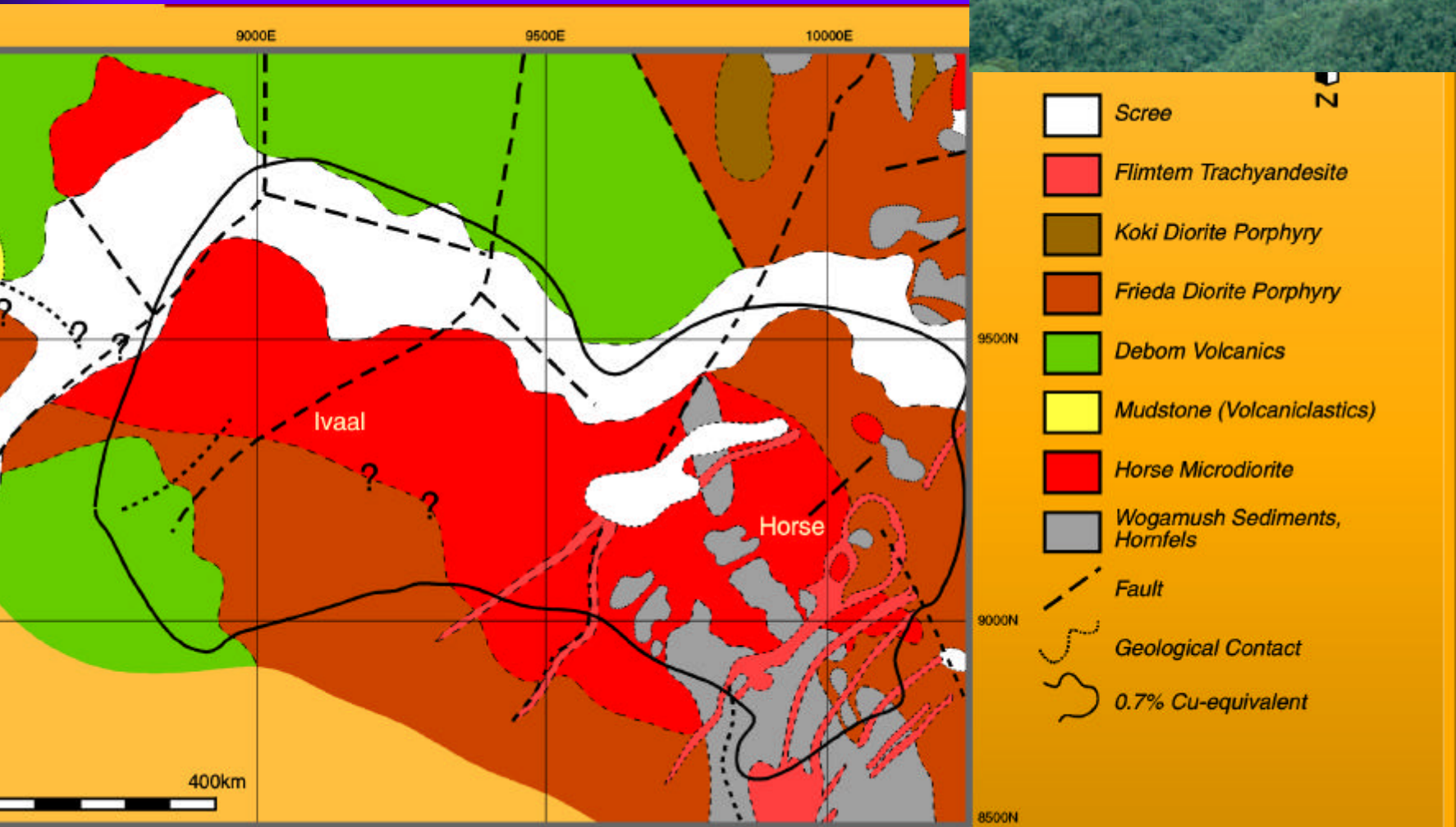
0.7% Cu
0.6 g/t Au
0.11% M

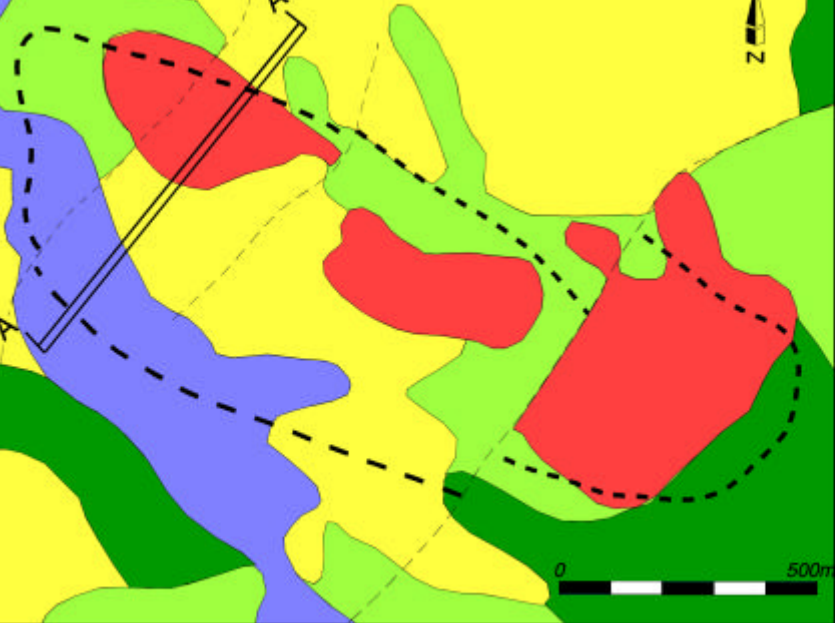
Freida-Nena



Horse-Ivaal Geology

1 Bt @ 0.5% Cu, 0.3 g/t Au





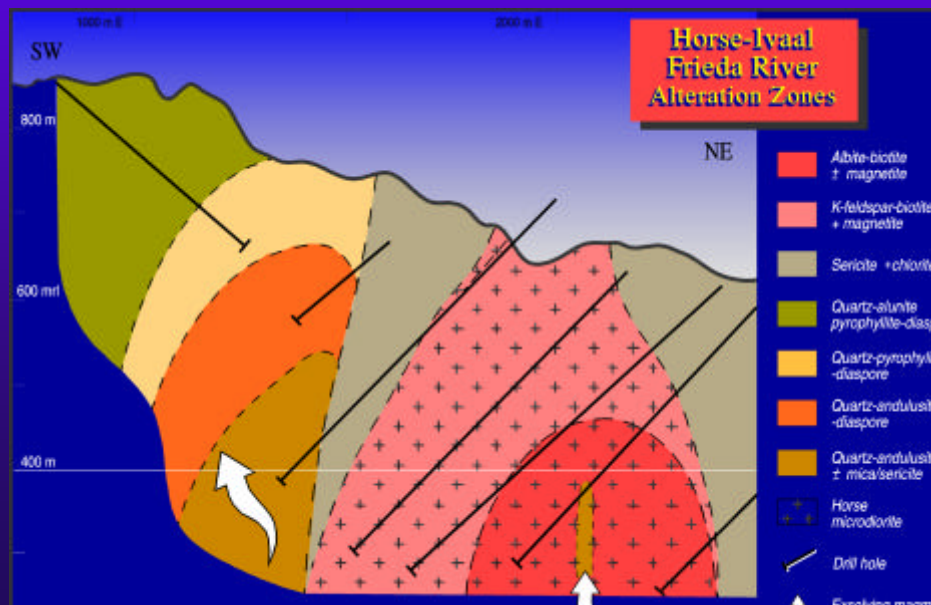
Modified from Britten 1981.

Horse-Ivaal Plan Frieda River

- Potassic
(Biotite-K-Feldspar)
- Propylitic
(Epidote-Actinolite)
- Intermediate-Argillic
(Chloritic)
- Phyllic
(Sericitic)
- Advanced Argillic
(Alunite-Pyrophyllite)

