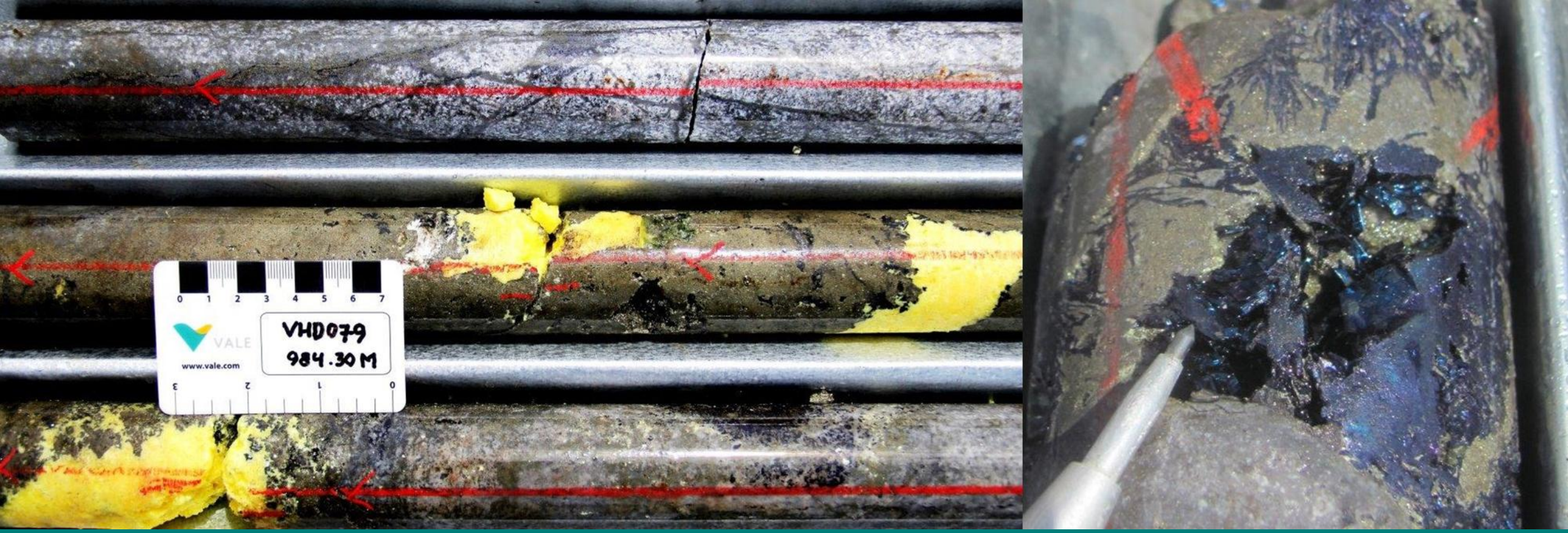

The Onto High Sulphidation Porphyry Cu-Au deposit Sumbawa, Indonesia

David Burt, Cobre Nuevo Exploration

Dave Burrows, Michael Rennison, Dave Toni

COBRE NUEVO Exploration

SUMBAWA TIMUR MINING

VALE

Outline

- **Location**
- Exploration History
- Discovery
- Deposit Geology
- High Sulphidation Overprint
- Geophysical Response
- Summary

Location


Sangeang Api (May 2014)

118°30.0′E
118°0.0′E
117°30.0′E
117°0.0′E
119°0.0′E
8°30.0′S
9°0.0′S
Tambora volcano
Sumbawa Strait Fault
Sumbawa Besar
Bima
Hu'u
Contract of Work
Onto Deposit
Trans Sumbawa Fault
Teluk Panas Fault
Batu Hijau Mine
PT Amman
Elang Deposit
PT Amman
50km

Environment

Wadubura river and camp, NW end of Onto

Outline

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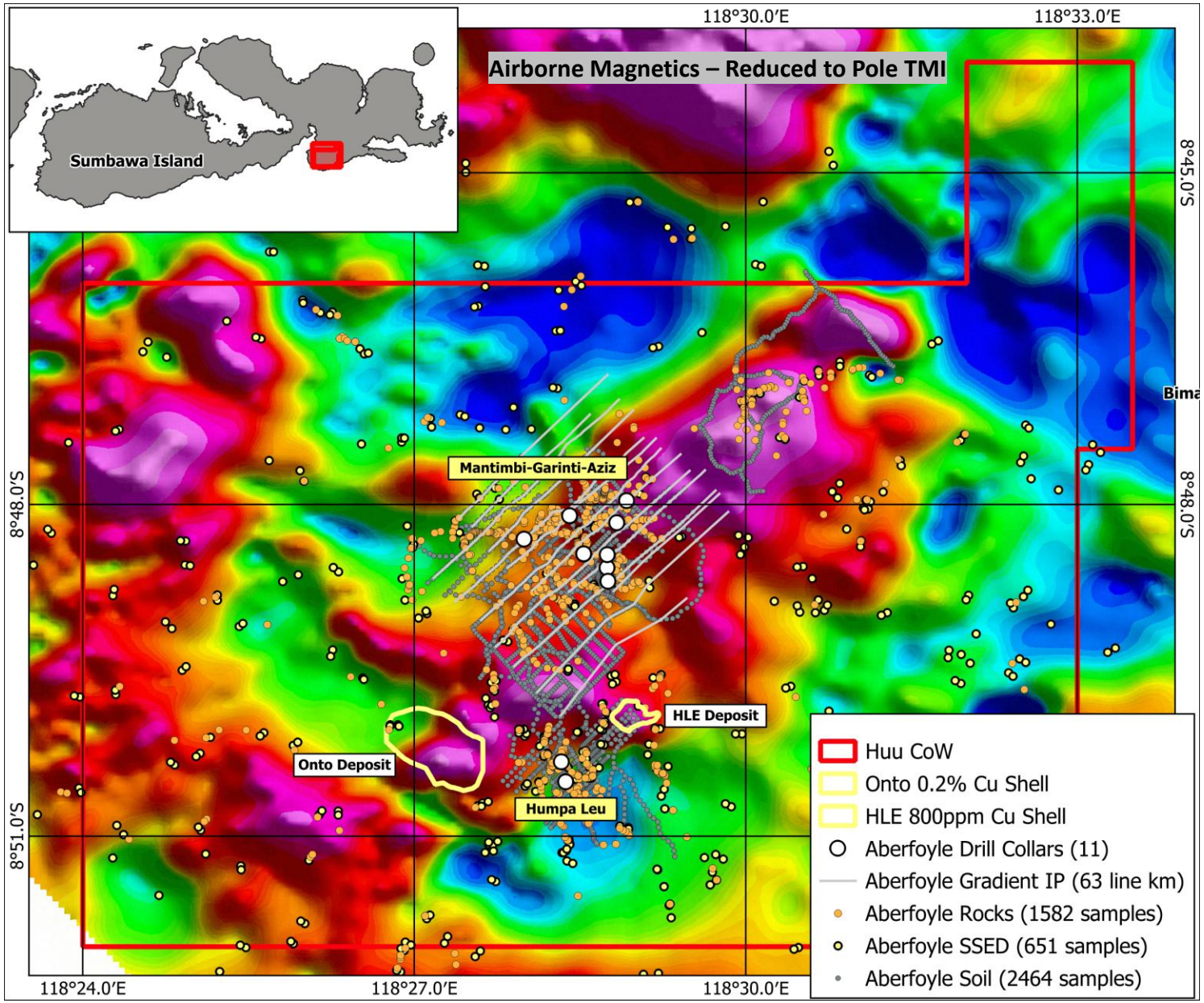
Previous Exploration

- By early 1996, Aberfoyle had focused in on the current Hu'u project area using detailed regional stream sampling and mapping.
- By mid 1998 an extensive exploration program had defined numerous targets and several had been drill tested.
- Exploration datasets included:
  - Airborne magnetics
  - Stream, soil and rock geochemistry
  - CSAMT and Gradient Array IP
- 11 completed holes for a total of 5528m
- The best intercept at Humpa Leu, HHD001 returning 326m @ 947ppm Cu and 0.1g/t Au from 2m to EOH.
- Results had been encouraging but no potentially economic mineral intercepts had been made.
- The project was placed in suspension following the hostile takeover of Aberfoyle.

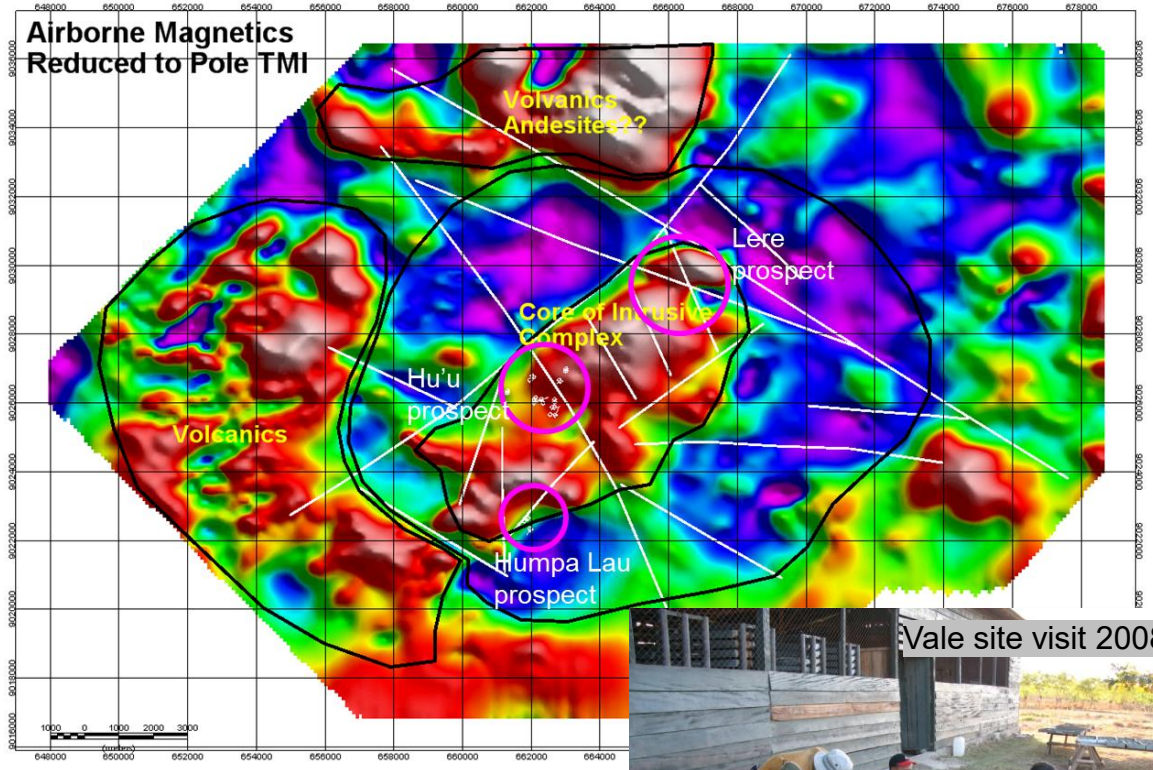


Project Generation

- In 2006 the Vale regional exploration team commenced a porphyry Cu exploration program in Southeast Asia.
- The focus of the program was to identify prospective, high-level advanced argillic alteration (lithocap) and rapidly assess their potential for concealed porphyry mineralization.
- Rod Davies was consulting to Vale at that time as a member of the project generation team. He had worked at the Hu'u project during the Aberfoyle exploration and thought it was a good fit for the strategy.

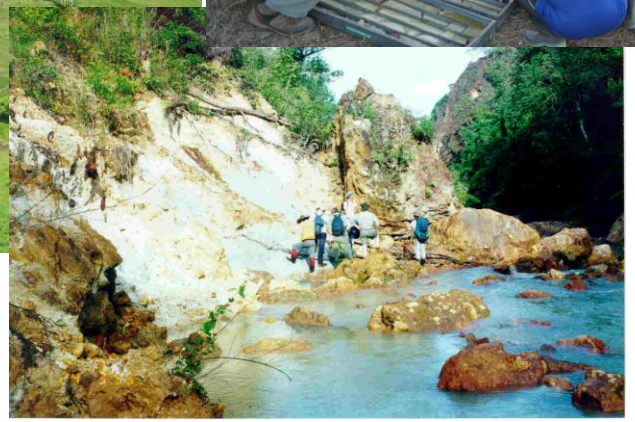
- In early 2008 a CA was signed with STM to review the project and a site visit was conducted shortly after.
- The Vale team concluded that the Hu'u project had significant potential and a Purchase Option Agreement was signed with Eastern Star Resources in October 2009.

- Work immediately started to reactivate the CoW and obtain the required approvals to recommence field activities. Final approvals were obtained in late 2010 and drilling commenced in early 2011.




Daha core shed (2008)

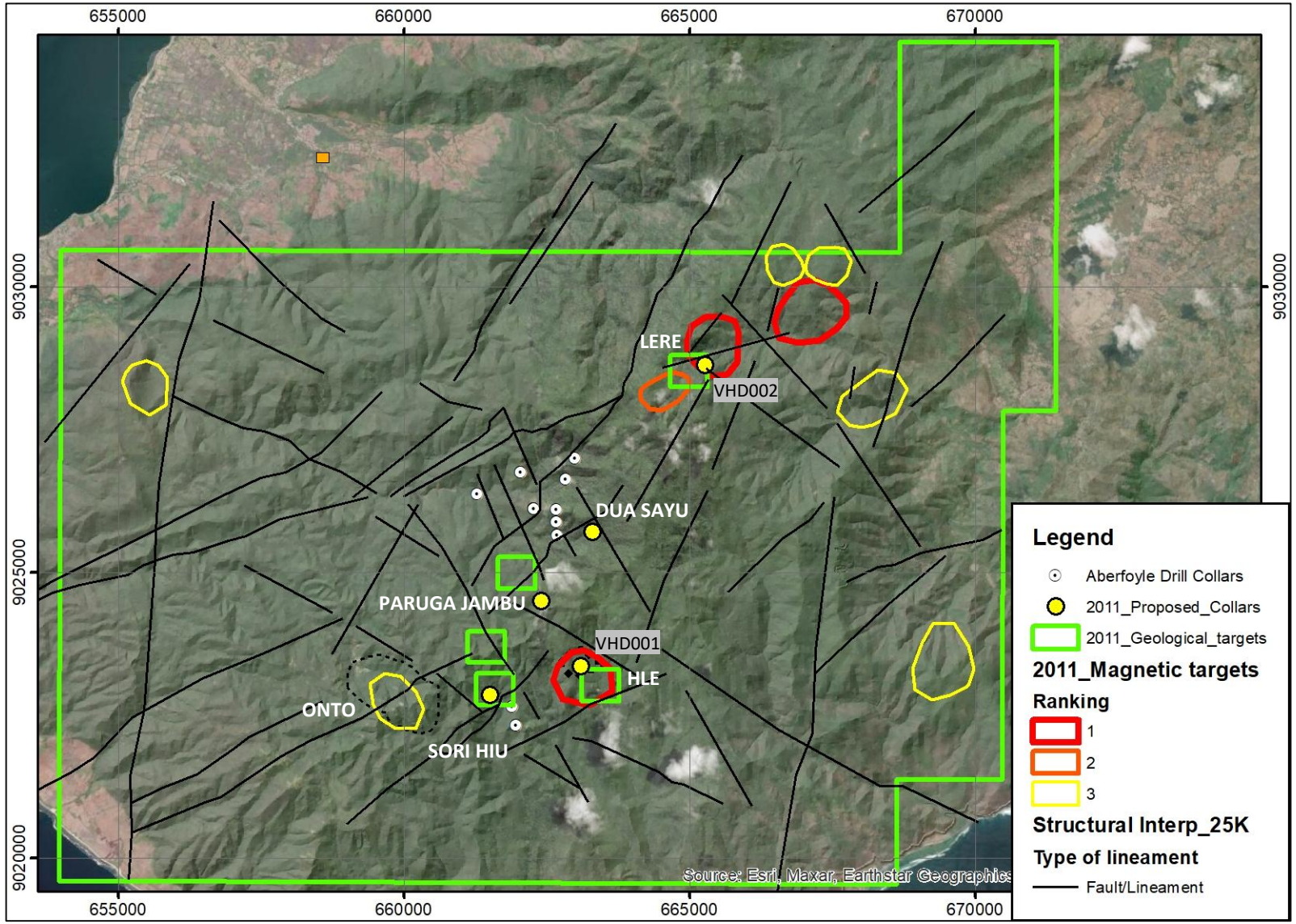

Vale site visit 2008



Target Generation

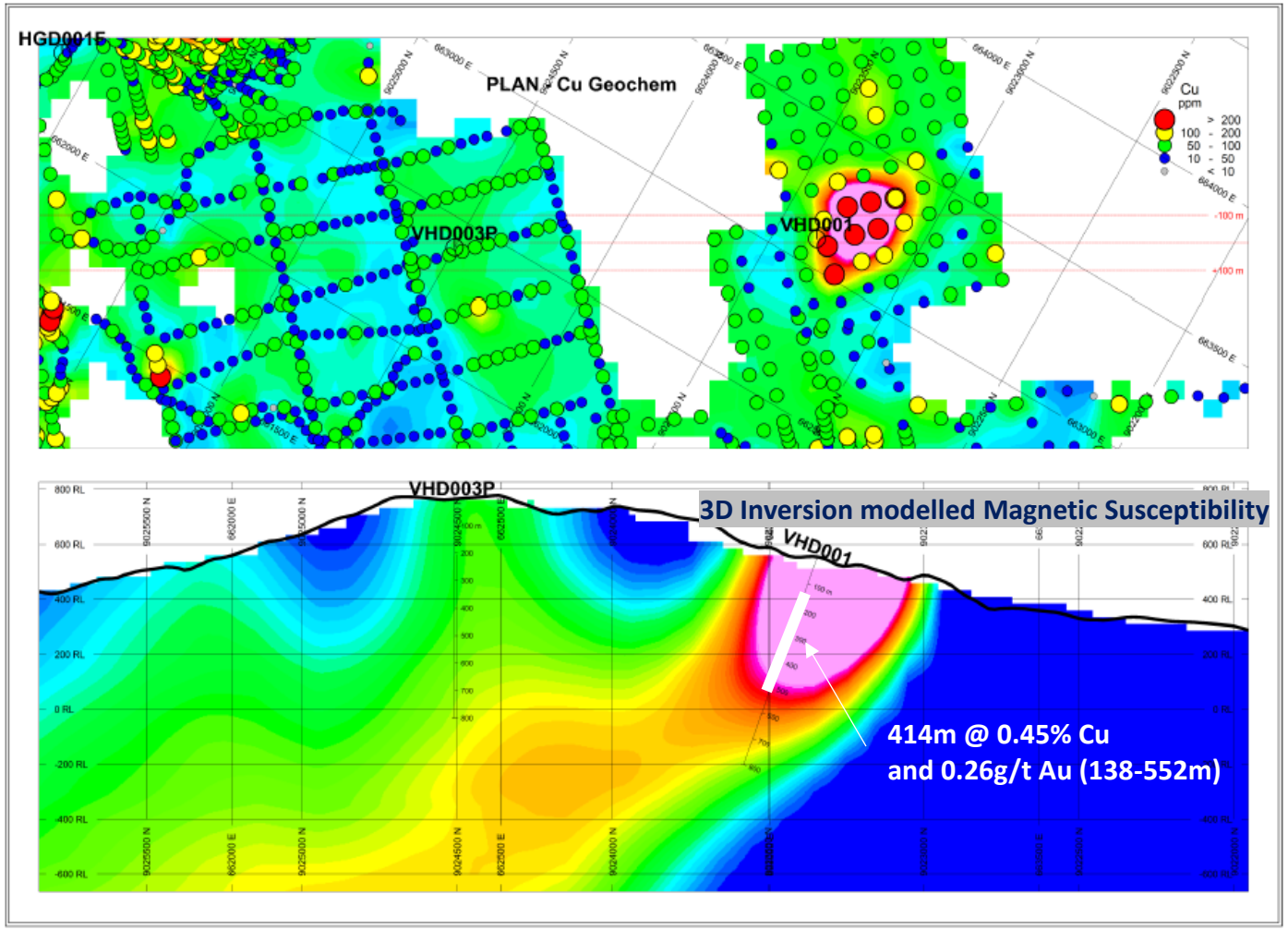
- During the time taken to acquire the appropriate approvals to recommence field activities only limited access to site was possible.
- Drill core and geochemical sample pulps had been stored by STM. Some samples were re-assayed and all sample pulps were analysed using portable spectrometer and the results used to enhance surface alteration maps.
- Targets were defined based on geology, geochemistry along with structural and geophysical interpretation.