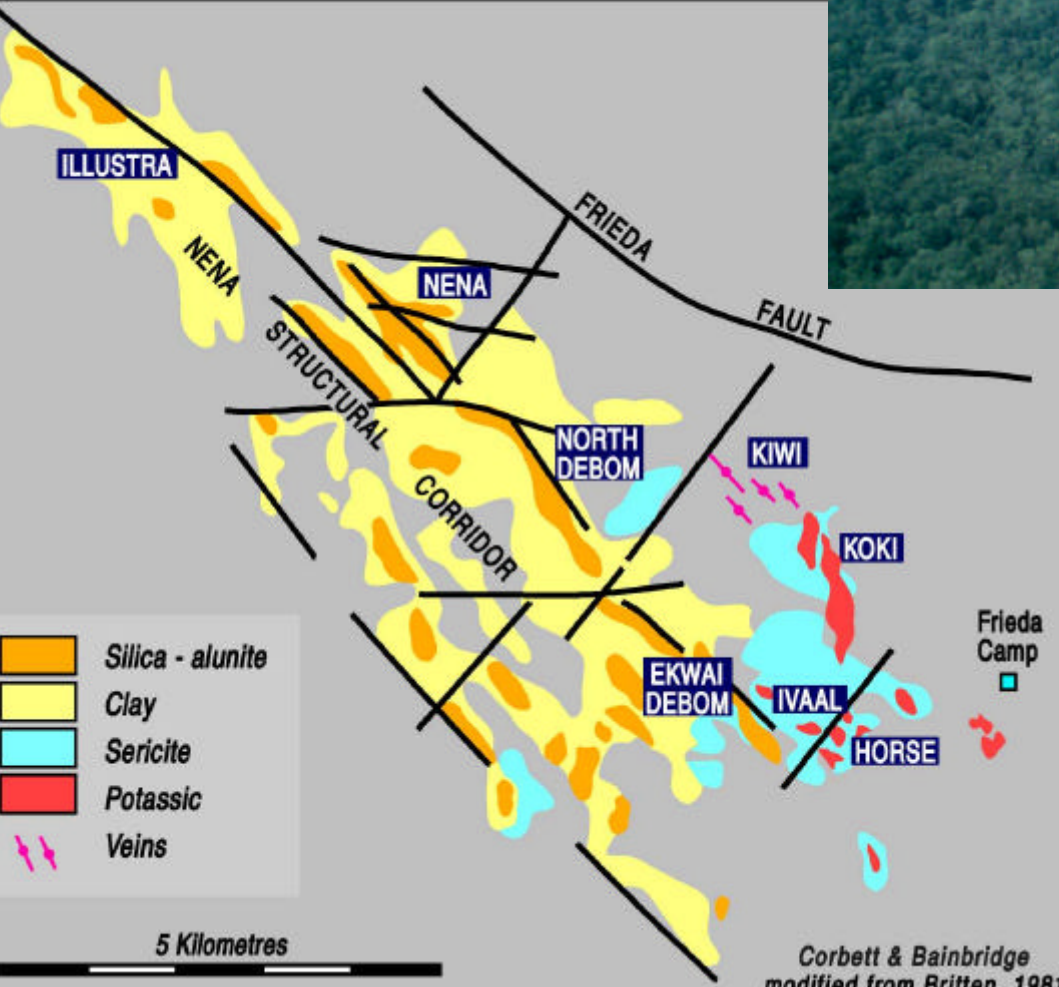
- Faults
- 0.3%
Cu Contact

Frieda Cu-Au porphyry



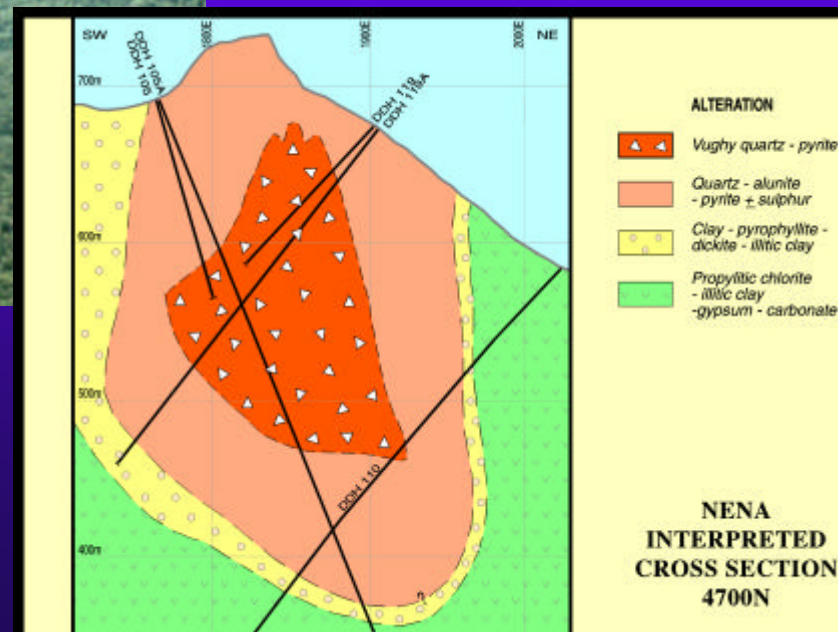
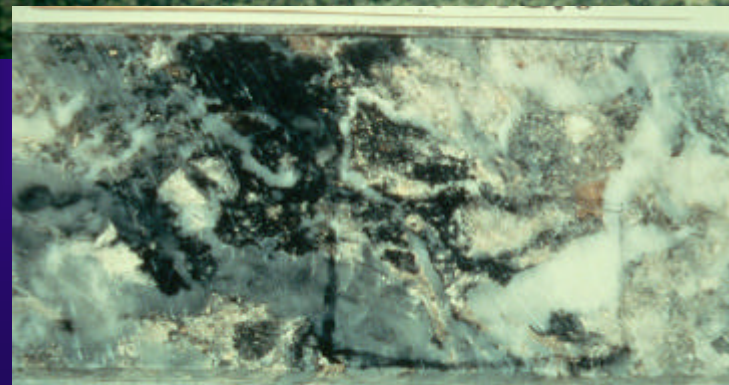
Ekwai Debom

Advanced argillic alteration

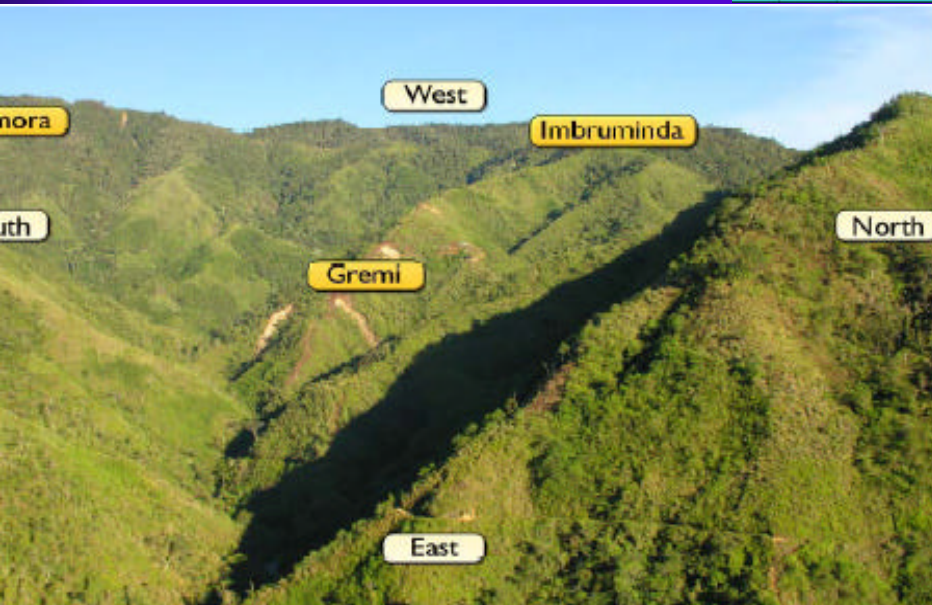


Nena high sulphidation Cu-Au

18 Mt @ 0.1% Cu, 1.4 g/t Au
51 Mt @ 2.2% Cu, 0.6 g/t Au

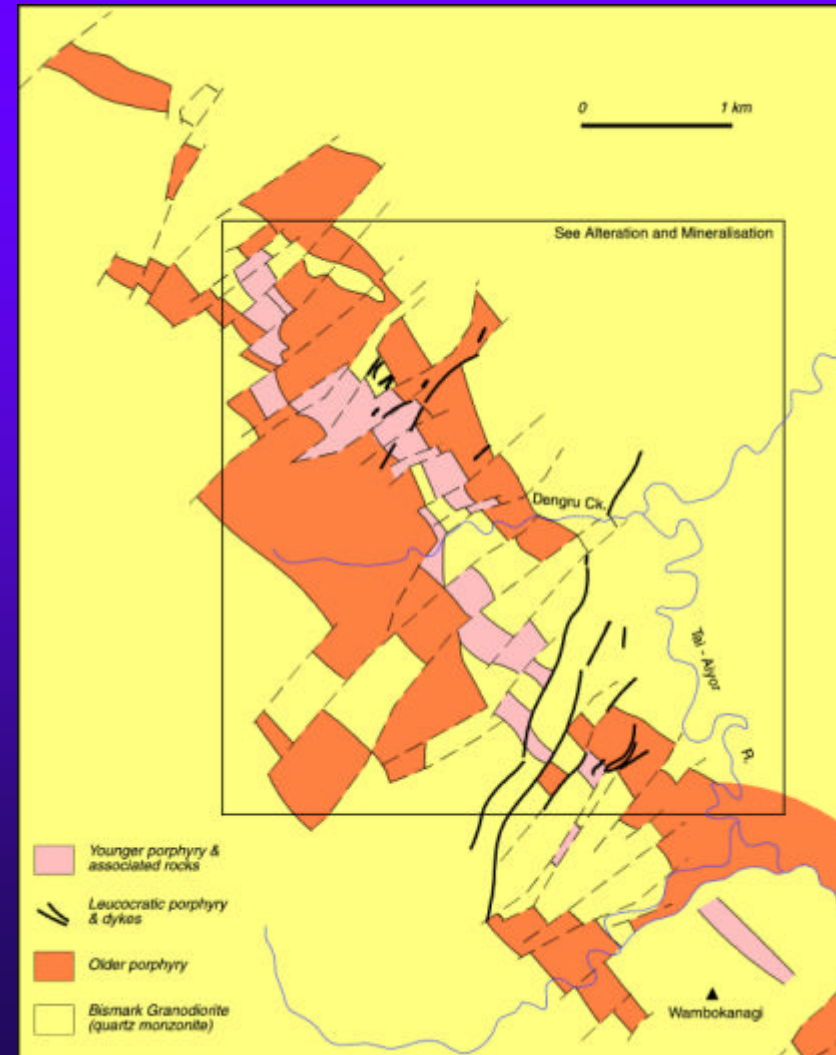


Yandera