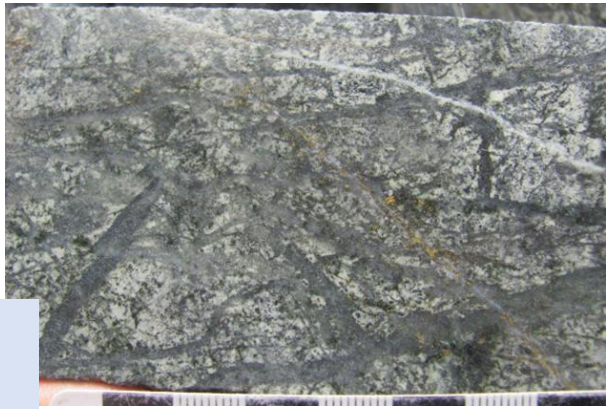
- An initial program of 5 x 800m diamond drill holes was approved and preparations made to commence drilling once approvals were granted.
- Drilling commenced at Humpa Leu East (HLE) and Lere in January 2011.



Humpa Leu East Porphyry

- The highest priority target defined from the historical exploration data was at Humpa Leu East
- 3D inversion modelling of the original airborne magnetic data defined a discrete cylindrical magnetic susceptibility high with coincident soil geochemical anomalism.
- Drilling of hole VHD001 commenced in January 2011 and intersected porphyry mineralisation from 138m downhole.
- VHD001 intersected 414m @ 0.45% Cu & 0.26g/t Au (138-552)
- Mineralization was associated with a multiphase diorite porphyry stock with strong quartz vein stockwork and biotite-magnetite alteration.





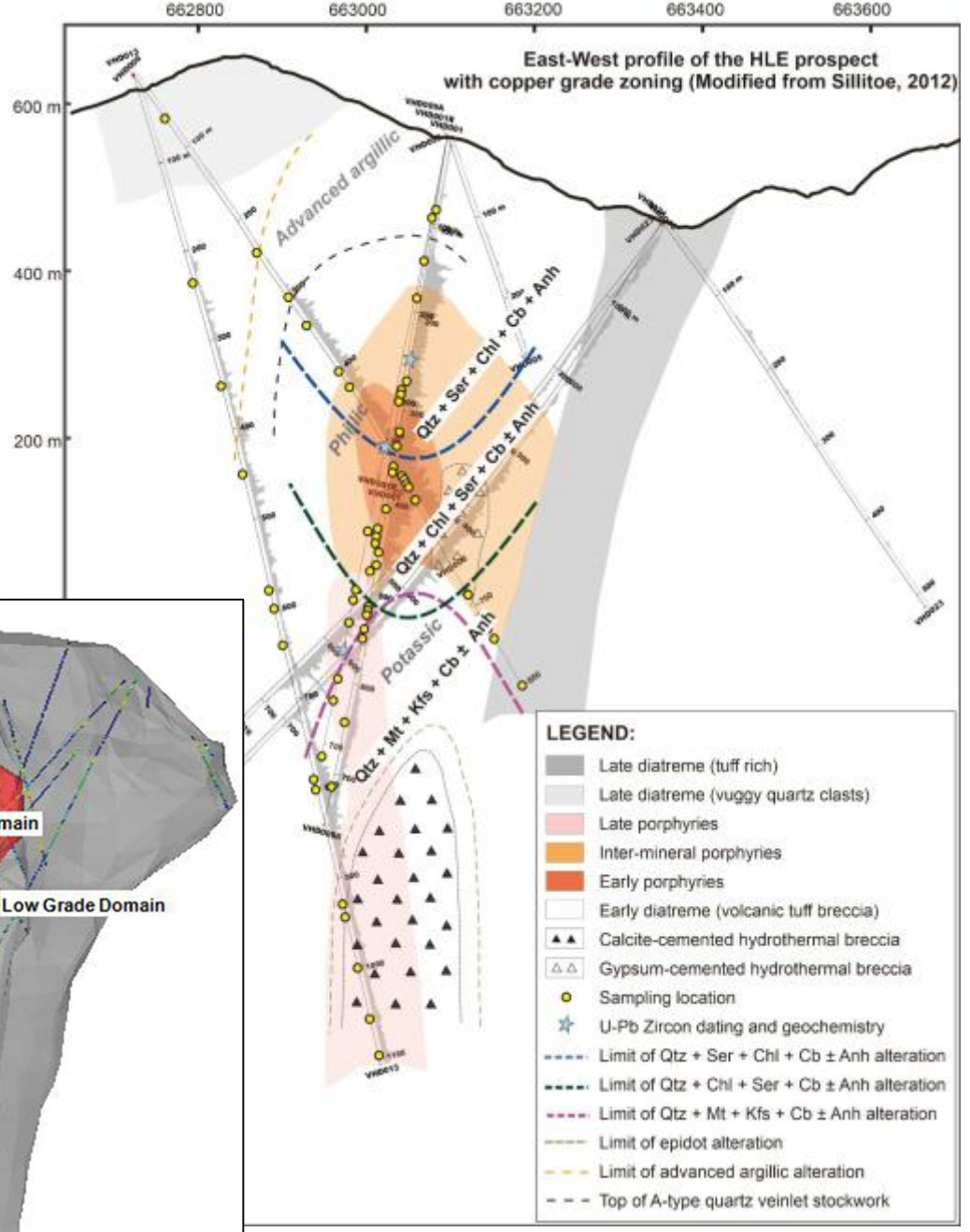
VHD001 - typical mineralized diorite porphyry with strong quartz vein stockwork and potassic alteration

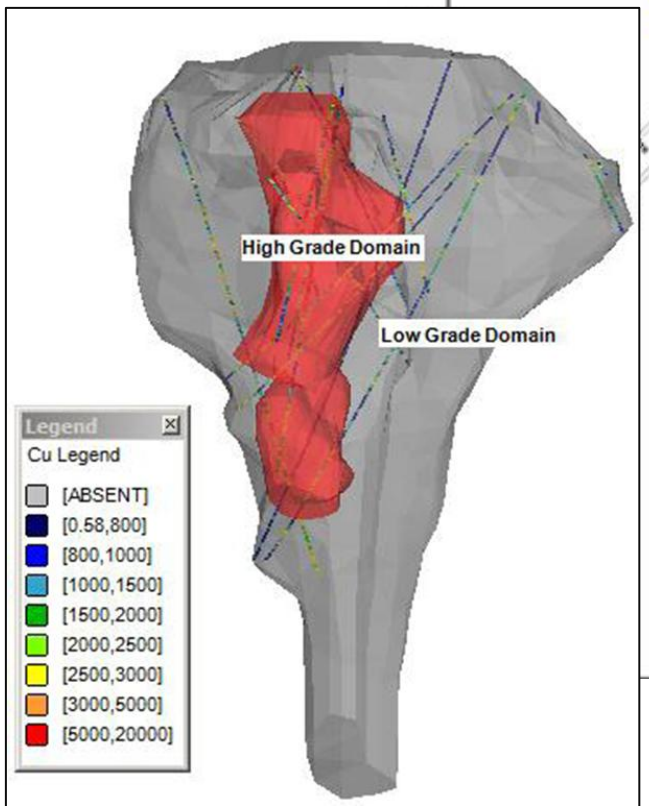
Humpa Leu East Porphyry

- Work on site now focussed on defining the extent of the mineralization at HLE.
- The system is a complex multiphase porphyry intrusive with several late hydrothermal breccias truncating or stoping out mineralization.
- Roughly 15000m of drilling delineated a small resource of 250Mt @ 0.25% Cu and 0.29g/t Au
- The system was not considered of economic size by Vale. However, the discovery was an important proof of concept and provided encouragement for the exploration program.

- Best intercept at HLE was from VHD009 which drilled down the centre of the early diorite porphyry.
- VHD009 intersected 386m @ 0.53 % Cu and 1.25 g/t Au (148-562)

- The porphyry intrusive stocks at HLE are aged from 1.0 to 1.2 Ma (zircon U/Pb)





Outline

- Location
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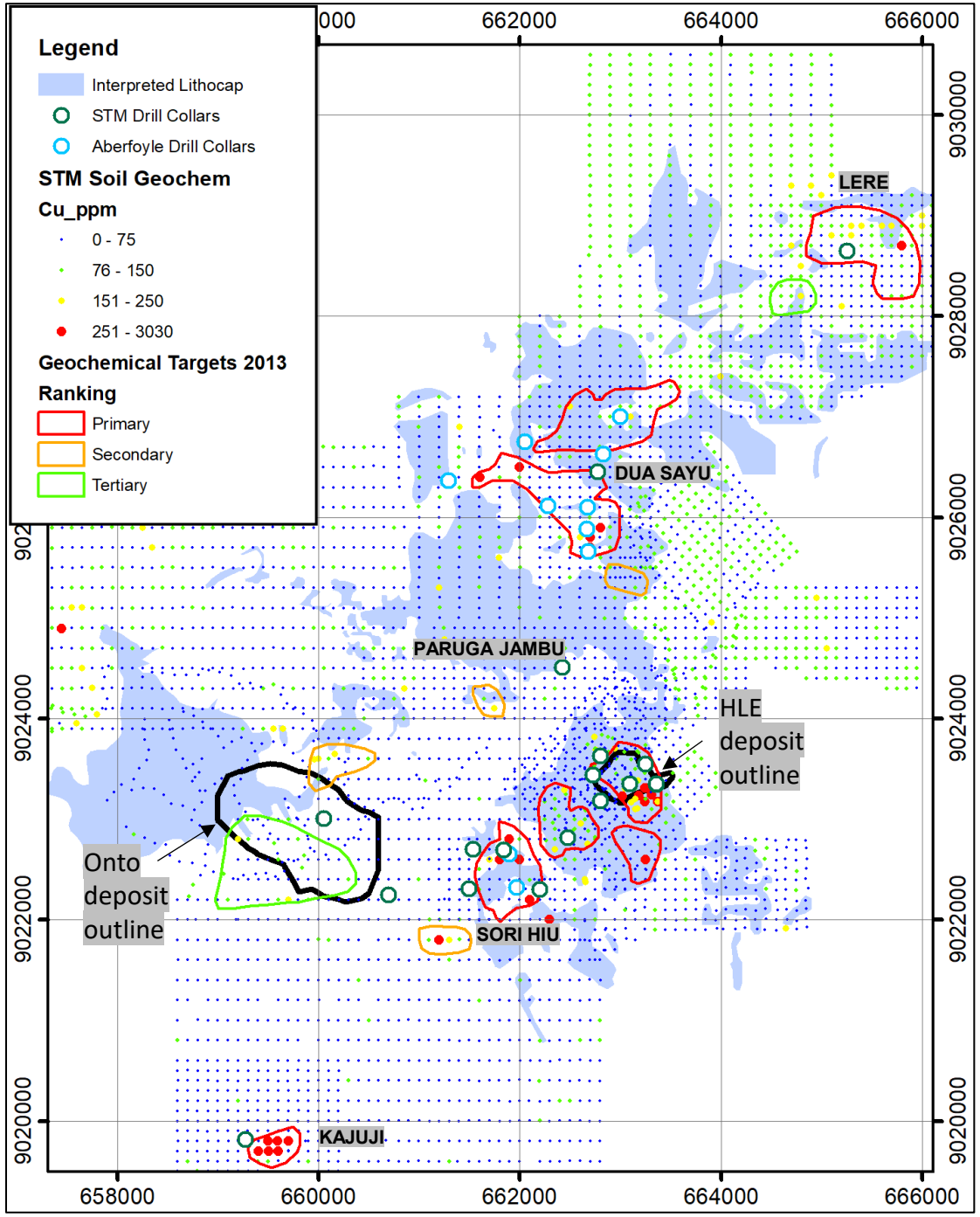
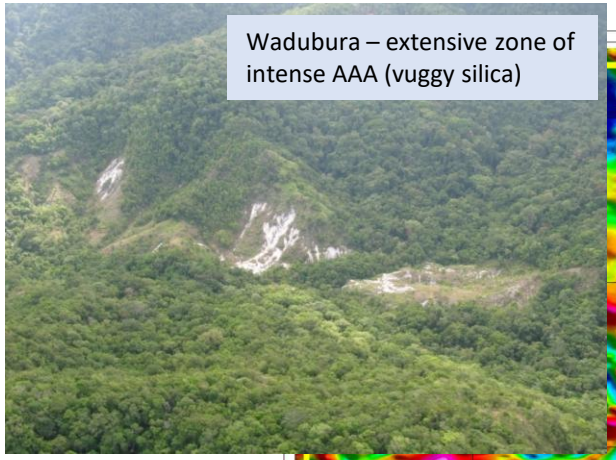
Onto

- By early 2013, all the original targets had been tested apart from Lere in the northeast where local community concerns continued to delay access.
- Several new targets had been tested but without success and the exploration team were running out of ideas.
- One last effort was made to reinterpret all the available information incorporating the new datasets.
- Vale's Chief Geochemist at the time, Peter Winterburn noted a weak multi-element porphyry indicator geochemical target at Onto. This anomaly was roughly coincident with a low order magnetic feature highlighted during the original target generation phase.
- One further piece of work from the local geology team would prove vital for move the Onto prospect towards drill testing.



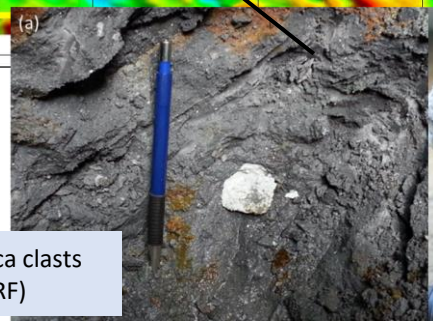
Onto

- While prospecting in the area near Onto the local geological team located a small phreatic breccia (5m x 5m) containing mineralized clasts of vuggy silica and AA altered porphyry. ‘Bornite in outcrop had been noted on old Aberfoyle paper geology maps.
- The discovery of these mineralized clasts combined with the magnetic feature and the weak geochemical anomaly provided solid indications for possible concealed mineralization.
- VHD034 was designed to test the magnetic feature as close as possible to the phreatic breccia.
- Several small breccias were mapped following the discovery of the deposit. Probably accounting for the ‘spotty’ Cu in soil values.



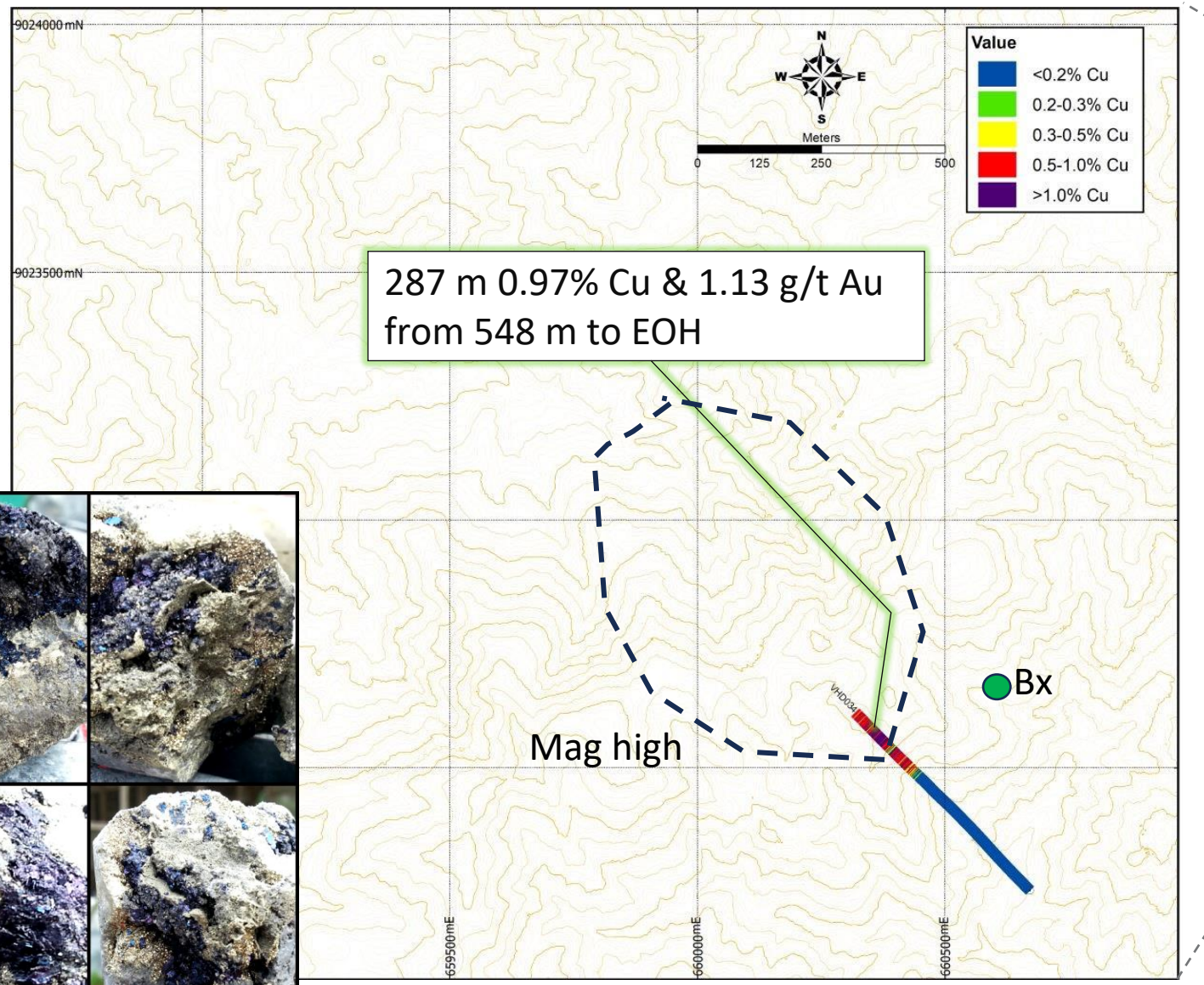
Wadubura – extensive zone of intense AAA (vuggy silica)

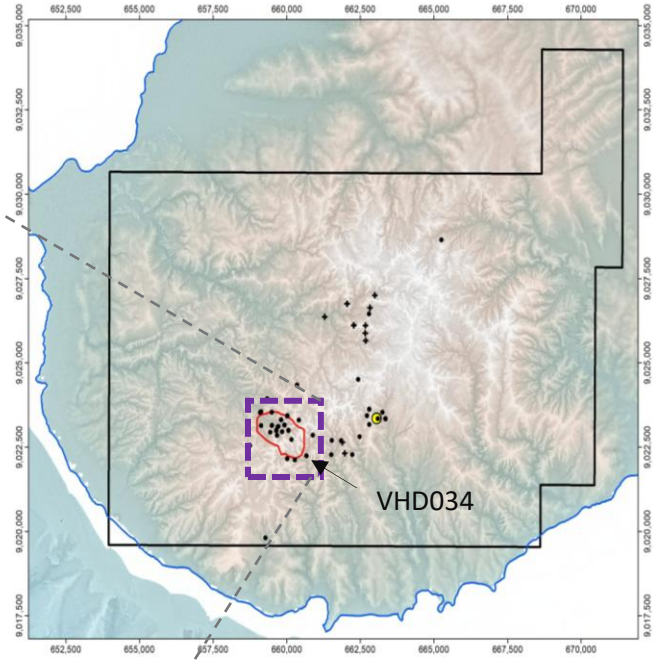
Onto - mineralized porphyry clasts in breccia (2700ppm Cu - pXRF)



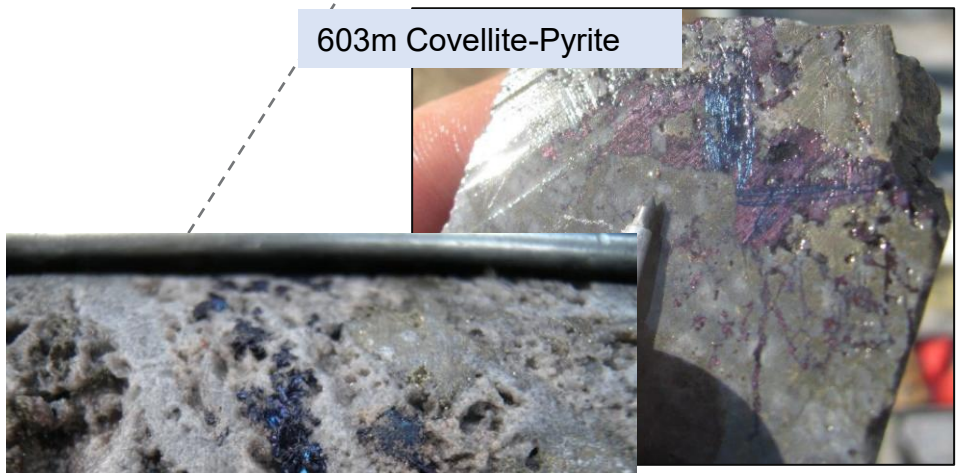
Onto - mineralized vuggy silica clasts in breccia (7000ppm Cu - pXRF)

Onto Discovery: Hole VHD034



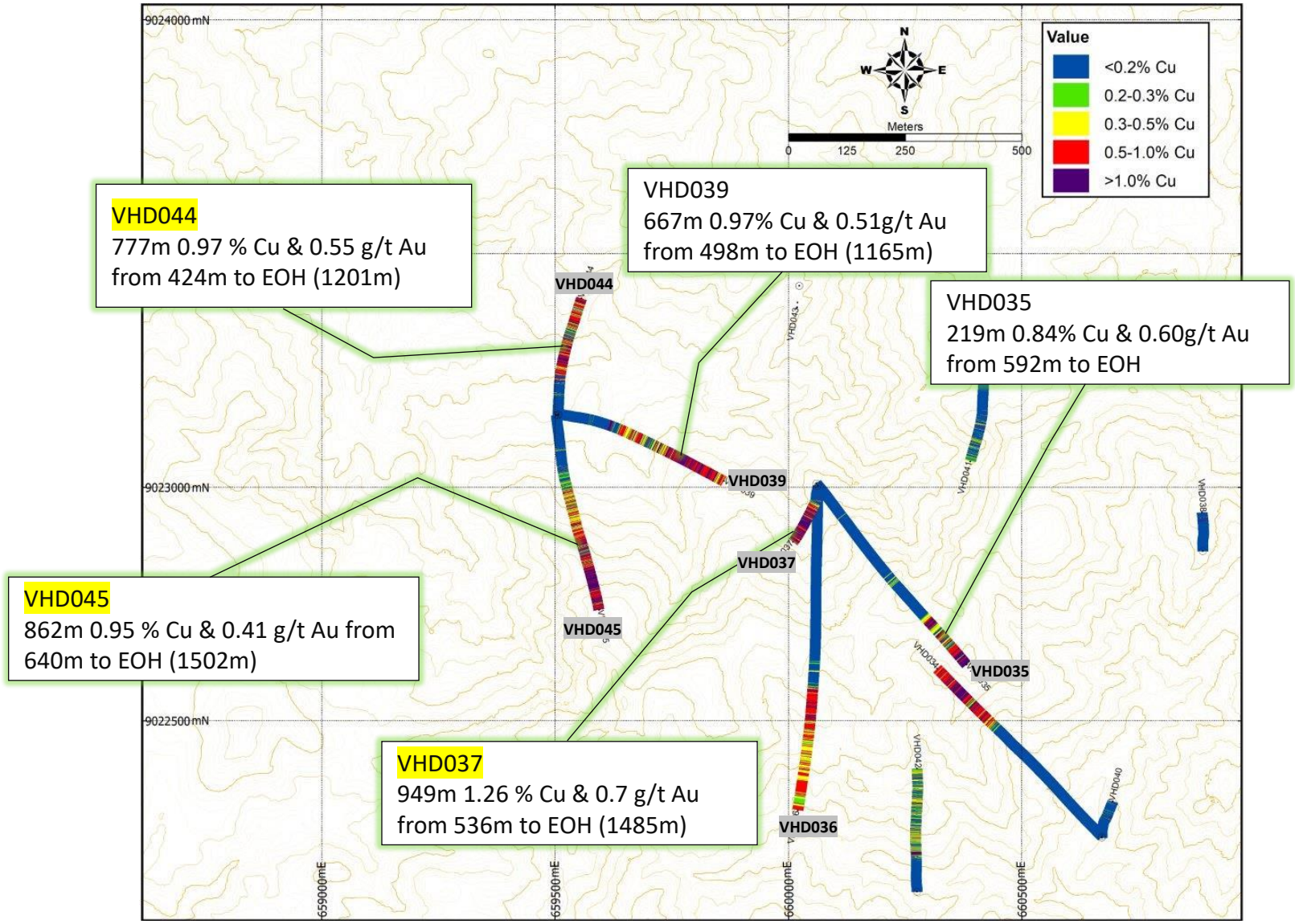


603m Covellite-Pyrite



835m VRQ overprinting
A-B vein stockwork

Onto Drilling: Confirming size



VHD044
777m 0.97 % Cu & 0.55 g/t Au
from 424m to EOH (1201m)

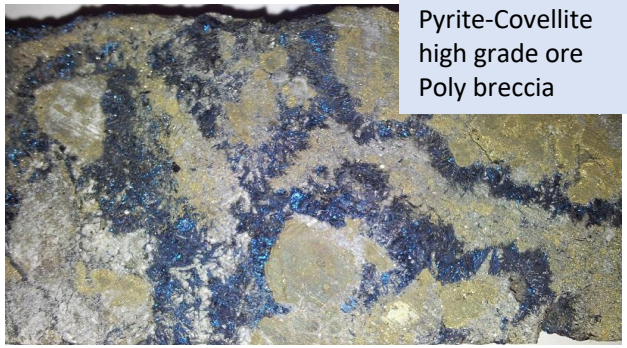
VHD039
667m 0.97% Cu & 0.51g/t Au
from 498m to EOH (1165m)

VHD035
219m 0.84% Cu & 0.60g/t Au
from 592m to EOH

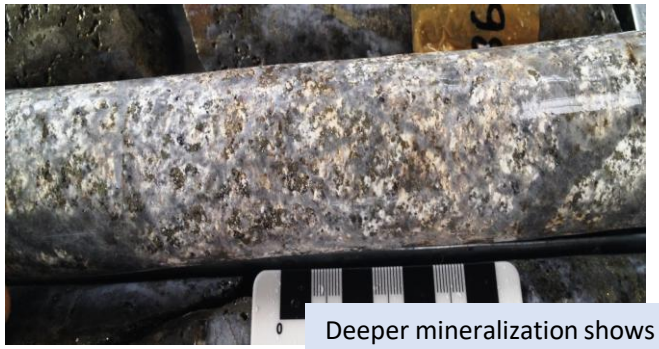
VHD045
862m 0.95 % Cu & 0.41 g/t Au from
640m to EOH (1502m)

VHD037
949m 1.26 % Cu & 0.7 g/t Au
from 536m to EOH (1485m)

'Platey' Covellite filling vugs is common throughout

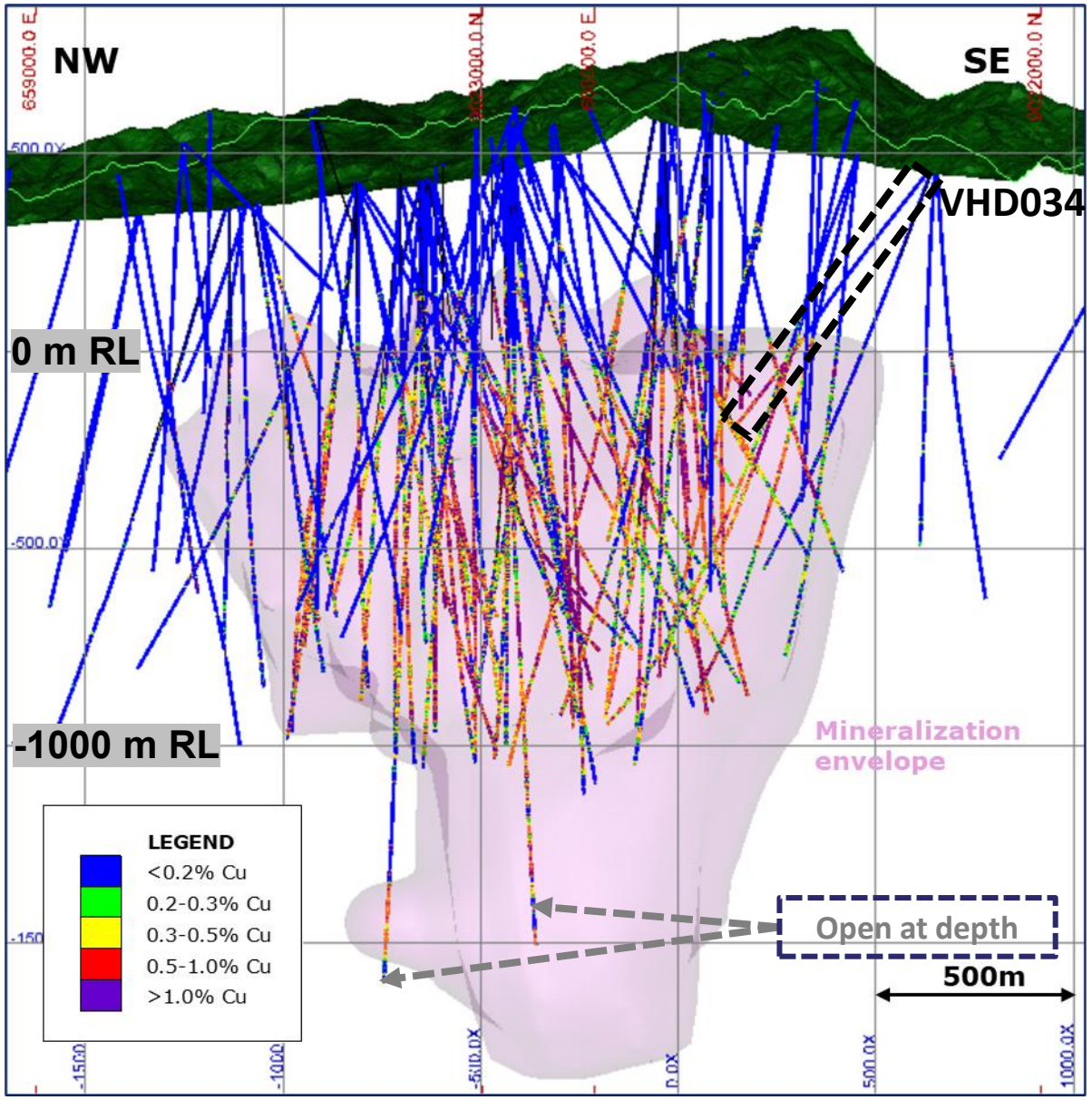


Pyrite-Covellite high grade ore Poly breccia



Deeper mineralization shows 'ghost' qtz stockwork overprinted by strong AA alteration.

The Onto Deposit



A total of 126 holes have now been drilled into the deposit for some 123,348m.

The current resource is calculated down to the -1000m RL although two deeper hole indicate the mineralization continues at least a further 500m.

The project is currently undertaking the feasibility study for a phased block caving operation starting at 24Mtpa and growing to 48Mtpa peak.

Resource Category	Tonnes	Grade		Contained Metal	
		Cu	Au	Cu	Au
	(Bt)	(%)	(g/t)	(Mt)	(Moz)
Indicated	1.6	0.85	0.51	13.9	26.9
Inferred	1.4	0.6	0.2	7.8	10.6
Total	**3.0Bt**	**0.72**	**0.39**	**21.7Mt**	**37.5Moz**

[PDAC Presentation 2025 – Resource Estimate of the Onto Deposit Increases to 3 Billion Tonnes – Sumbawa Timur Mining]

Outline

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- High Sulphidation Overprint
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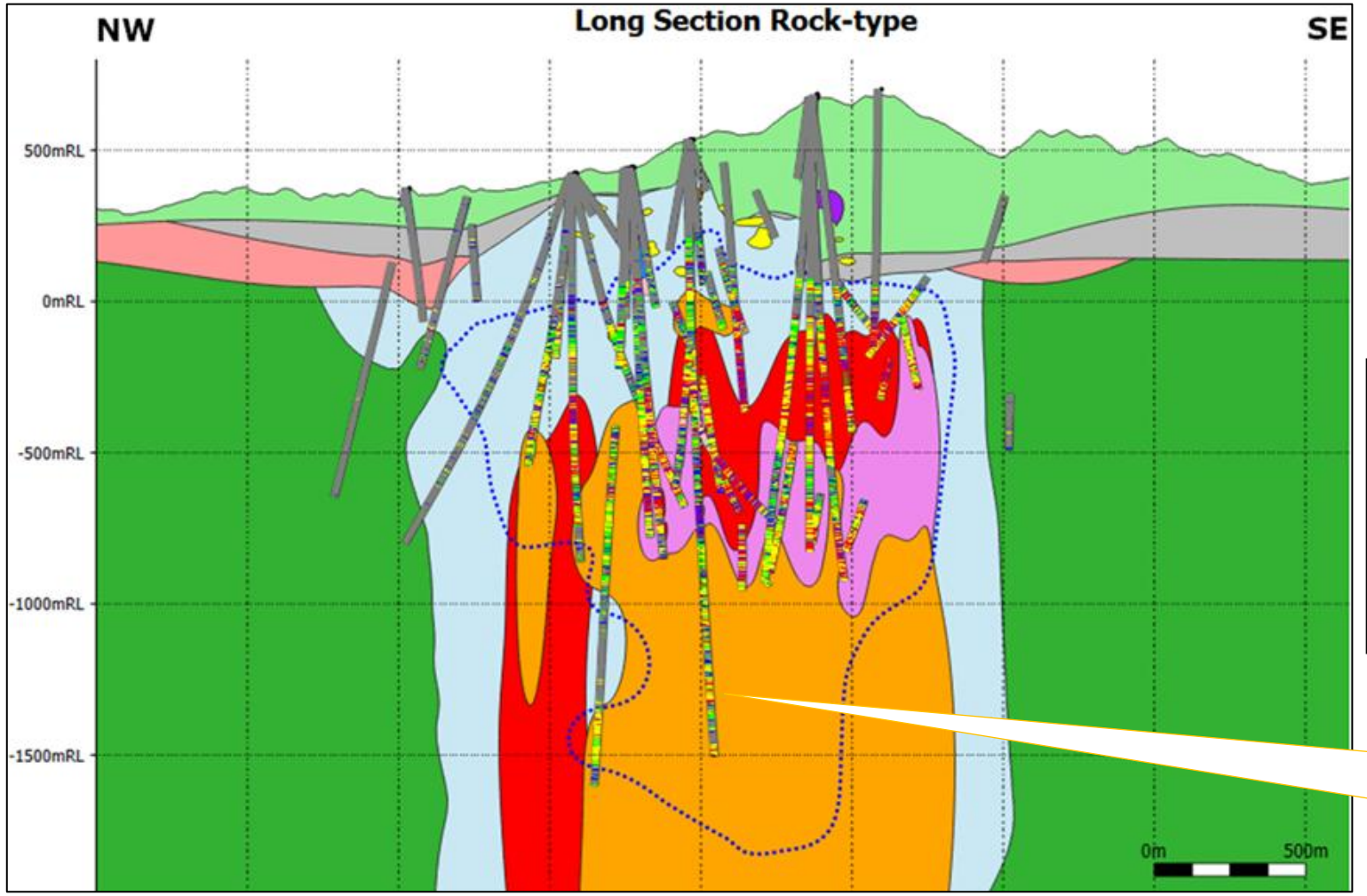
Lithology
Longitudinal Section NW to SE



- Early andesite sequence
- Diatreme polymictic breccia with maar sediments and tuff ring
- Capping andesite
- Core of coalesced porphyry stocks
- Mineralisation centred on the top of the stocks
  pyrite>>covellite>enargite>chalco>bornite

Legend

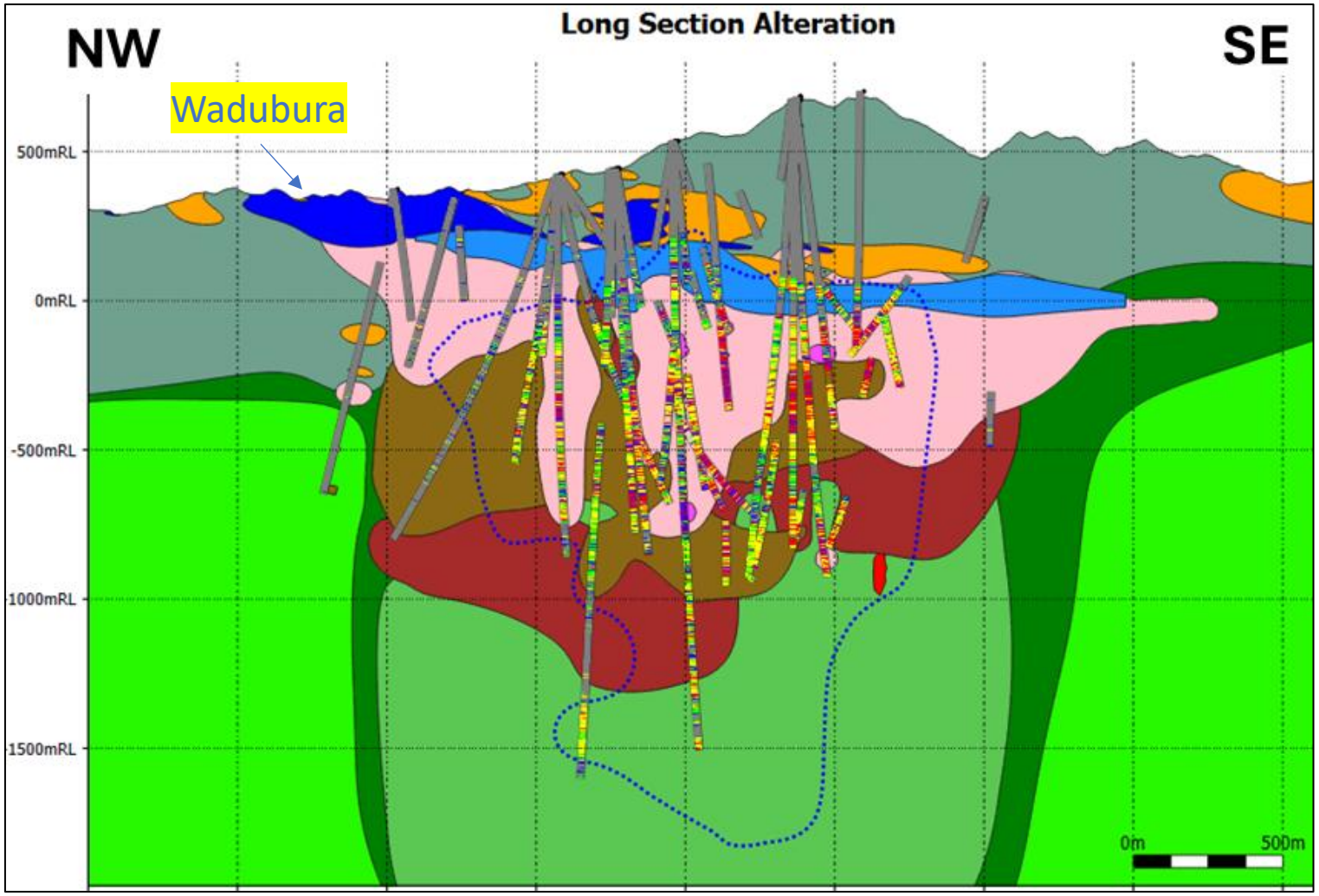
Lithology

Phreatic Breccia	QFP
Late Inter Porphyry	USP
Early Inter Porphyry	Pyroclastic Tuff
Early Porphyry	Poly Bx
Capping andesite	Early Andesite Sequence
Andesite Dyke	

0.2% Cu shell

VHD096 to 2042m intersected 1595m at 1% Cu & 0.4 g/t Au including 100 m at 6% Cu & 1.1 g/t Au

Alteration
Longitudinal Section NW to SE



- Unaltered to illite-smectite altered rocks at top
- Quartz-dickite ± pyrophyllite
- Two sub-horizontal residual quartz horizons
- Quartz-alunite to quartz-pyrophyllite to quartz-diaspore
- The high-sulphidation event has created a thick lithocap of some 1,500m of a suite of advanced argillic alteration.
- Cu-Au mineralisation is almost entirely contained within advance argillic alteration assemblages (>90%).