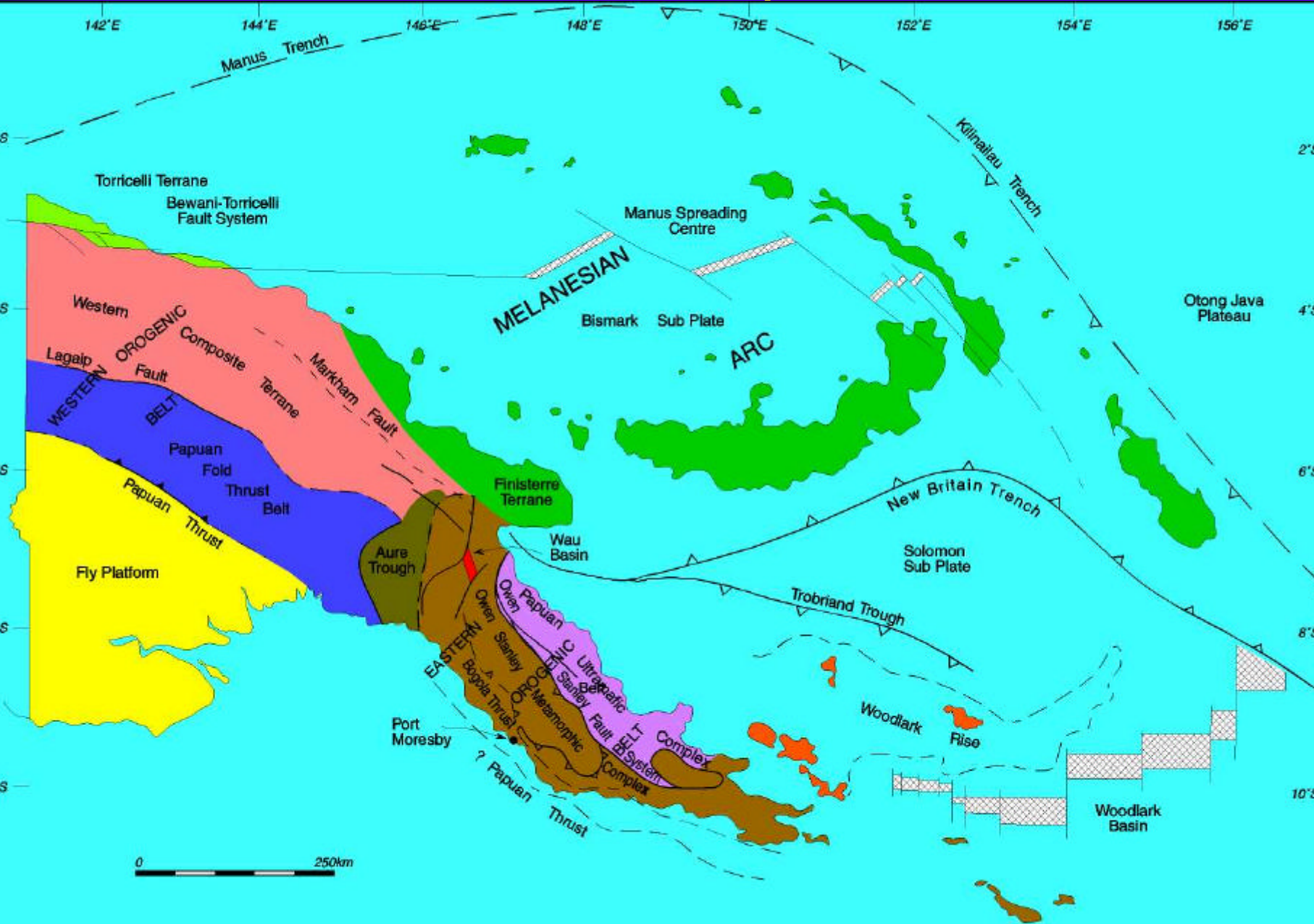


Yandera – geology

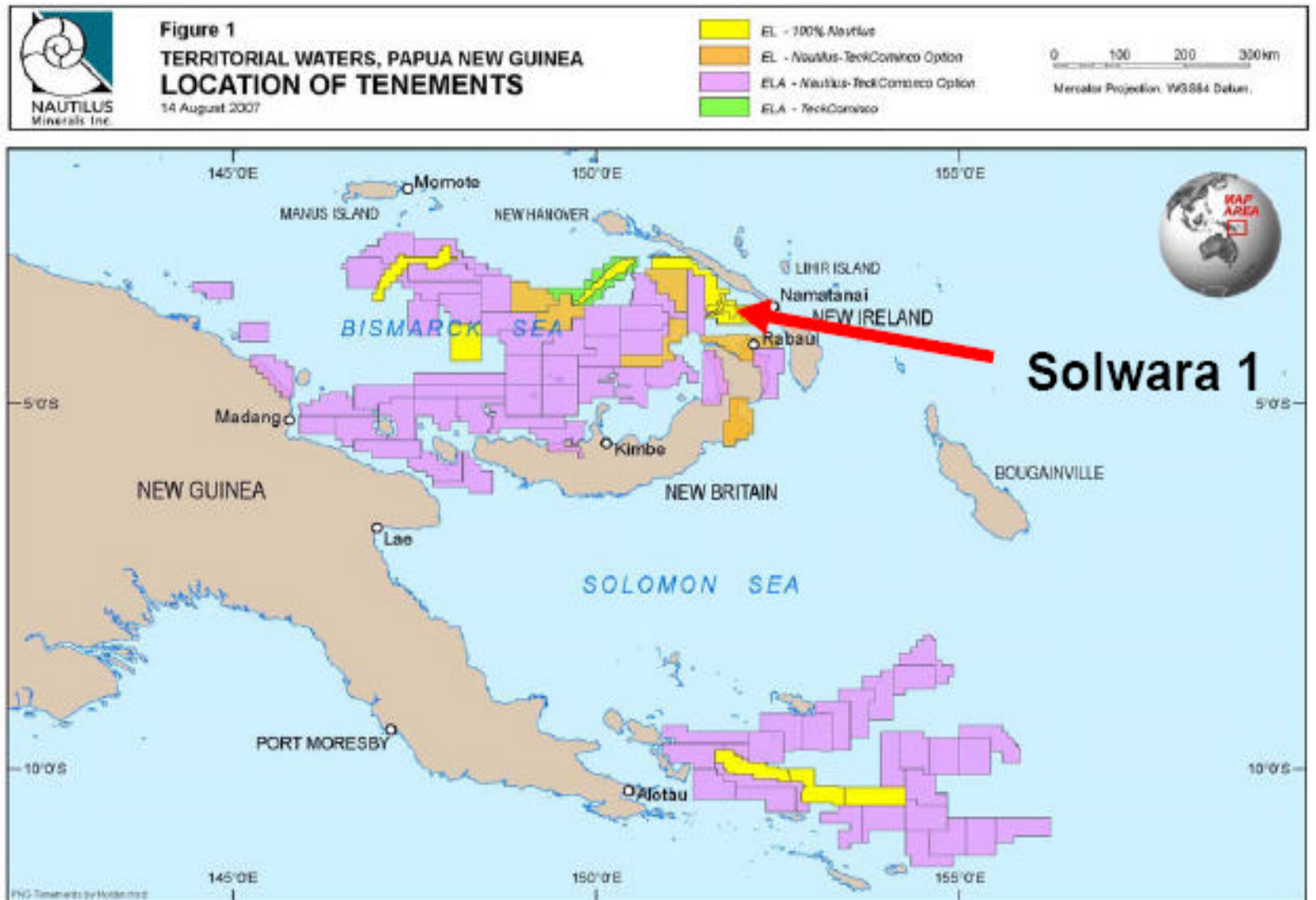
163 Mt @ 0.5 Cu equ



Tectonic elements of Papua New Guinea

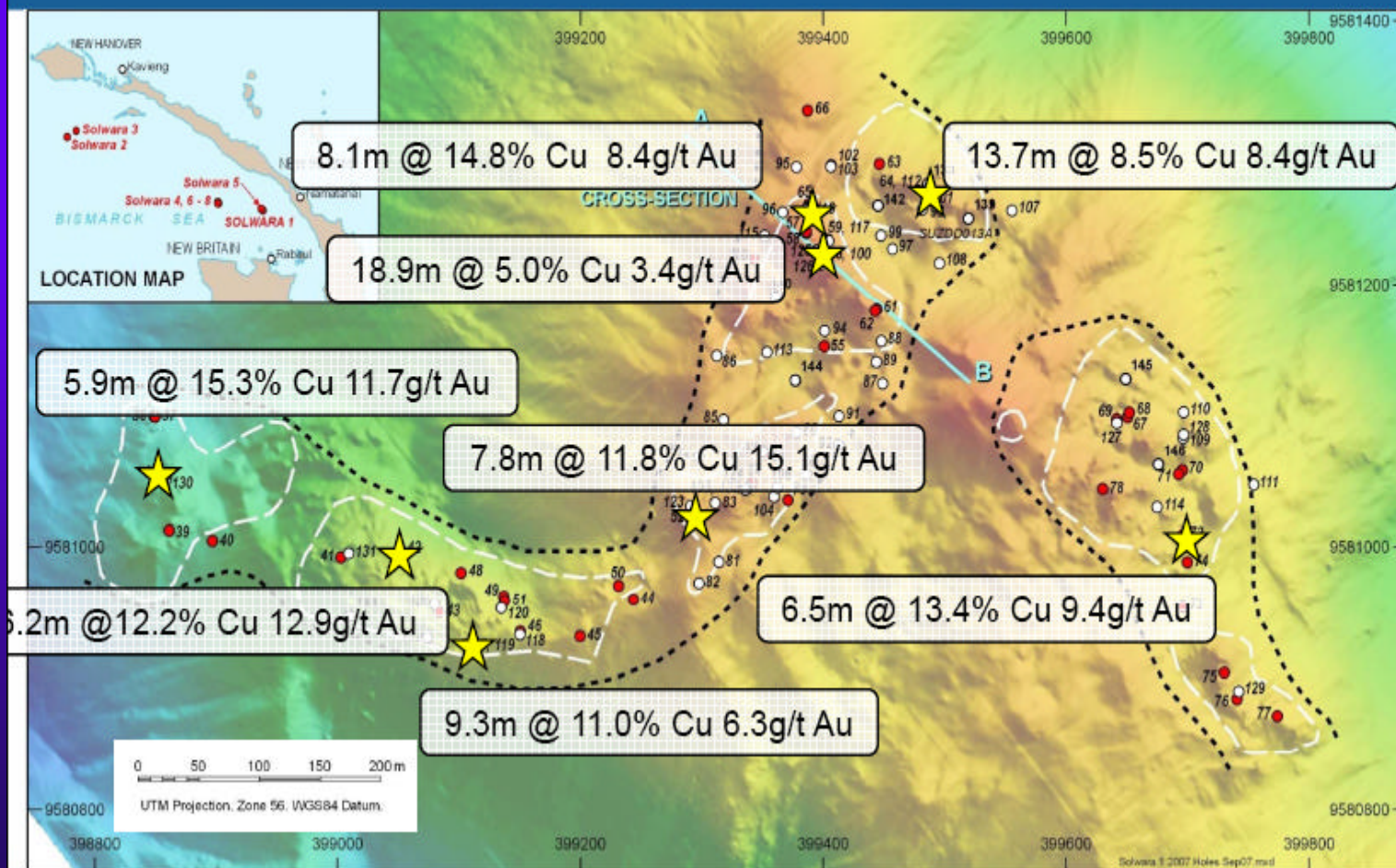


Solwara



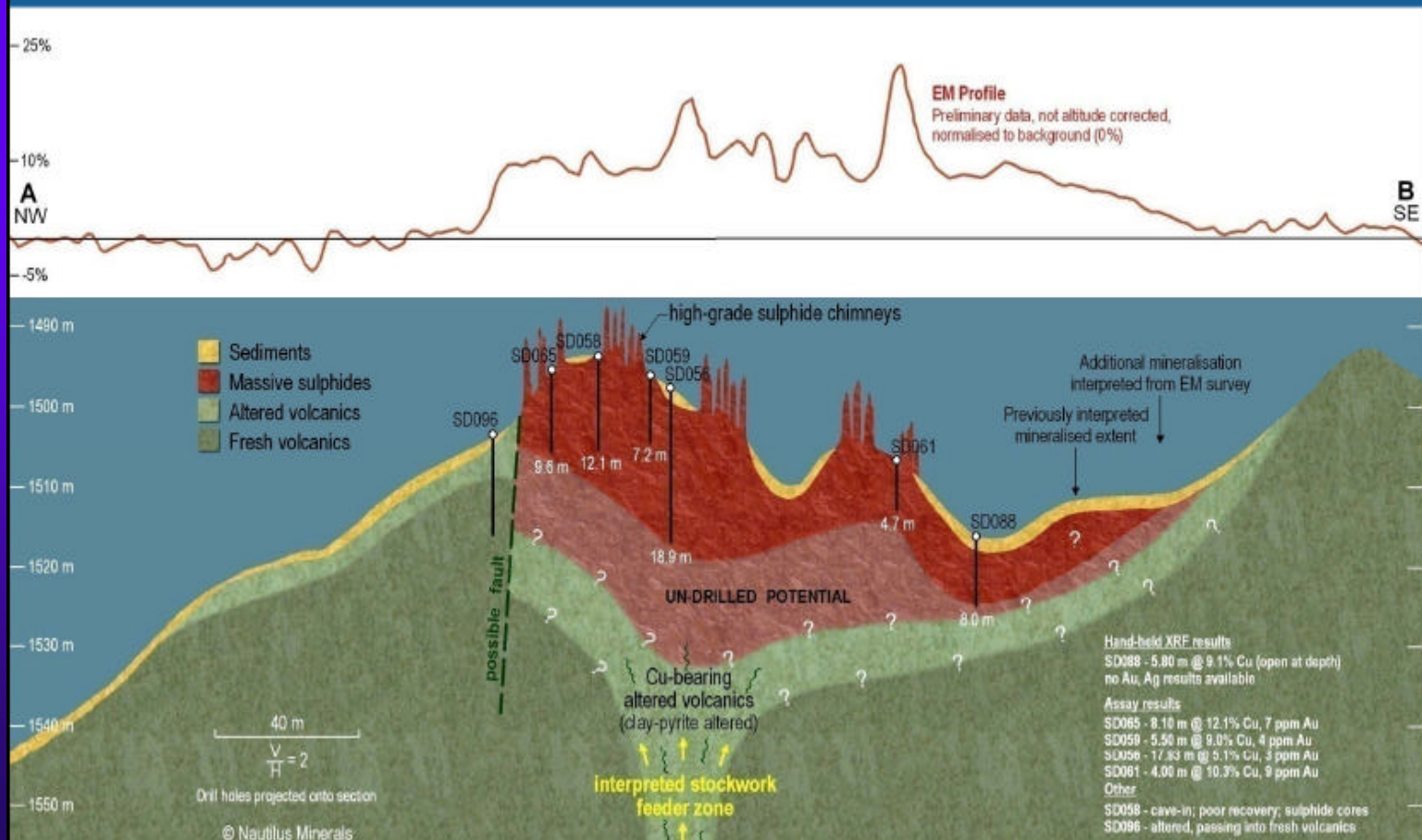
Solwara

SOLWARA 1 – MASSIVE SULPHIDE INTERCEPTS



Solwara

SOLWARA 1 – ELECTROMAGNETIC SURVEY



Conclusion – Controls to Cu-Au in PNG

- ◆ Constant theme of arc parallel and arc normal structures
- ◆ Linkages between different deposit types at various levels of erosion and distance from intrusion source rocks
- ◆ Importance of uplift and erosion
- ◆ Geological mapping continues as the most important element in mineralisation models