Legend

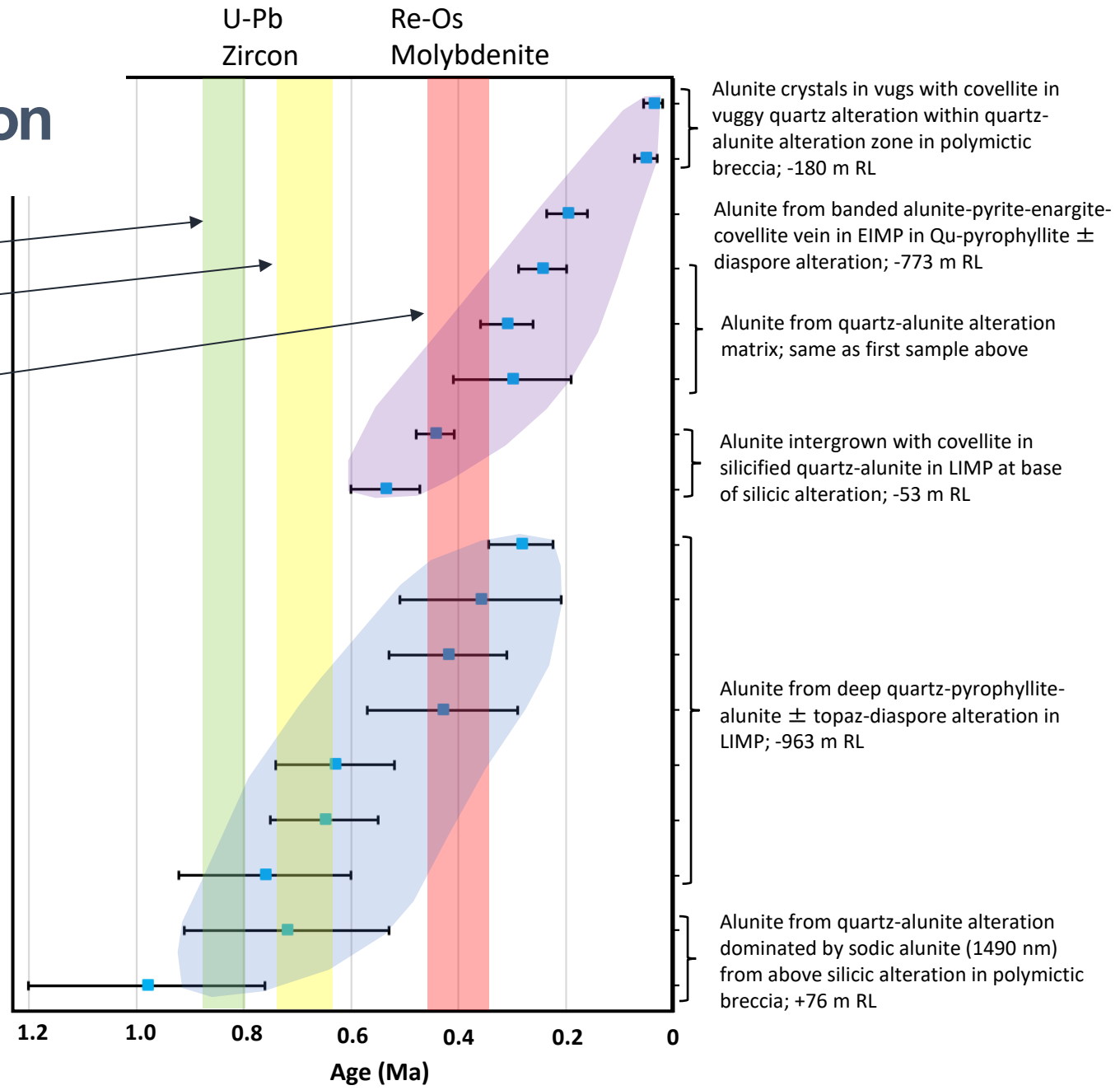
Alteration

- Porous VRQ
- Silicic
- Quartz-dickite-kaolinite+/-pyropyllite
- Quartz-Alunite
- Quartz-Pyrophyllite +/- Alunite
- Quartz-Diaspore-Pyrophyllite
- Chlorite-sericite
- Chlorite_epidote-regional
- Chlorite-regional
- Illite-Smectite-Unaltered

0.2% Cu shell

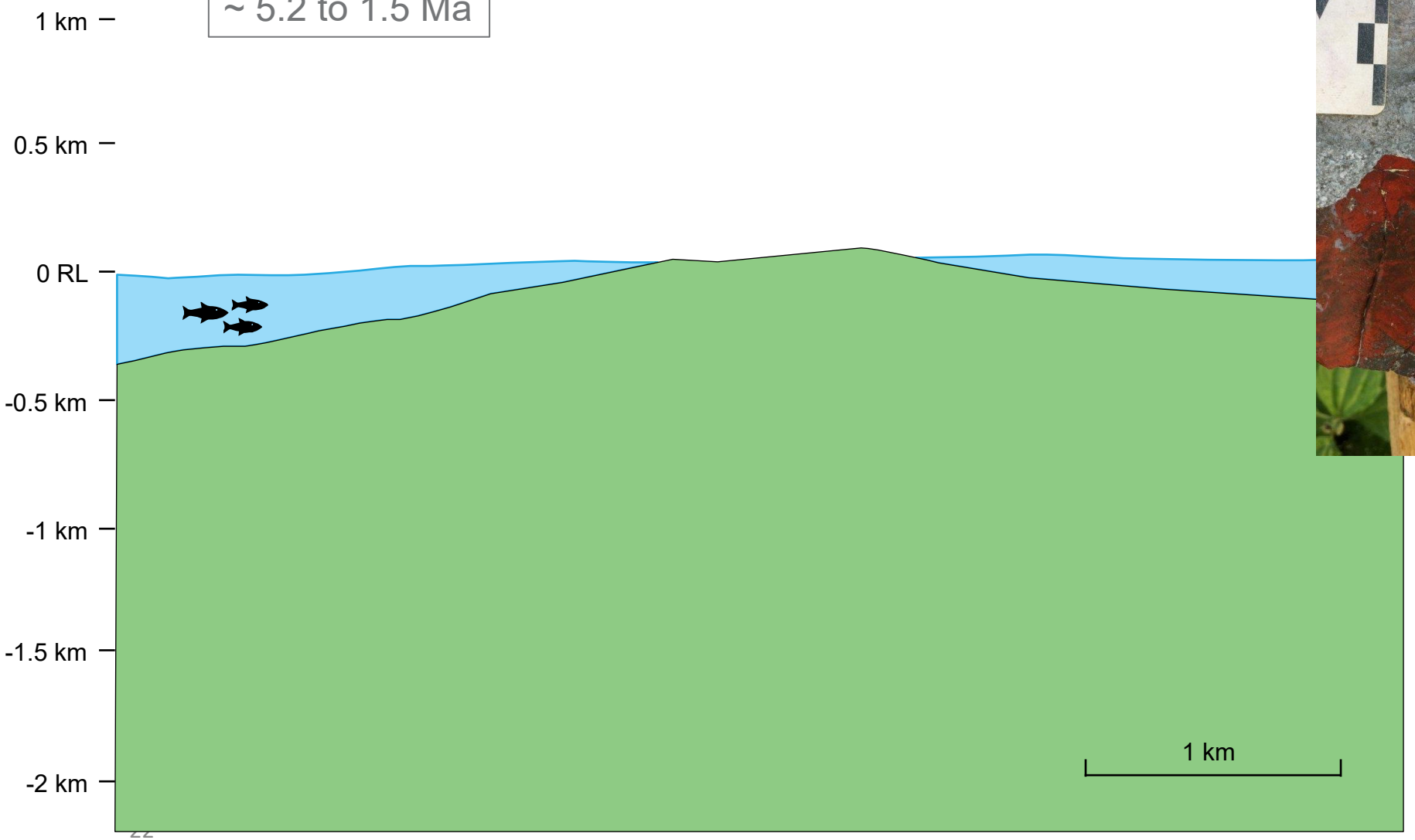
Onto Age
Timing of Mineralization & Alteration

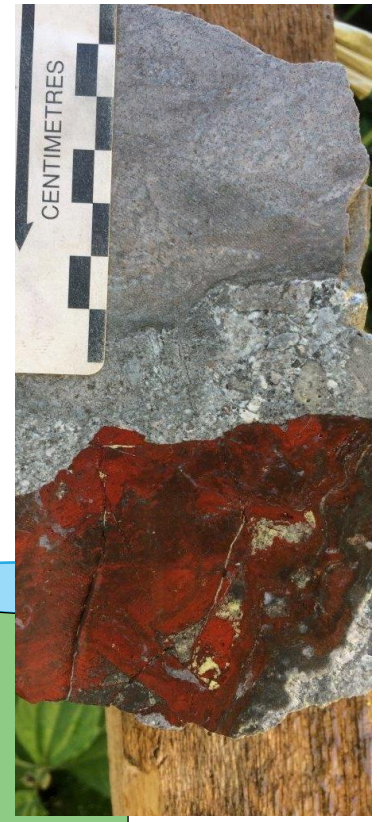
- Capping Andesites: 0.838 ± 0.039 Ma
- Early Porphyry: 0.688 ± 0.053 Ma
- Middle Pleistocene mineralization (~0.4 Ma) with same age of B vein and HS-style pyrite veins, and synchronous with alteration
- Advanced argillic alteration pre-dated diatreme formation and overlapped with porphyry intrusion
  - Resulted in very high sulfidation assemblage (covellite-pyrite) as no rock buffering
- Alunites closely associated with covellite have a younger age range from ~ 0.6 Ma to 38 ky and overlap with Re-Os molybdenite ages
- Alunite dated using Ar-Ar



Geological Development
Early Andesites

~ 5.2 to 1.5 Ma

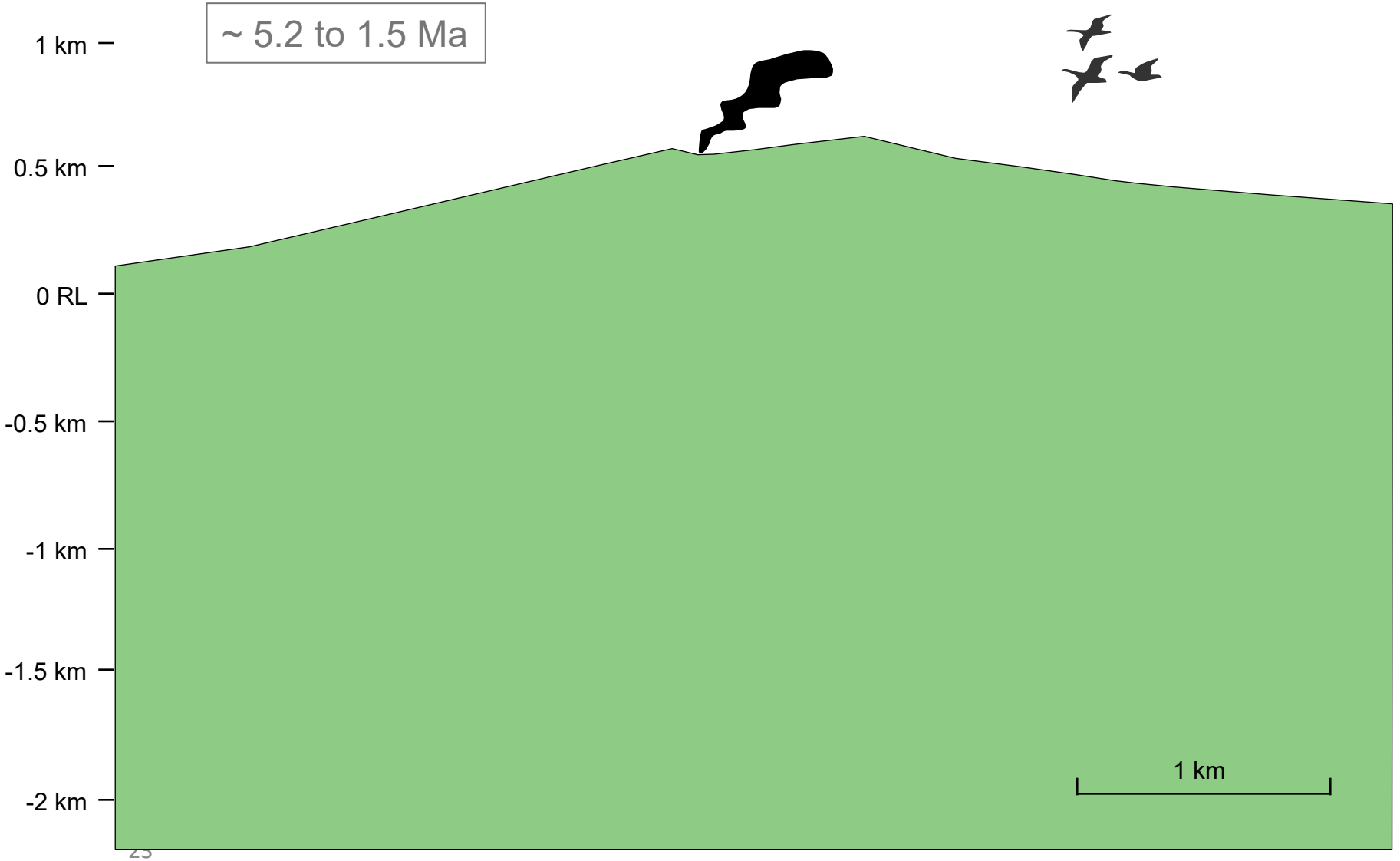




- The Oldest rocks at Onto well bedded sequence of basaltic to andesitic flows.
- Interflow horizons, including bright red cherts, and hyaloclastic textures indicate some submarine deposition.

Geological Development
Early Andesites

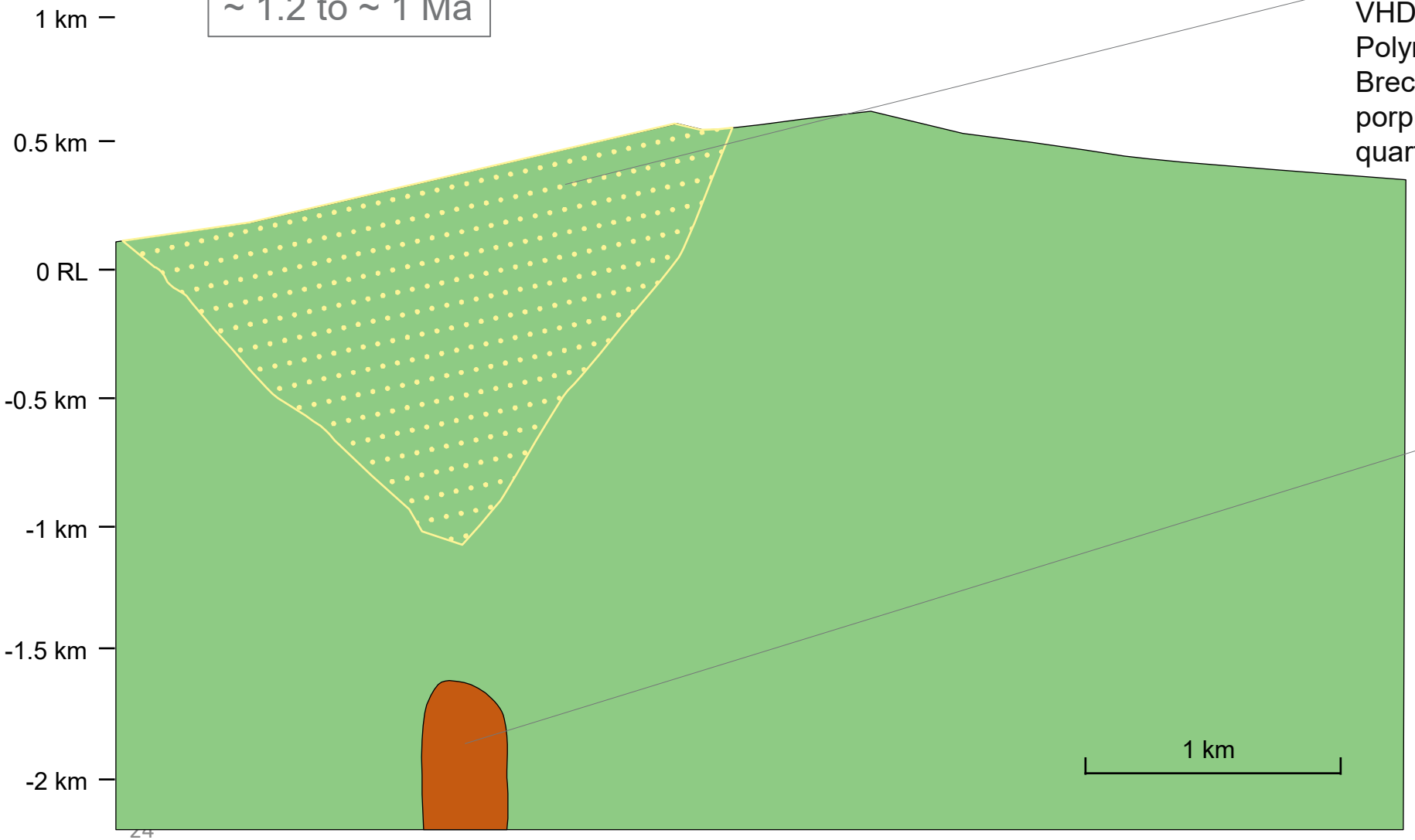
~ 5.2 to 1.5 Ma



- Later probably emergent with mixed massive, plag-phyric and vesicular basaltic andesites to andesite lavas
- Recent K-Ar age dating 4.7 to 1.5Ma

Geological Development
Early Porphyry & Advanced Argillic Alteration

~ 1.2 to ~ 1 Ma

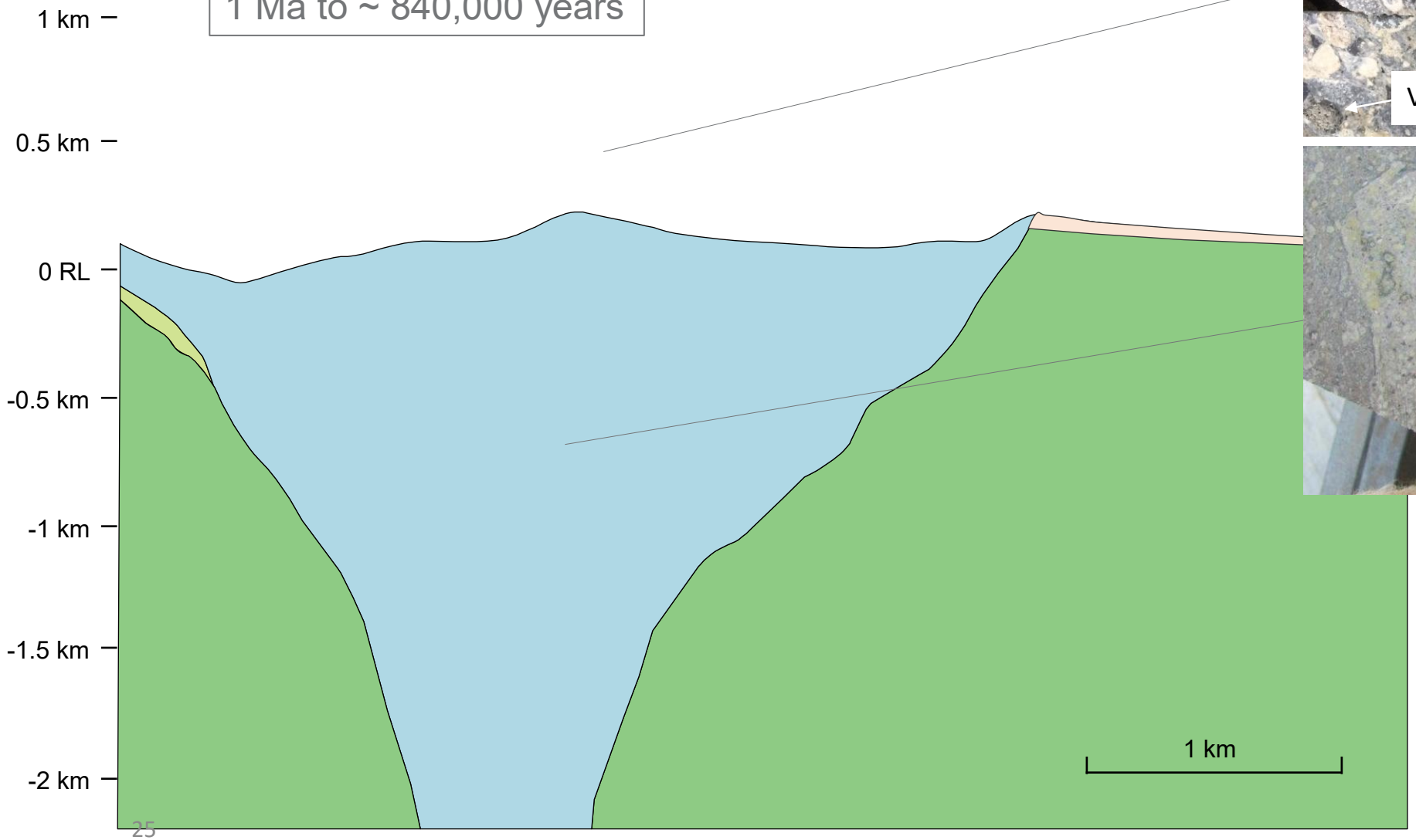


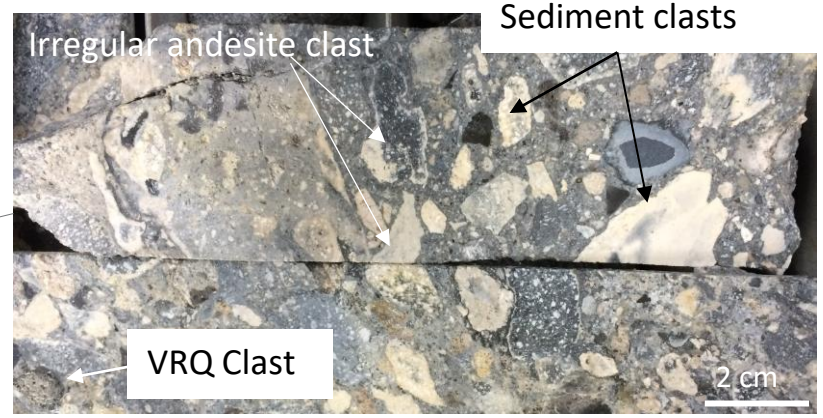
VHD061R 431m
Polymictic Diatreme Breccia with veined porphyry and vuggy quartz fragments

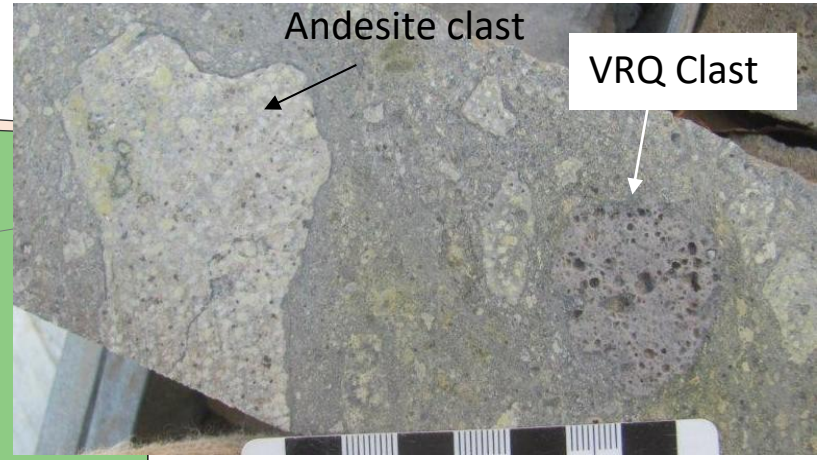
- There was some early porphyry development and lithocap development
- Perhaps aborted by diatreme formation

Geological Development
Diatreme and Pyroclastic tuff ring

1 Ma to ~ 840,000 years



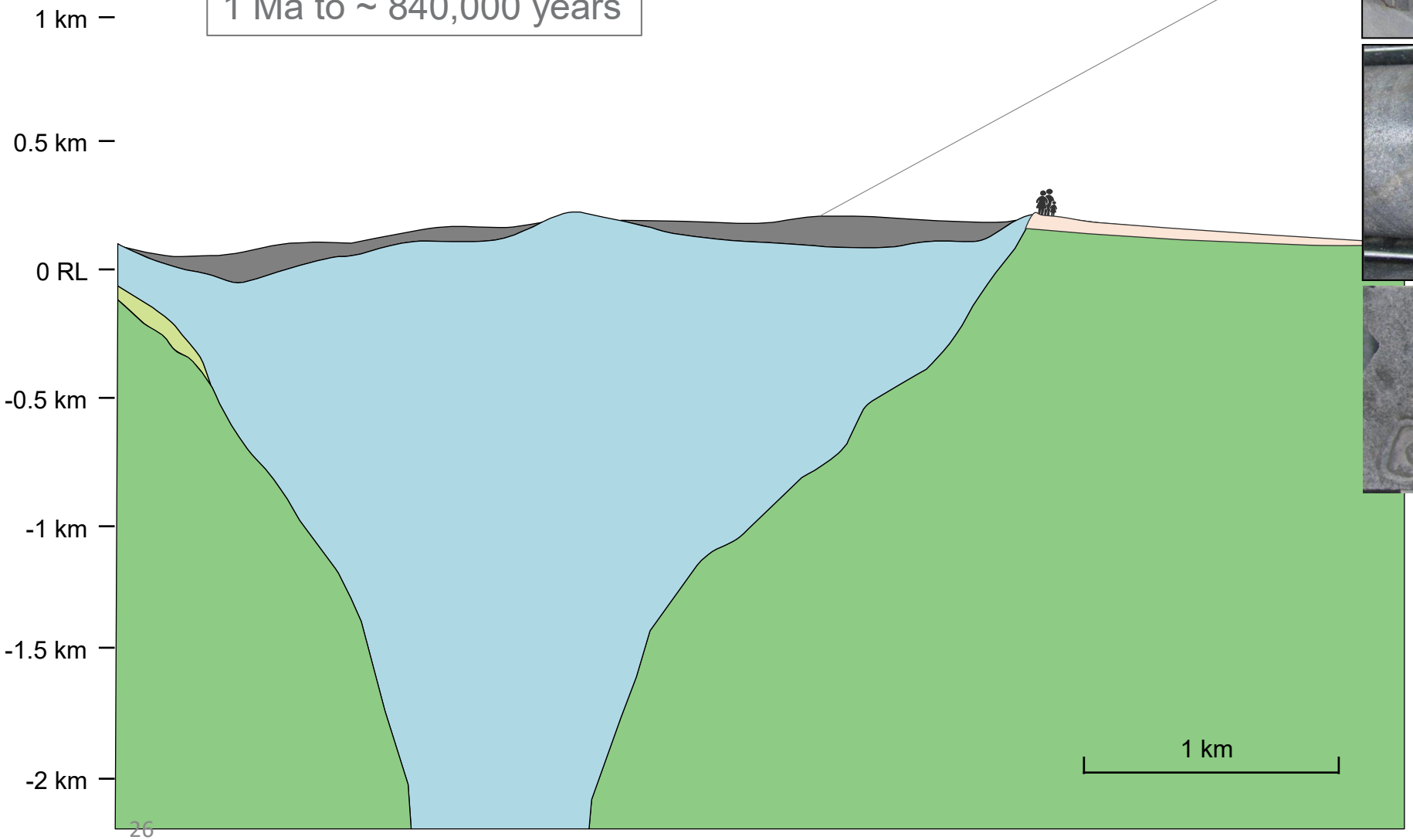


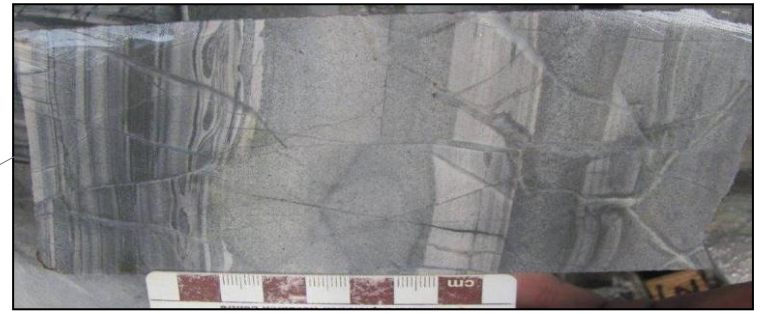


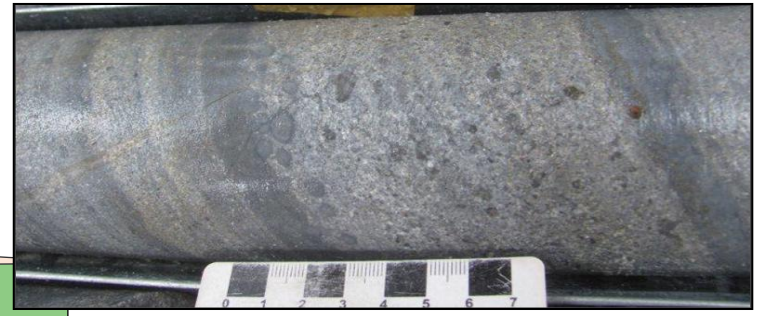
- Major phreatomagmatic eruption with development of a **polymictic breccia filling the diatreme vent**
- Wide variety of clasts including andesite, dacite, sediment, porphyry, VRQ

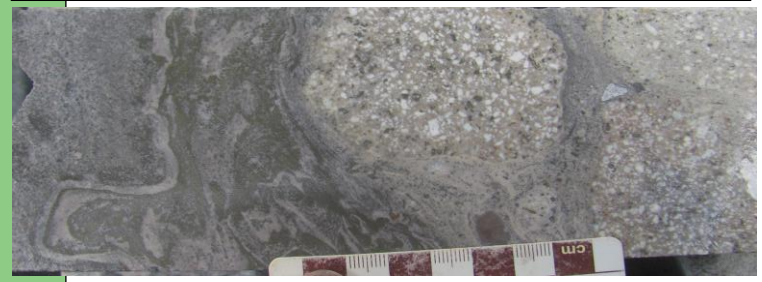
Geological Development
Maar-diatreme lacustrine sediments

1 Ma to ~ 840,000 years



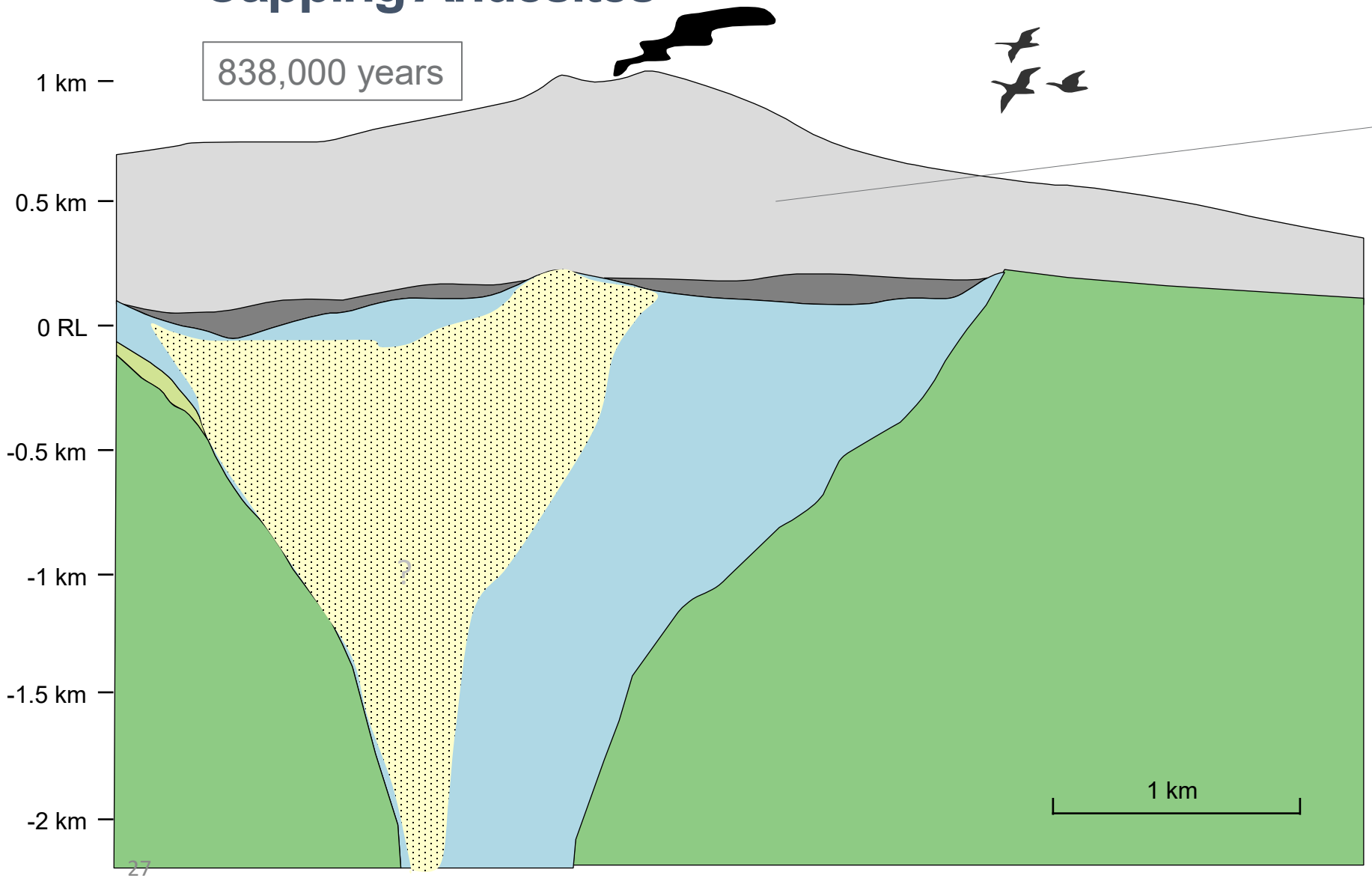


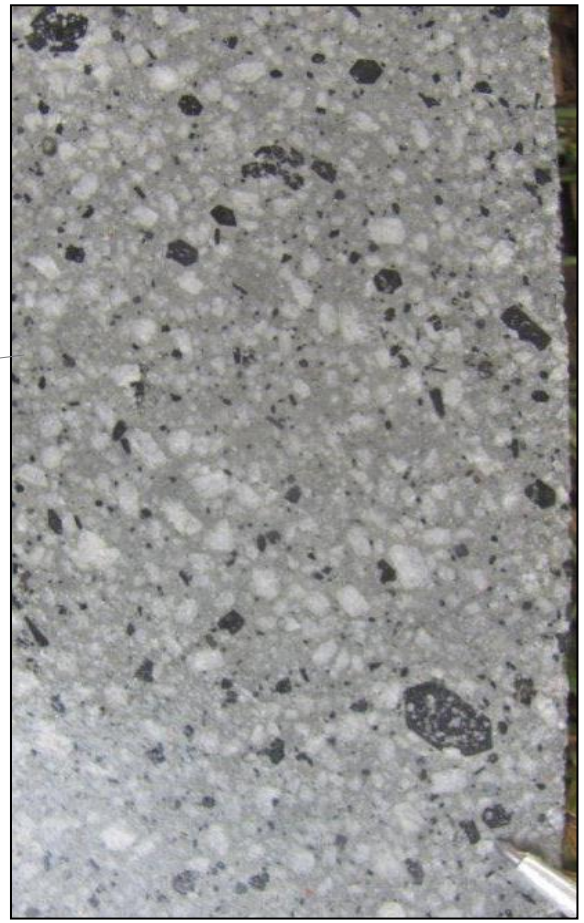




- On top of diatreme a lacustrine maar complex developed with well laminated siltstones up to 100m thick.
- Intercalated with pyroclastic and volcaniclastics

Geological Development
Capping Andesites

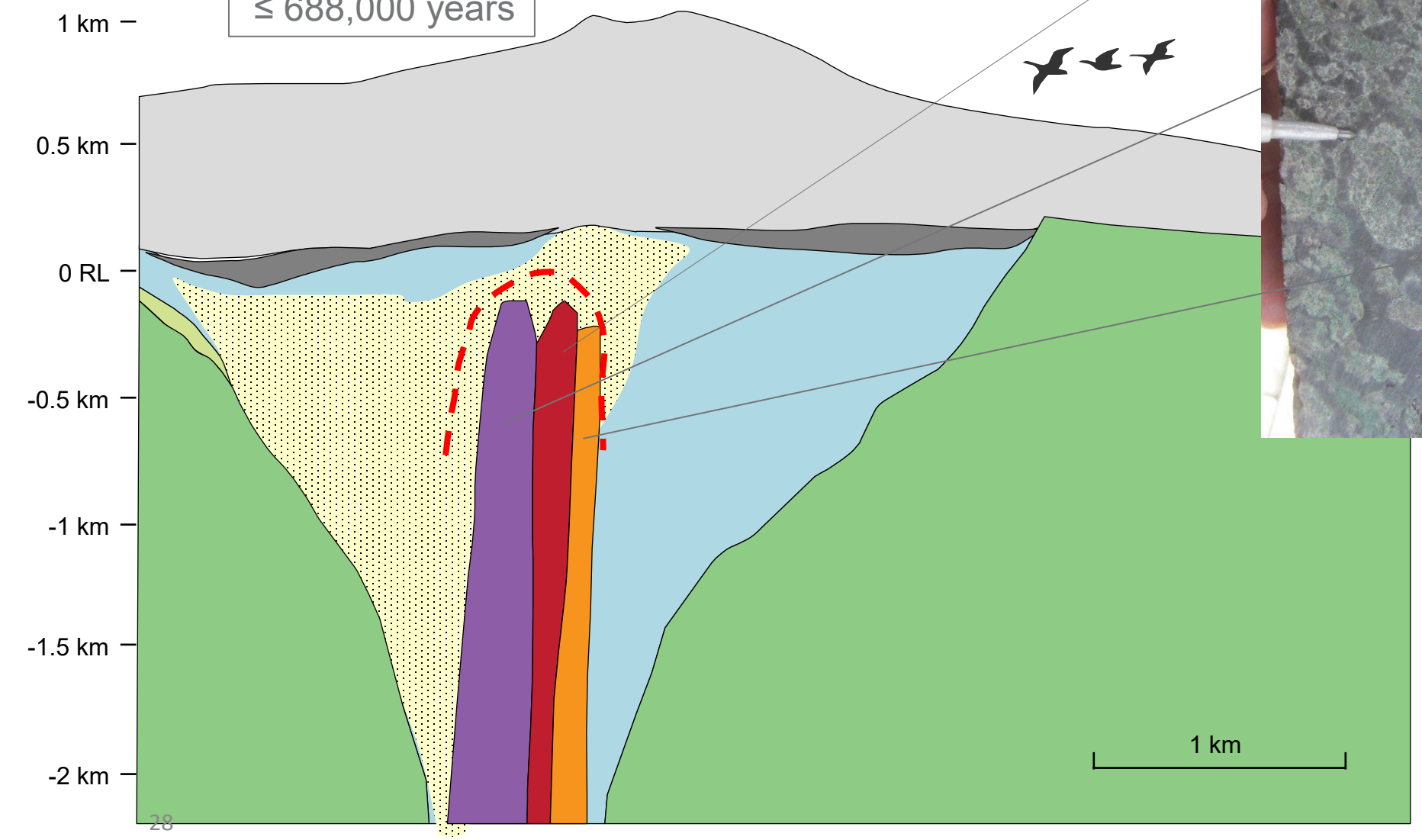




- Maar covered by massive hornblende plagioclase andesites in flows and flow domes.
- AA alteration was already taking place focused in the diatreme breccia

Geological Development
Porphyry Intrusions

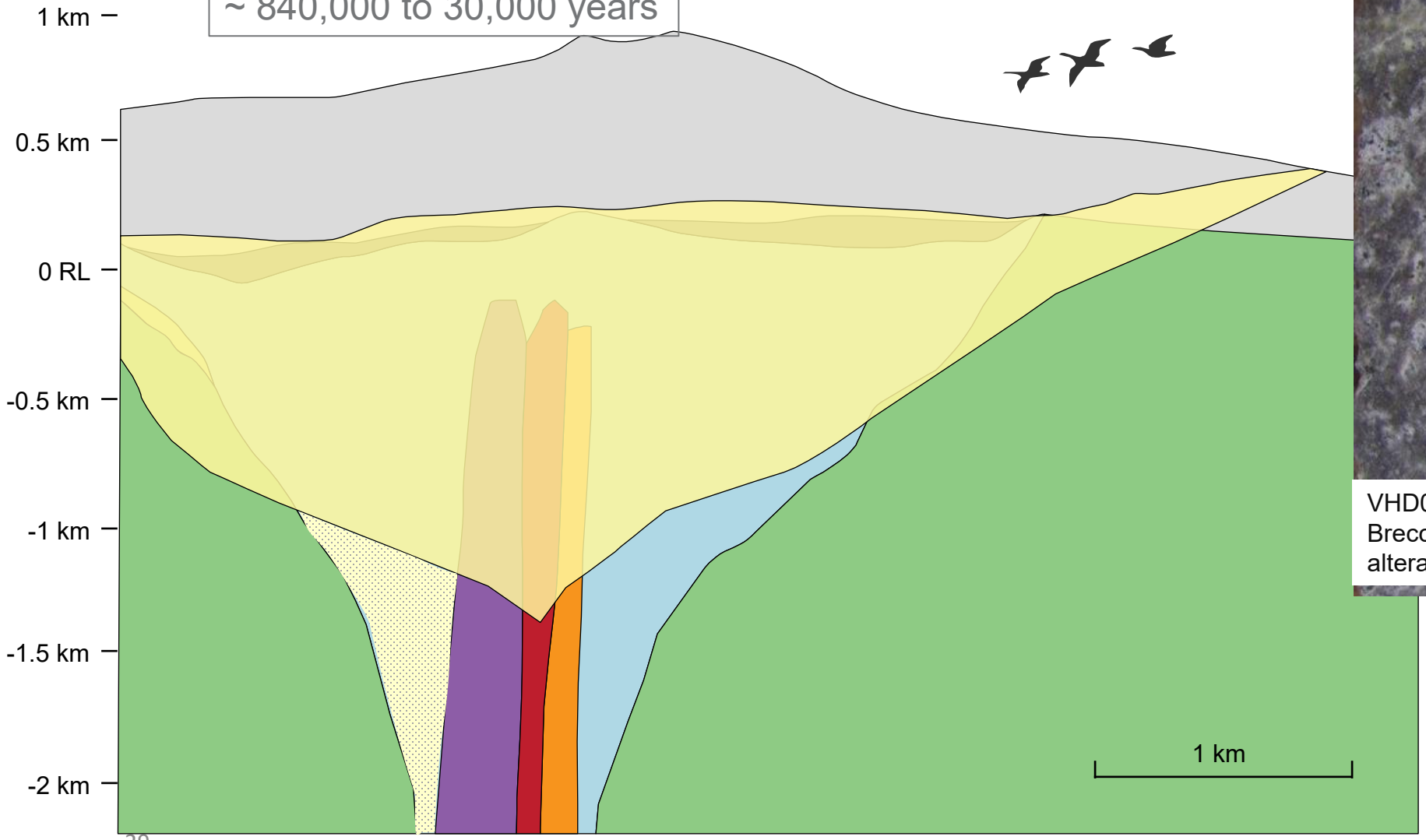
≤ 688,000 years



- The Early and Early Intermineral porphyry stocks generally have a well-developed qtz vein stockwork in the upper portion of the intrusion over a broad footprint
- Early Intermineral Porphyry
- Late Intermineral Porphyry
- Highest grade intrusion at ~1%Cu and 1g/t Au
- Pre-least qtz veining and mineralisation with later phases