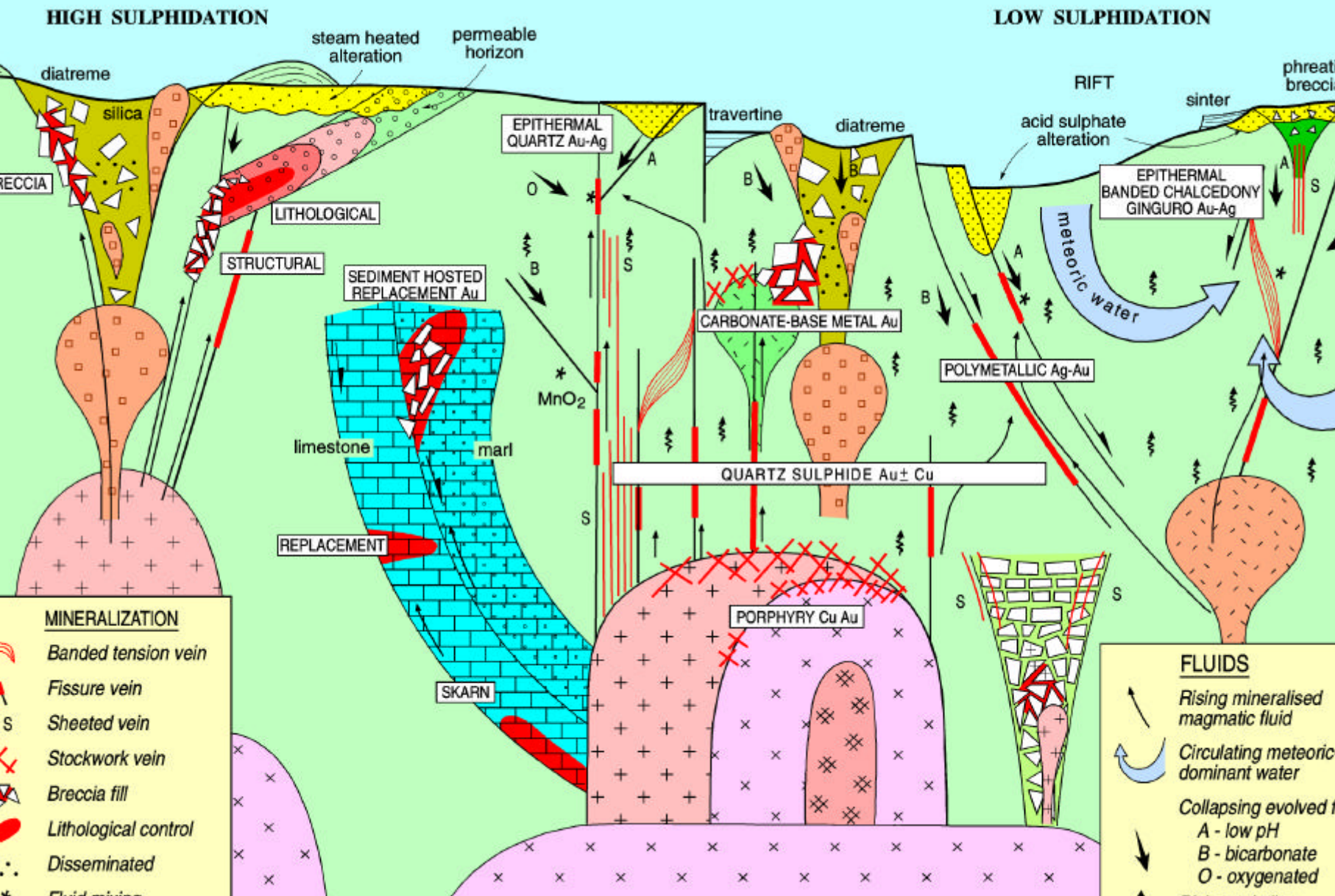
Thank you



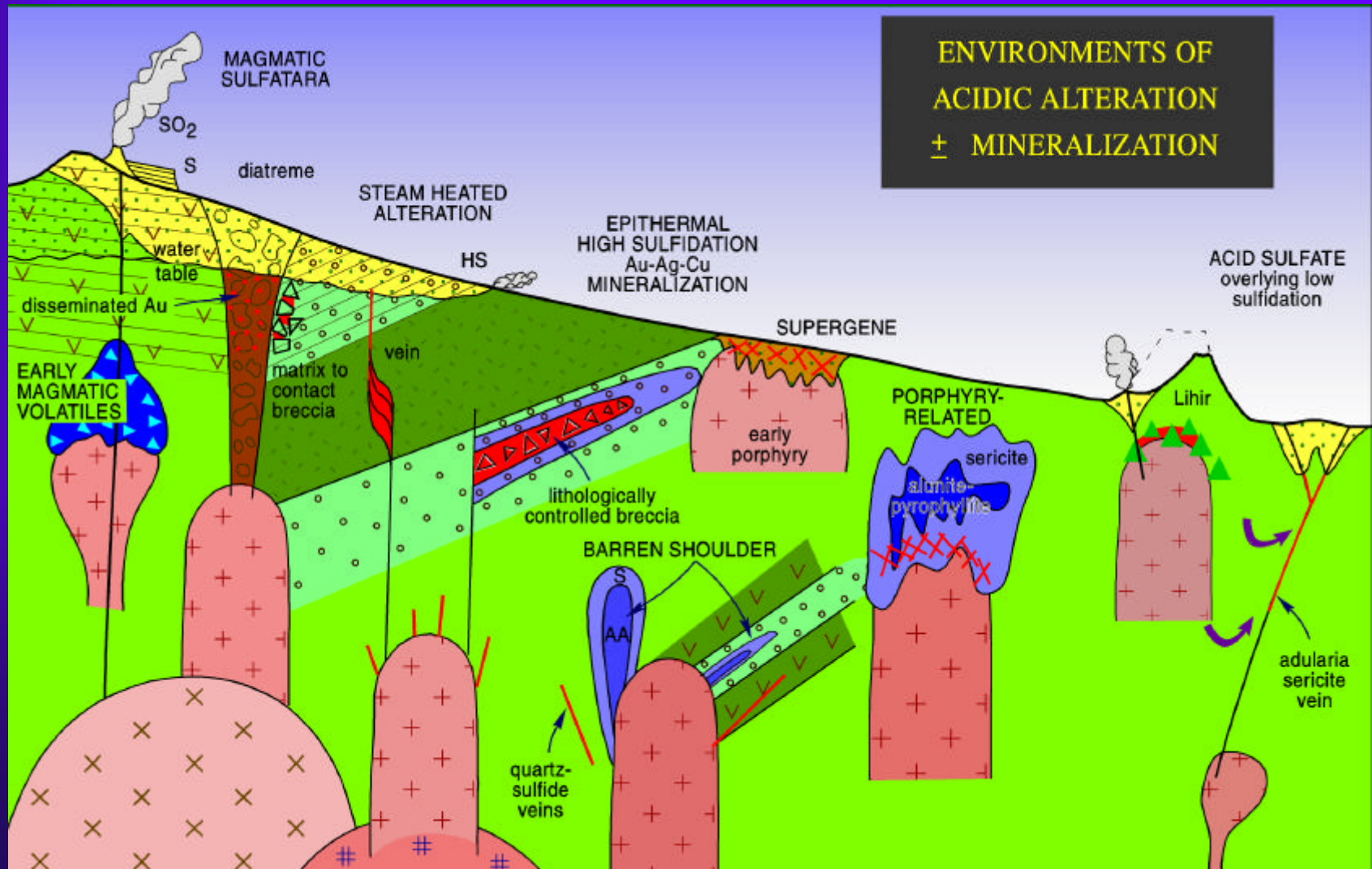
Thank you



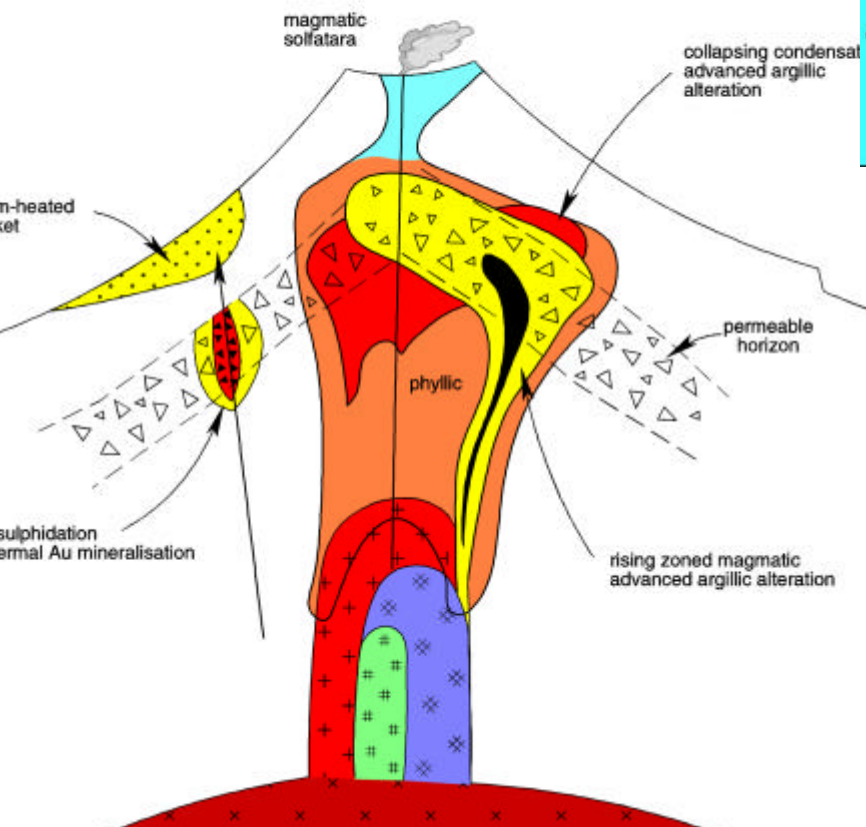
Styles of magmatic arc Cu-Au mineralisation