Geological Development
Early Advanced Argillic Alteration

~ 840,000 to 30,000 years

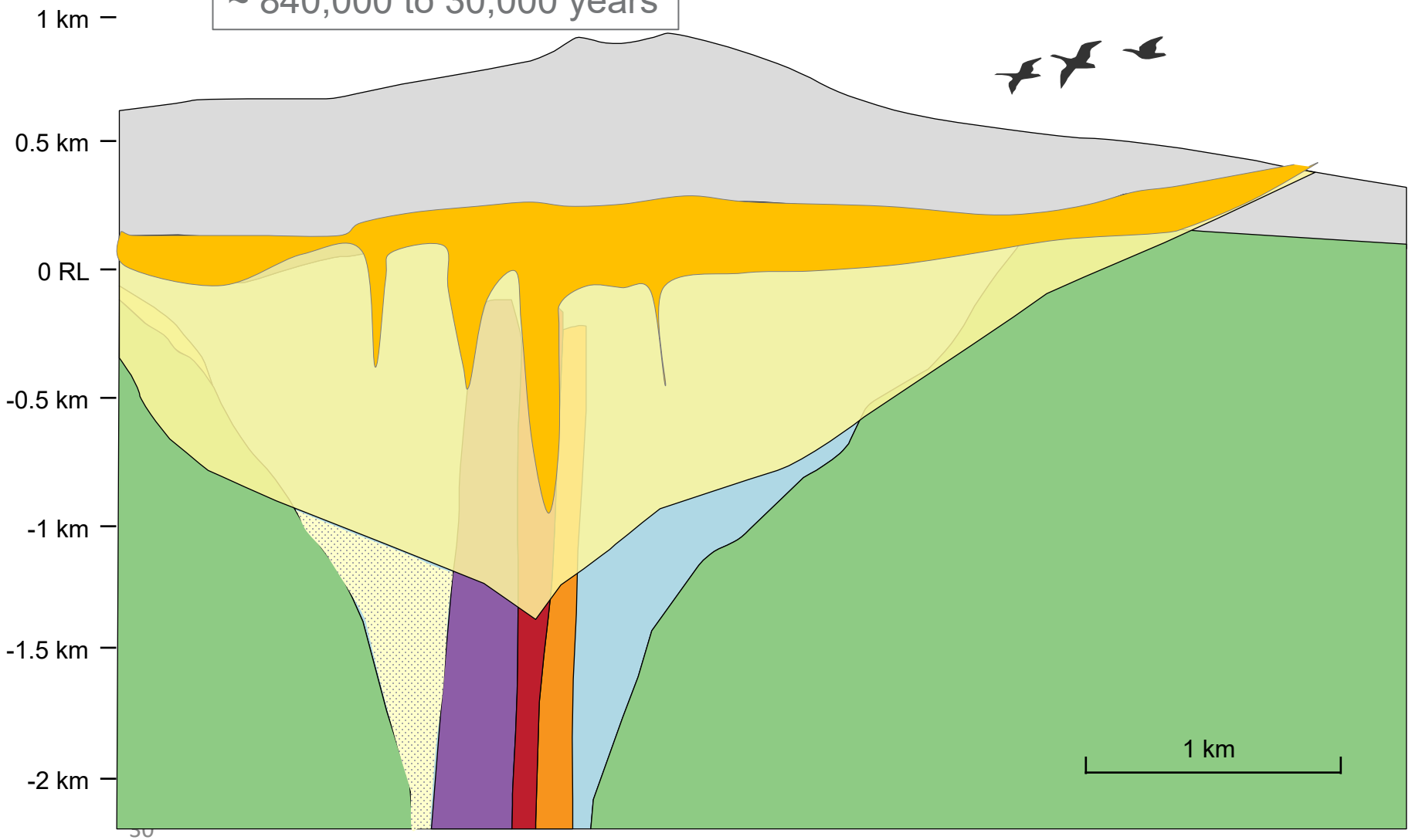


VHD048 at -900m RL, Patchy Texture in Polymictic Breccia (Quartz-diaspore-pyrophyllite-alunite alteration)

- Intense AA alteration continued to develop and extends down more than 1km

Geological Development
Early Advanced Argillic Alteration

~ 840,000 to 30,000 years

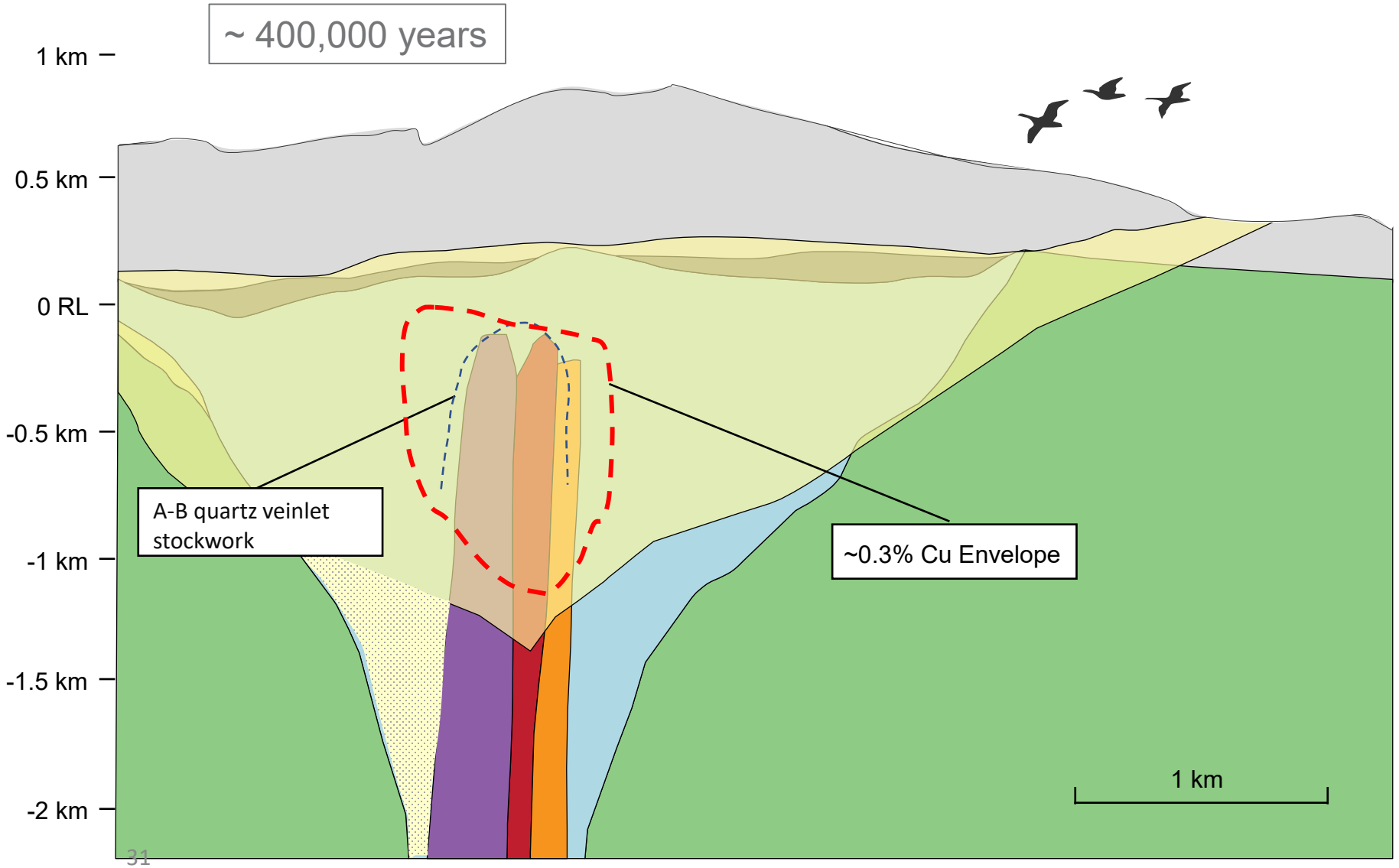


VHD078 at 585m Qu-K-alunite alteration: patchy textures in polymictic breccia

VHD041 at 492m Silicified vuggy residual quartz

- Cooling and increased acidic dissociation resulted in strong leaching and development of vuggy residual quartz alteration (paleo water table)

Geological Development
Mineralization overlapping AA alteration



- The outcome of these processes was the mineralization, as defined by the 0.3 % Cu envelope,
- Forming ~ 400 thousand years ago localized around the porphyry stocks but almost totally contained within intense quartz-alunite-pyrophyllite alteration with all copper occurring as covellite associated with pyrite.

Outline

- Location
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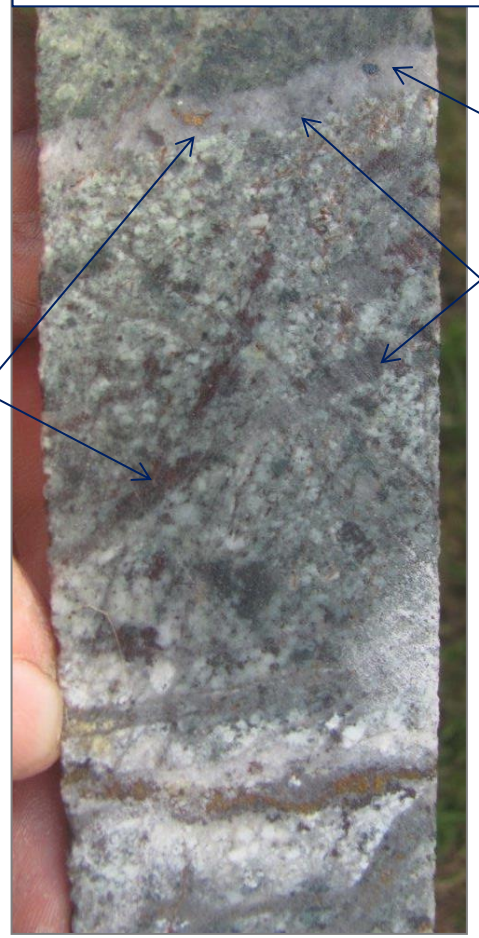
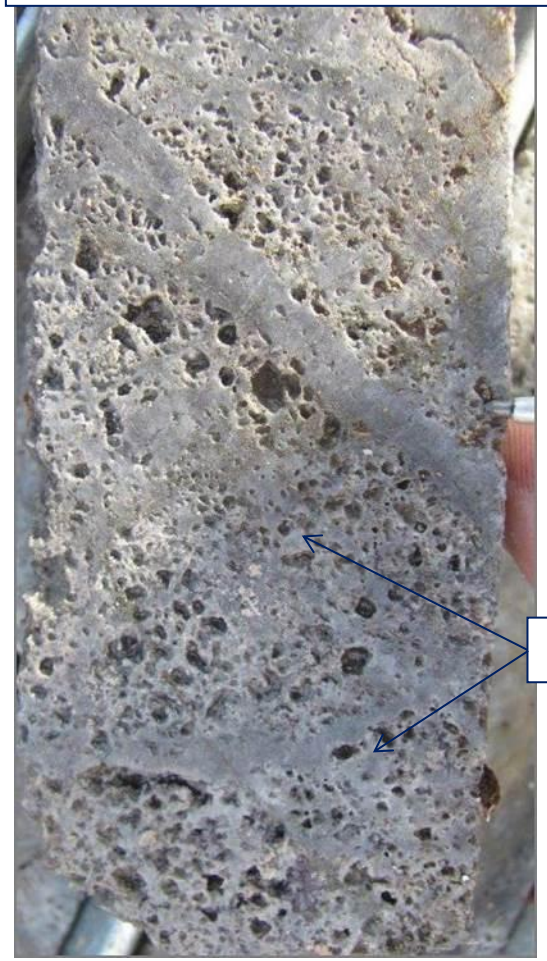
Advanced Argillic Alteration Overprint
Replacement with high sulphidation assemblage

VHD062R 993m: EP 1.2 % Cu, 3.4 g/t Au
Potassic with chloritic overprint



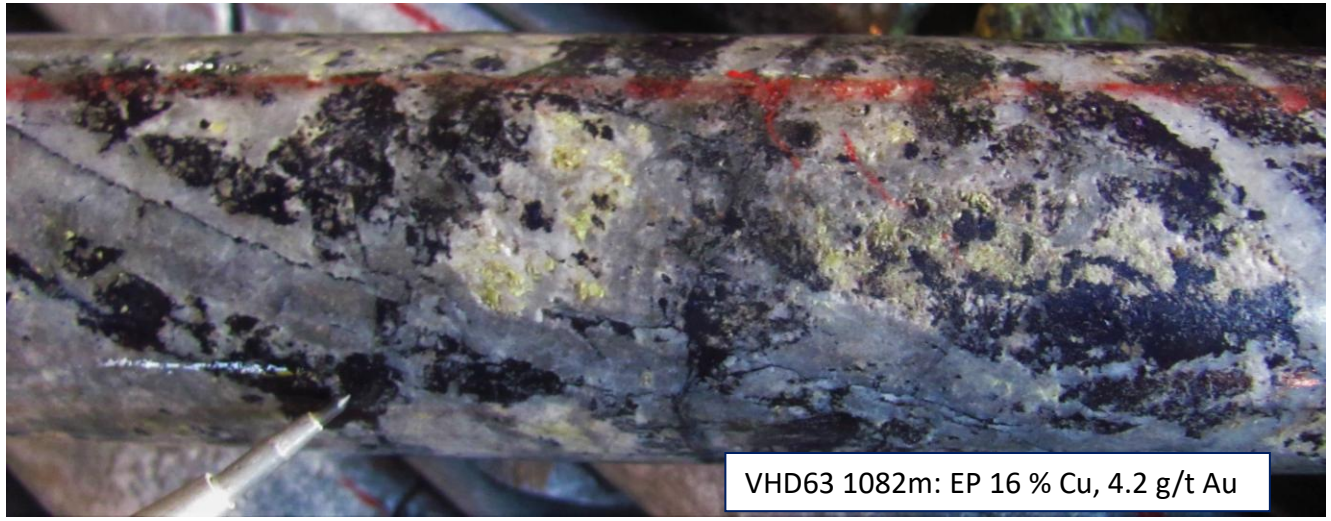
VHD063 1109m: EP 1.8 % Cu, 2.1 g/t Au
Quartz-pyrophyllite-alunite

VHD034 725m: EP 1.6 % Cu, 1.4 g/t Au
Vuggy Residual Quartz

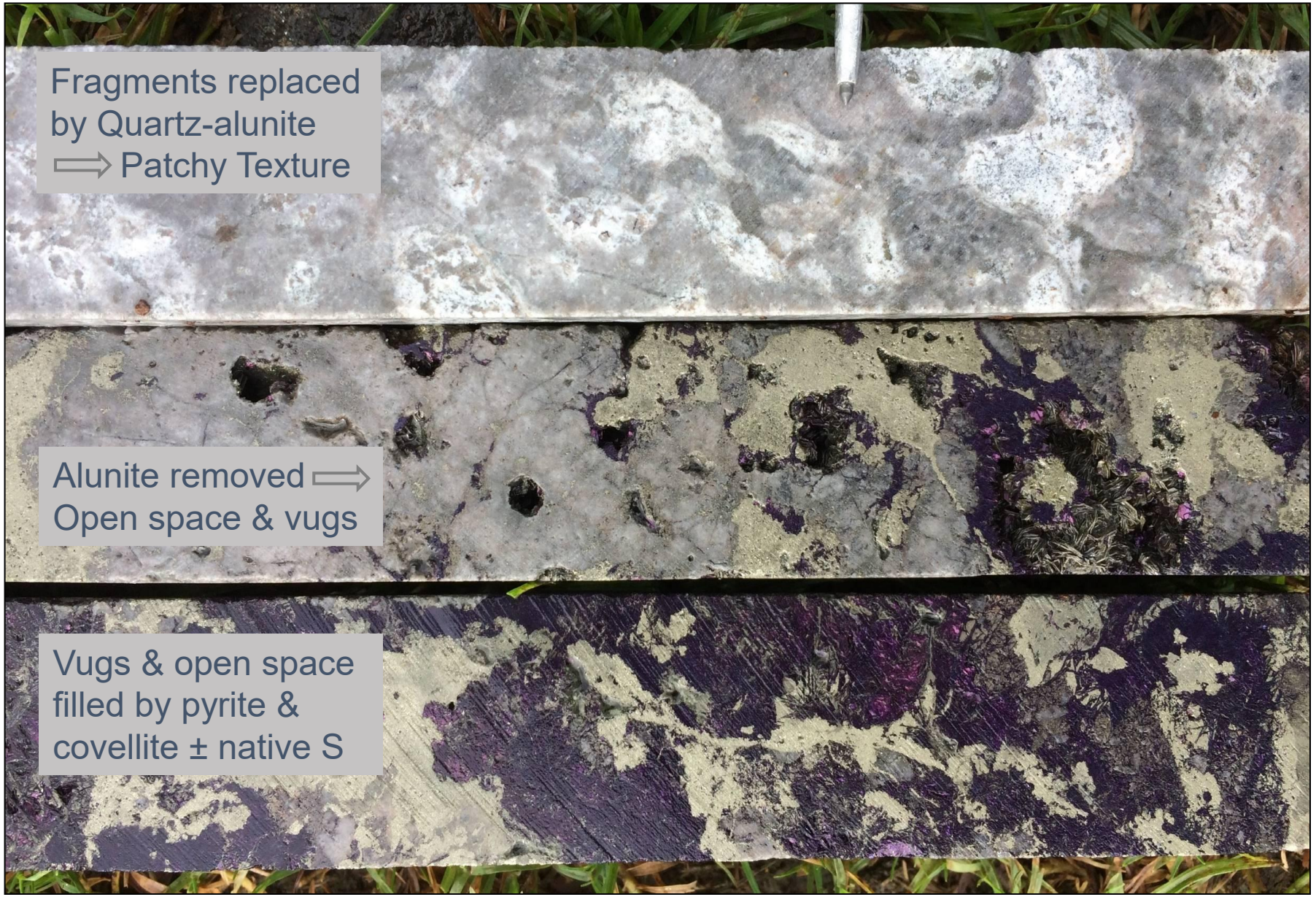


Porphyry-hosted HS Mineralization

- We believe the early porphyry introduced most of the copper and gold but HS process converted all copper minerals to covellite and remobilized.
- Much higher grades (> 10 % Cu, 2-4 g/t Au) locally as covellite ± pyrite and native sulphur
- replaces sulphides within and marginal to veins (including high grade chalcopyrite-bornite mineralization typical of areas with very dense stockworks)
- fills “interstitial” space between quartz veinlet stockwork meshes left after intense leaching of rock resulting in an **up-grade**



High grade mineralization ~ 5 % Cu & 1.5 g / t Au in polymictic breccia



- Mineralizing process in the polymictic breccia
- Fragments in breccia are replaced by quartz-alunite ± pyrophyllite
- Then as fluids become more acidic at lower temperatures, alunite is leached out and the vug space created is filled progressively with pyrite, then covellite.

Onto Cu-Au HS Mineralization
Vug and Open Space Filling often in vuggy residual quartz

VHD 045 1059m: Covellite-pyrite in VRQ
1.7 % Cu, 0.64g/t Au

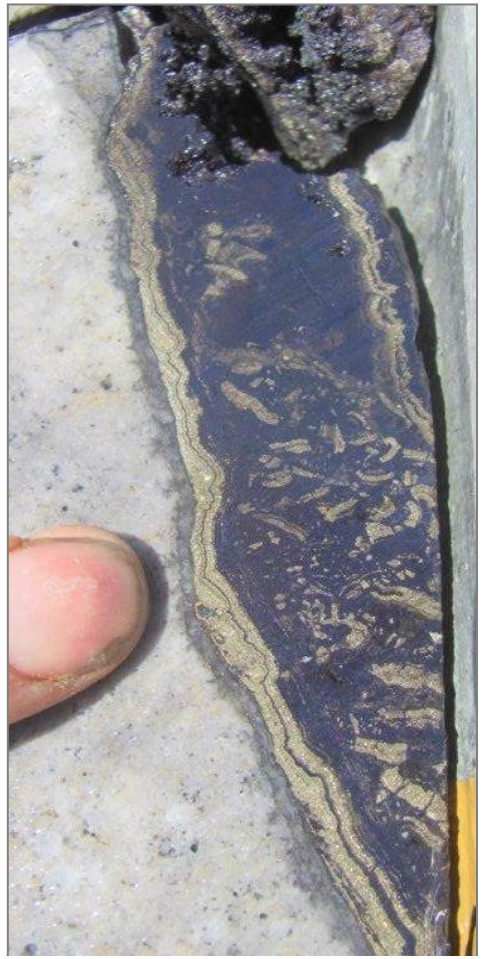
VHD 072 359m: Covellite-pyrite-nukundamite; 29% Cu, 0.07 g/t Au / 1m

VHD089 378m: Covellite-alunite-native sulphur in vug in vuggy quartz

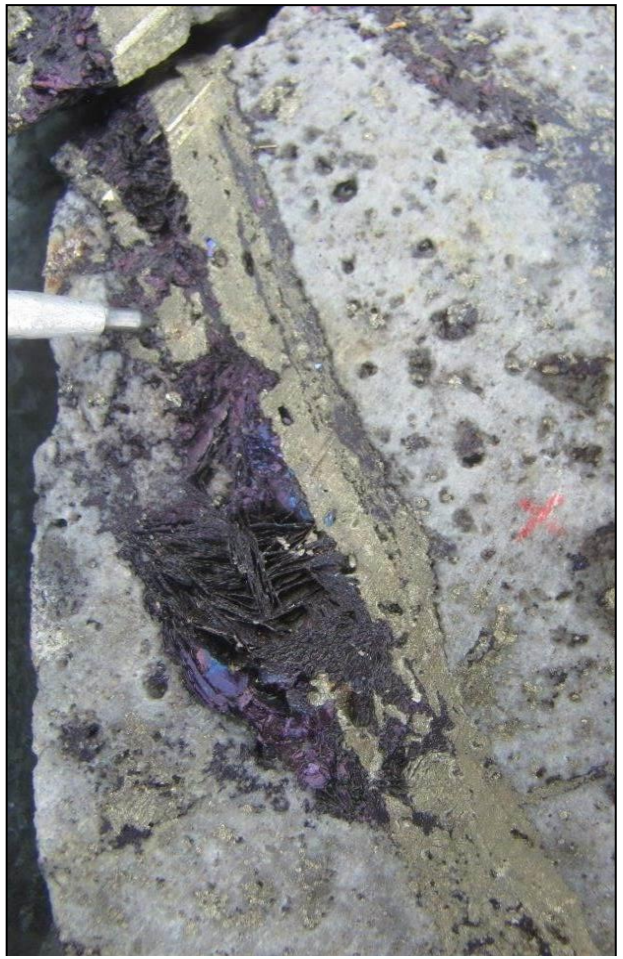
Fine, intricate intergrowths of covellite with alunite dickite and native sulphur indicate low temp. ≤ 200°C

Late HS mineralization
Discrete veins and replacements

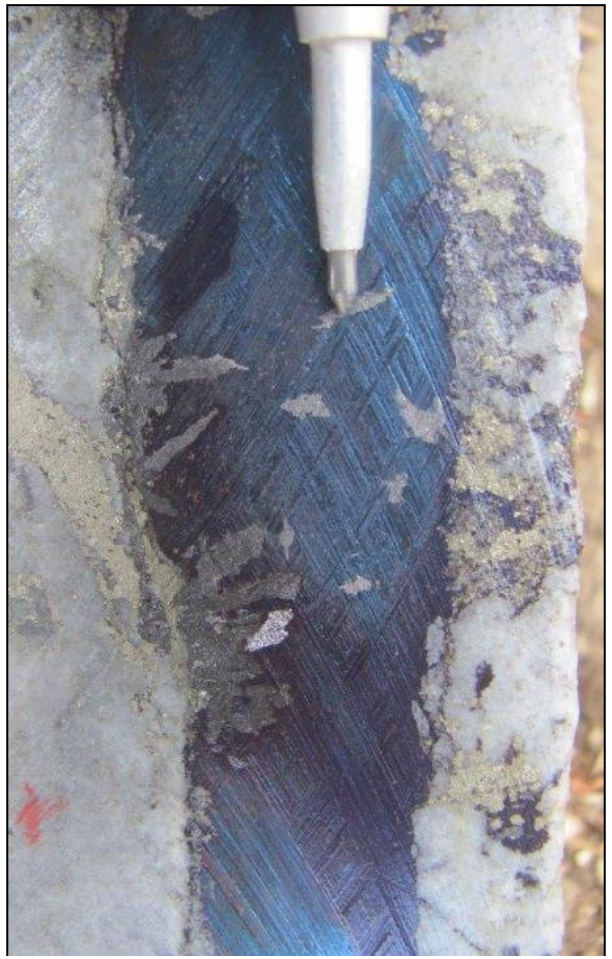
VHD058 426m: Covellite–Pyrite Vein



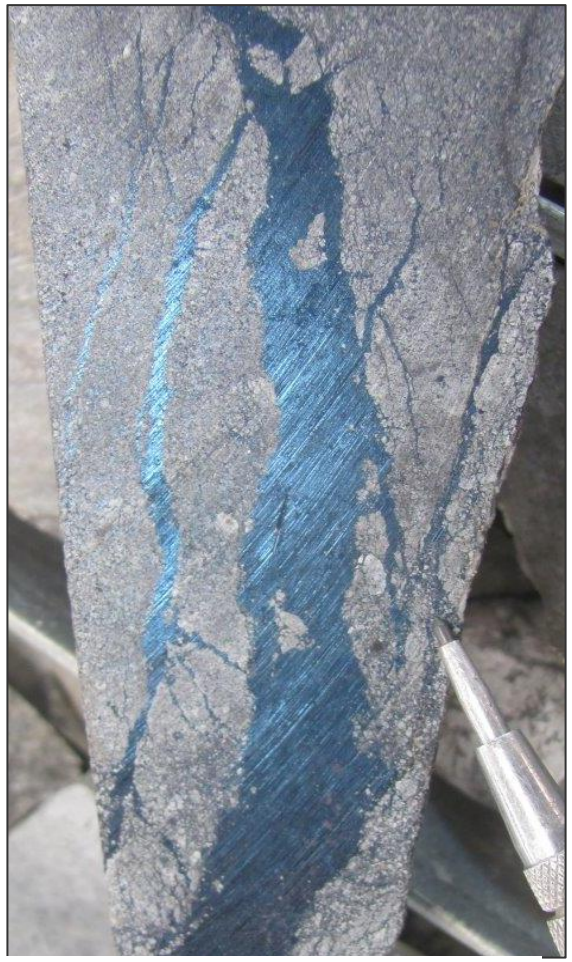
VHD045 1118m: Pyrite-coarse covellite vein



VHD045 1083m: Covellite–Luzonite-Pyrite



VHD042 542m: Covellite–Au^{o}



The final mineralizing event is fracturing and open space filling by pyrite-covellite veins; **occasionally up to half meter wide**, occurring particularly in the polymictic breccia and the late intermineral porphyry

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Historical Geophysics

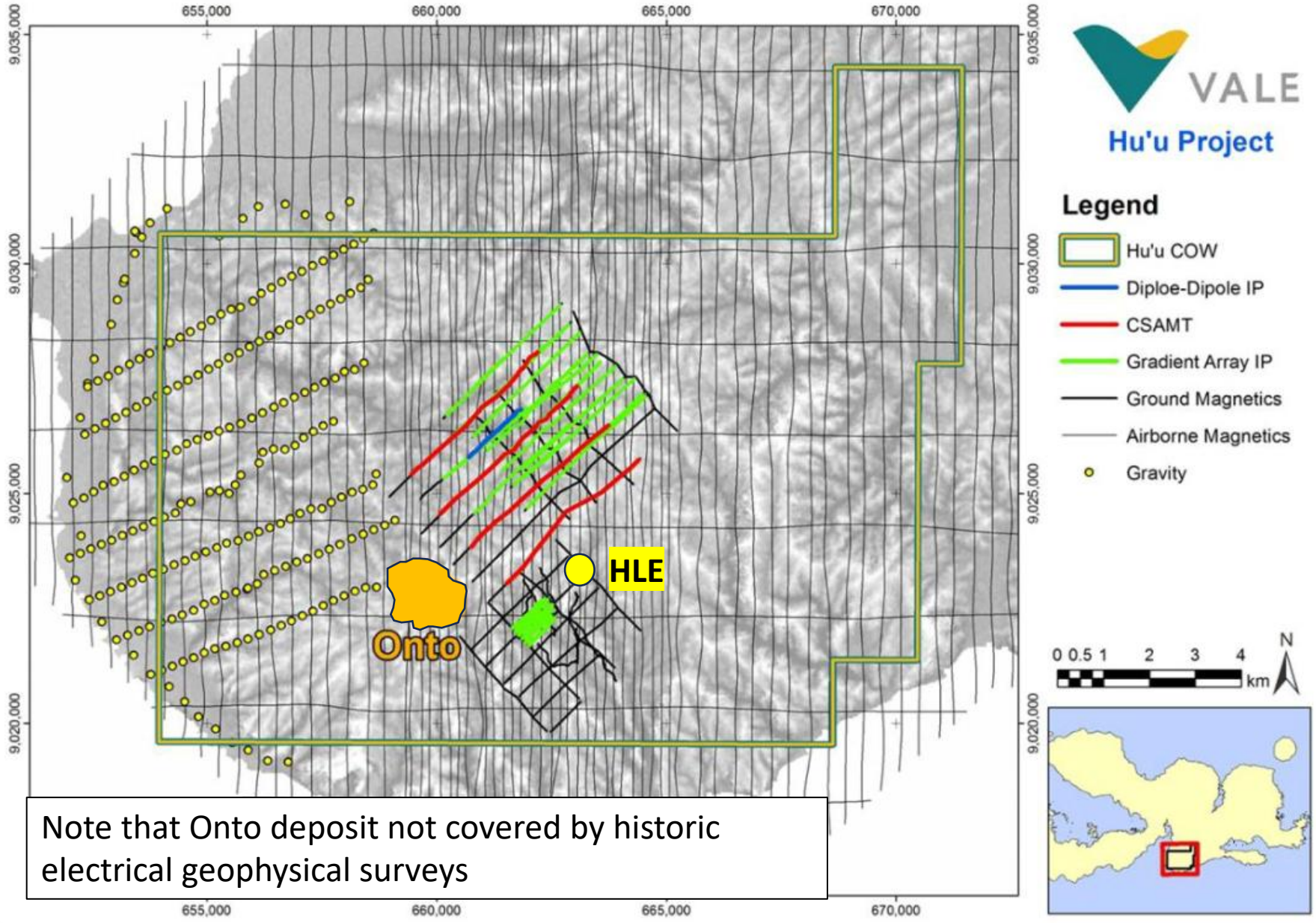
The Hu'u project had been explored in the 1990's and some geophysics undertaken. These data were available to Vale when they commenced exploration.

Ground geophysical data included:

CSAMT
Gradient Array IP
Dipole-Dipole IP
Ground Magnetics

Government gravity data (?)

The fixed-wing airborne magnetic data proved the most useful for initial targeting. 400m line spacing, in filled to 200m across the centre of the project.

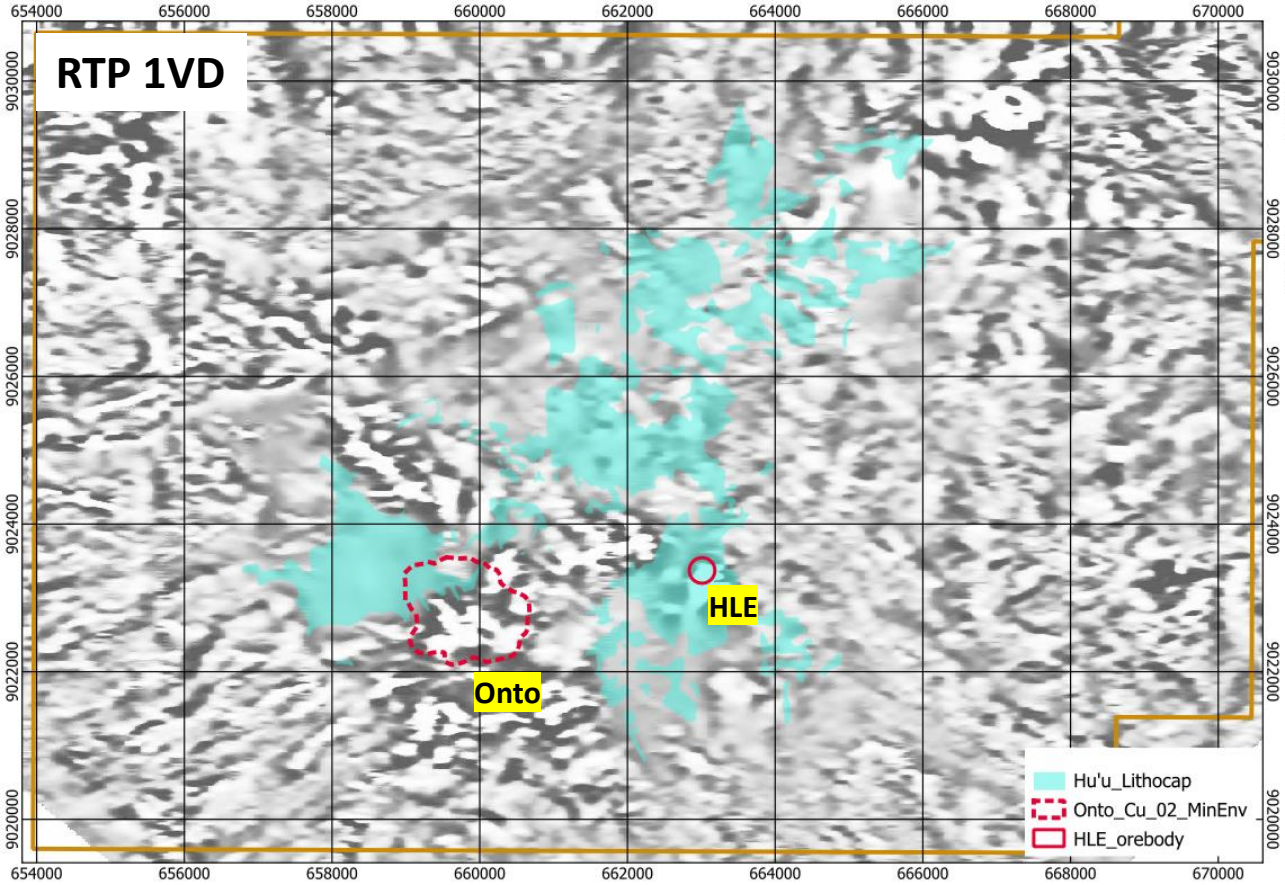


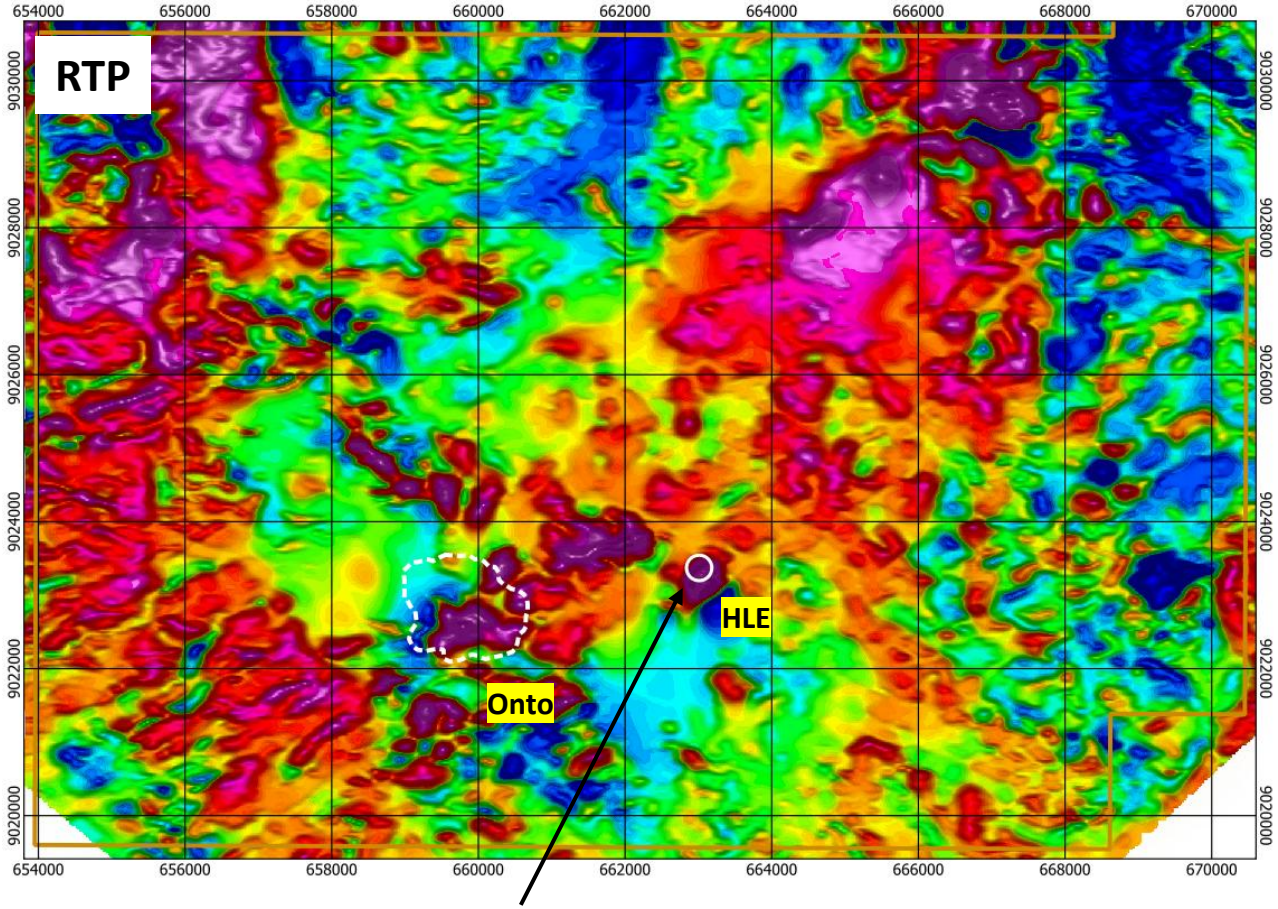
Note that Onto deposit not covered by historic electrical geophysical surveys

Heliborne Magnetics

The project area was re-flown with 100m spaced heliborne magnetic / radiometric data in 2012. This draped survey allowed for improved modelling of targets.

Note the coincidence of mapped lithocap with demagnetized magnetic character in both images.





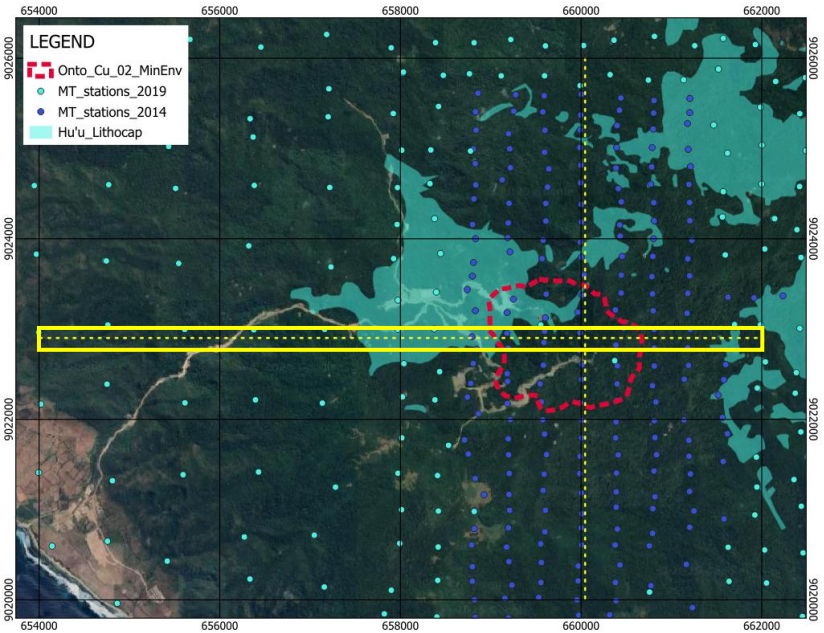
The Humpa Leu East (HLE) deposit was drilled to test a magnetic high with coincident elevated Cu, Au and Mo soil geochemistry.