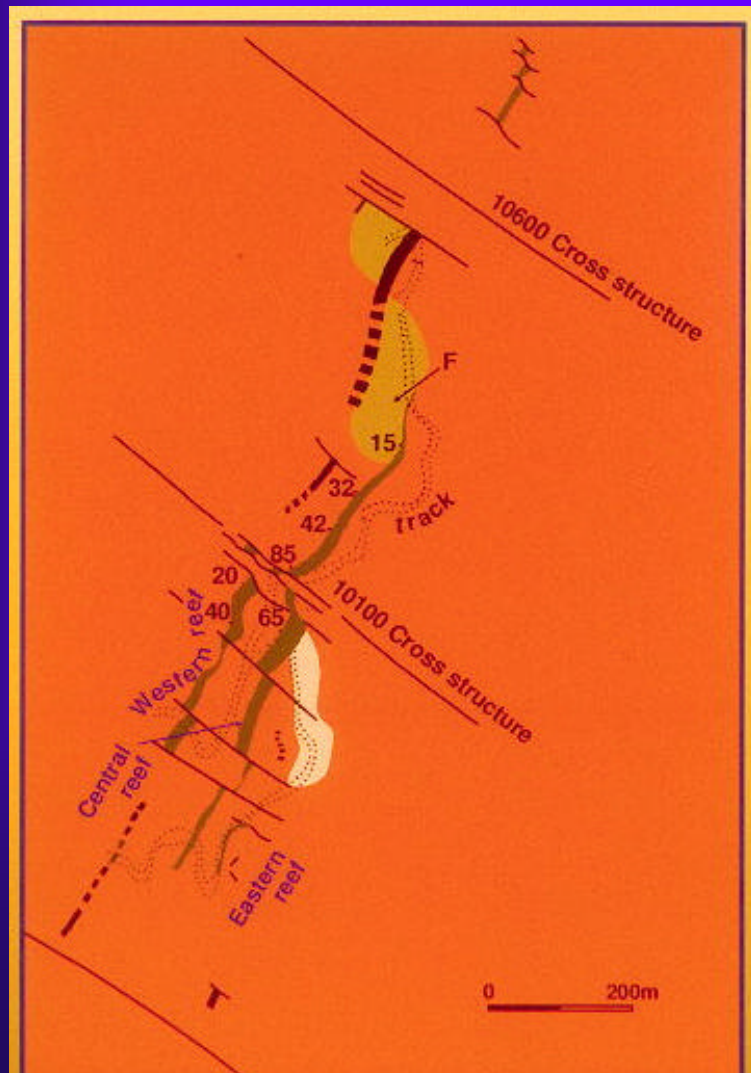
Barren shoulders of advanced argillic alteration



Barren advanced argillic alteration



Wild Dog



Bilimoia district