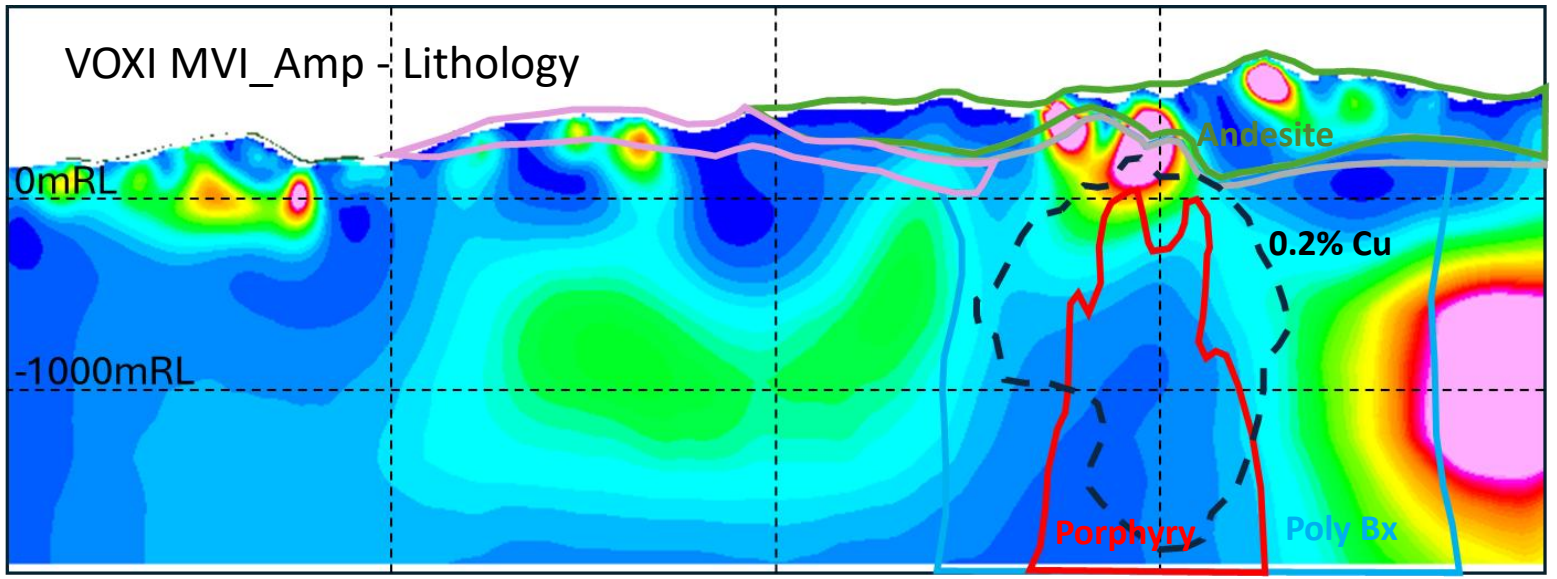
This early success using the classic magnetite bearing potassic Cu-Au porphyry model drove much of the early exploration at the project.

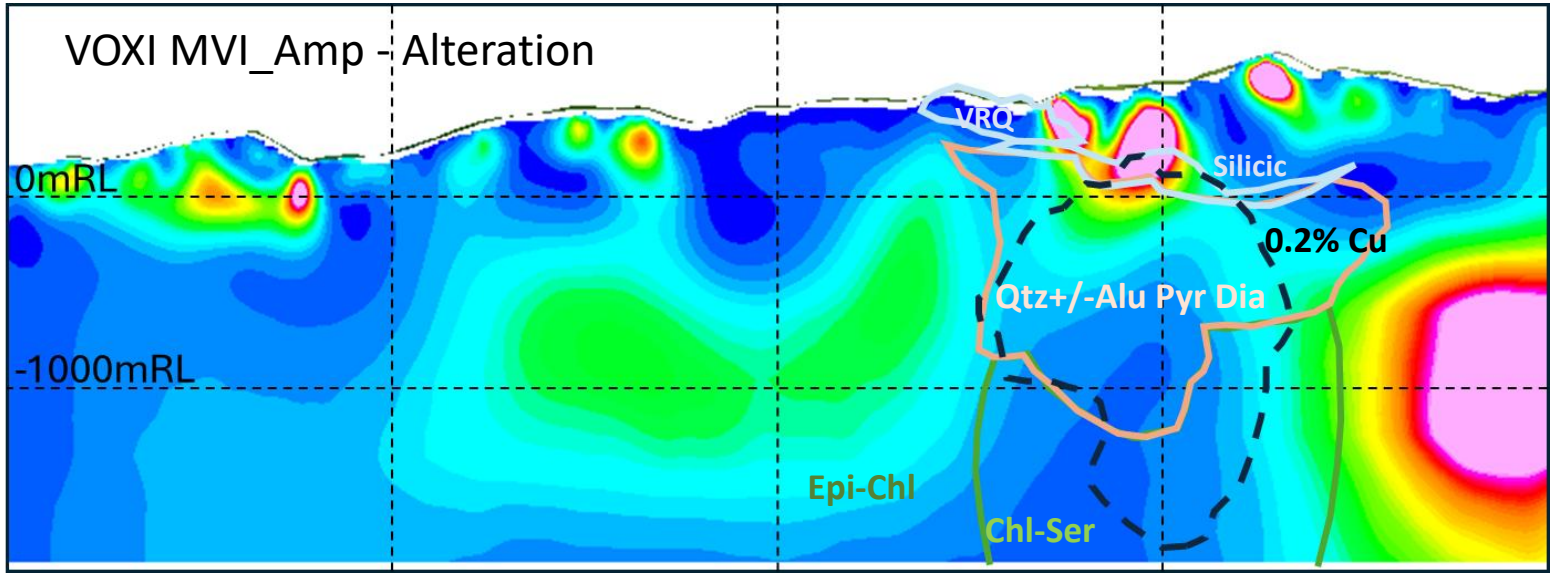
Magnetics – EW Section 3D modelling

Mineralisation and HS alteration correlate with low MVI amplitude.

Capping andesites are variably magnetic and not well resolved by the modelling.







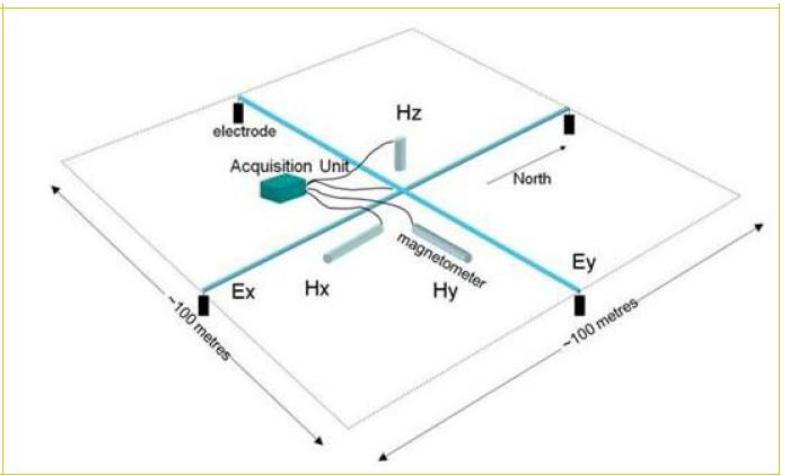
Magnetotellurics

Two phases of full tensor MT survey were undertaken at Onto.

In 2014, shortly after the discovery, an AMT/MT survey was completed over the known extent of the deposit.

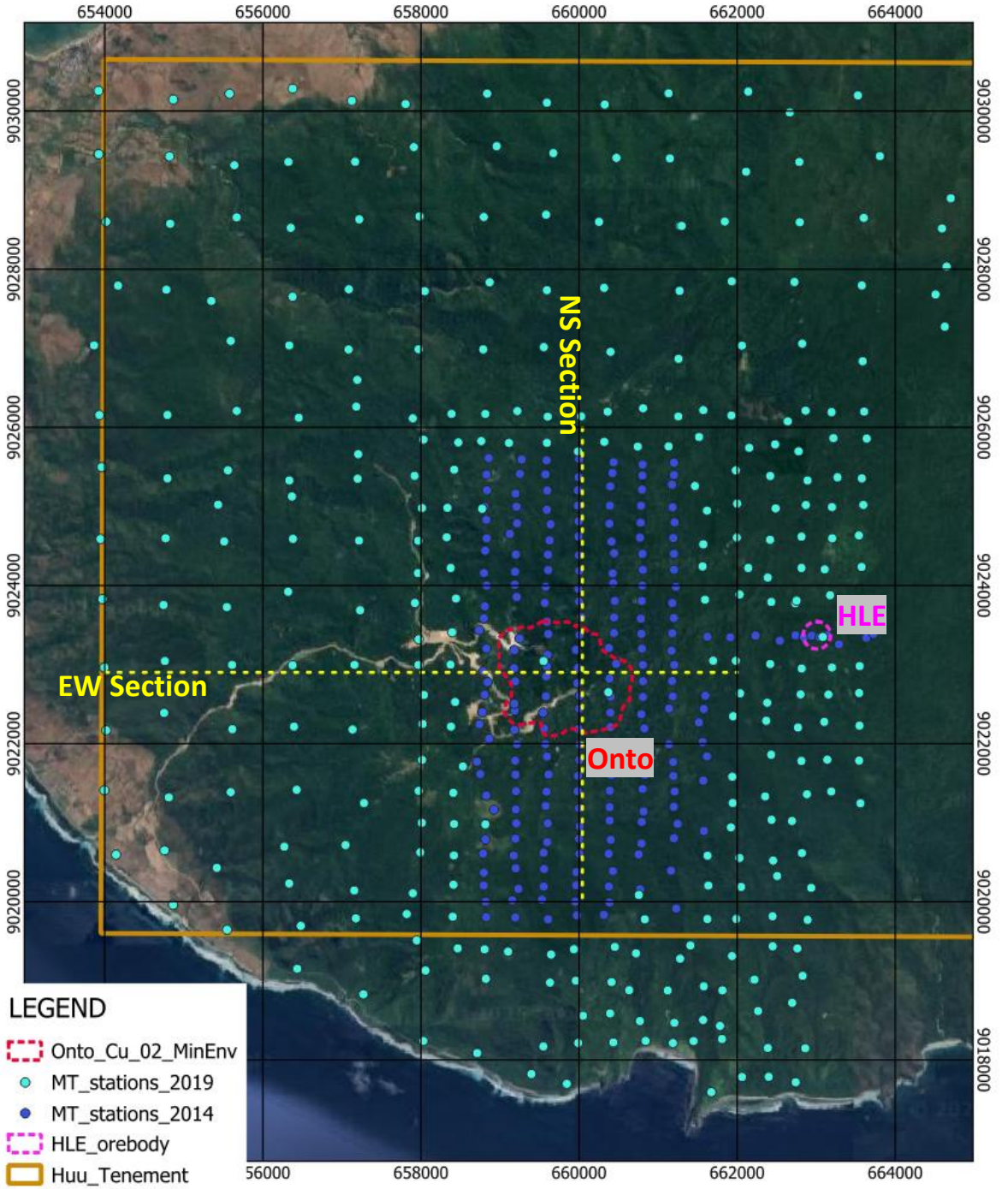
Then in 2019 the coverage was extended across the accessible area of the project.

The MT method was initially selected due to the relative ease of logistics in the difficult jungle terrain with limited access.



2014: 221 AMT/MT stations collected on a 200m x 400m grid with a nominal bandwidth of 0.1 (AMT) and 0.001 (MT) to 10000Hz.

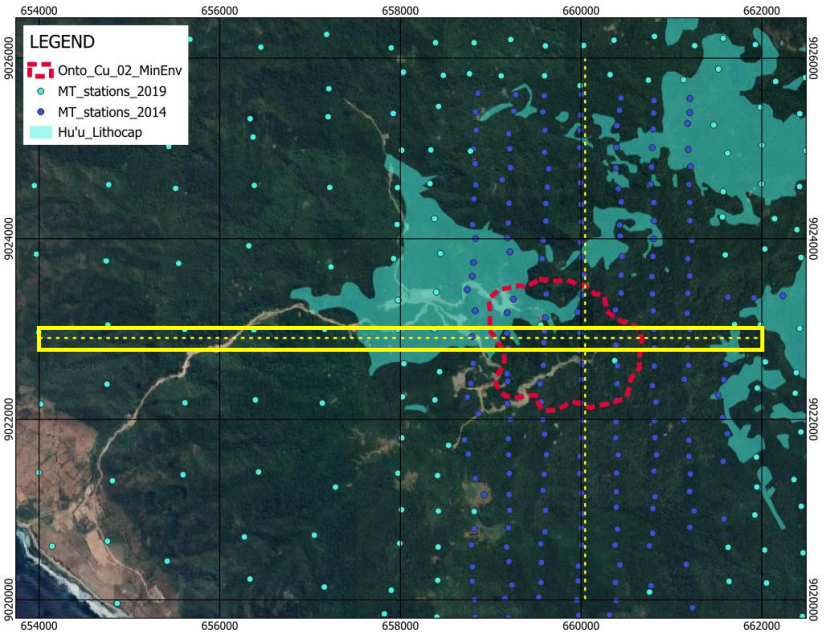
2019: 320 MT stations on 400m x 400m and 800m x 800m grids with a nominal bandwidth of 0.001 to 10000Hz.

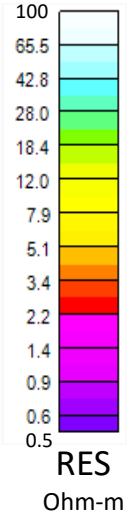


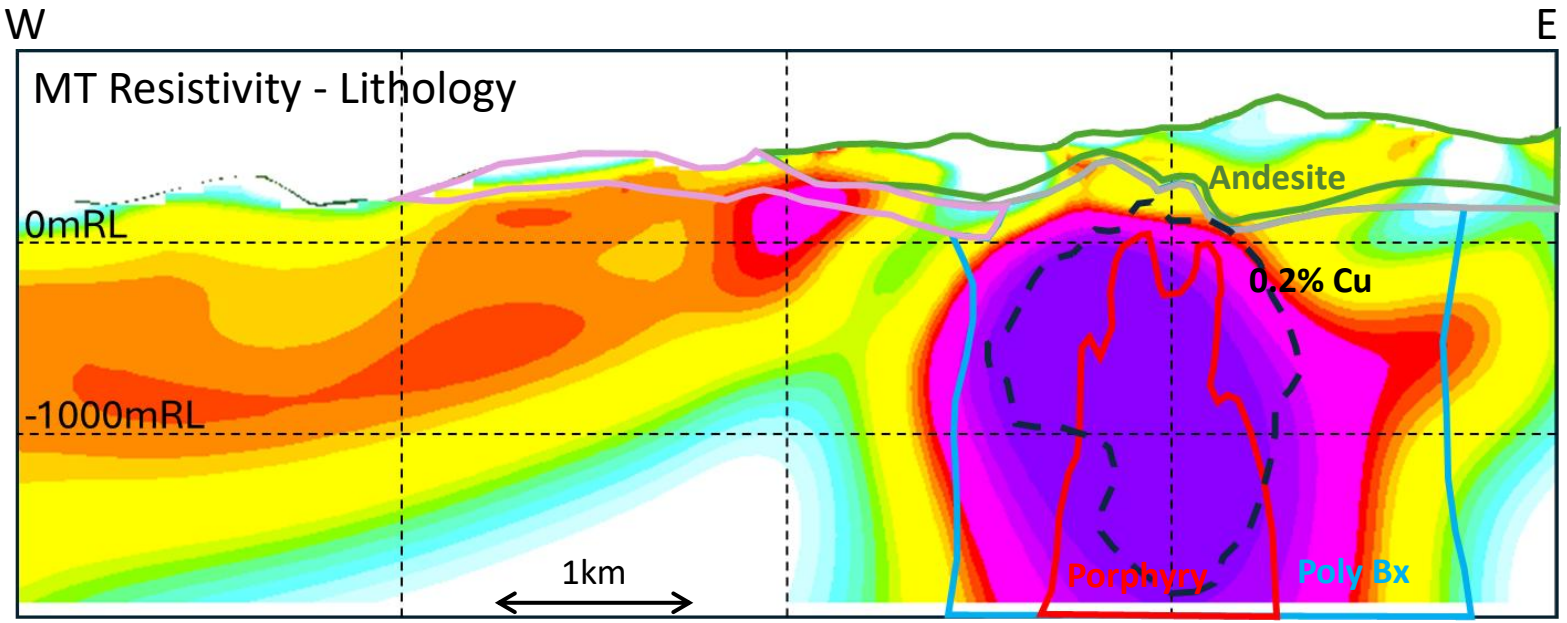
MT – EW Section
3D modelled Resistivity

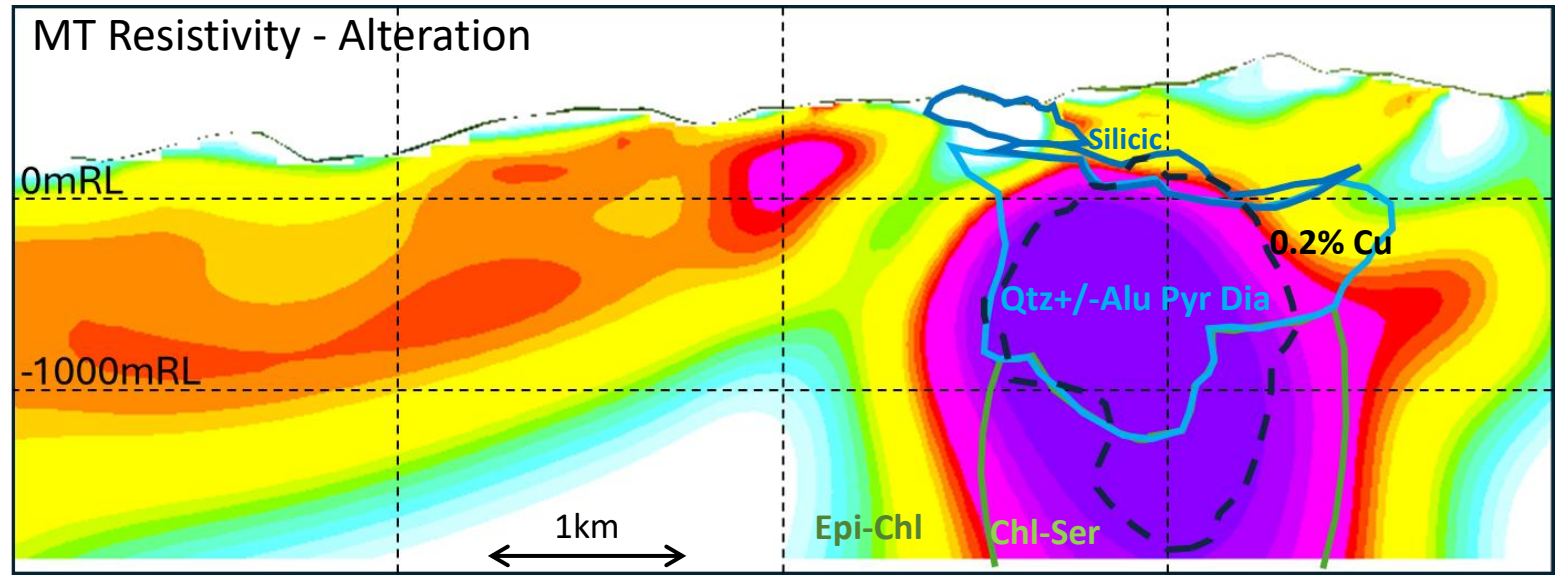
Strong correlation between very low modelled resistivity (<2 Ohm-m) and both logged porphyry intrusives and mineralization. Very low resistivity confined with the diatreme (polymictic breccia).

Also, a good correlation with the High Sulphidation alteration.







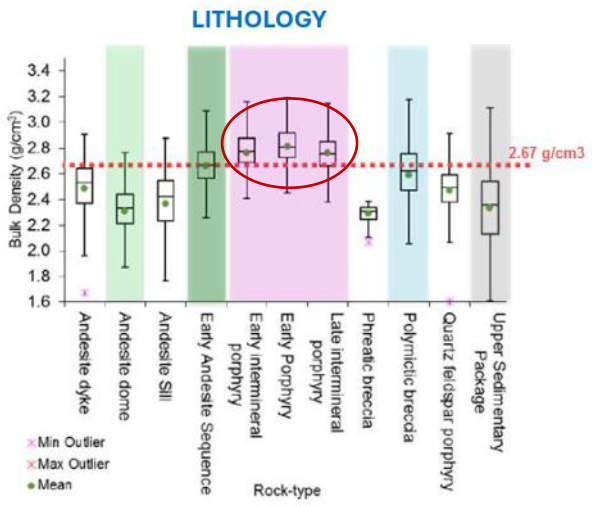


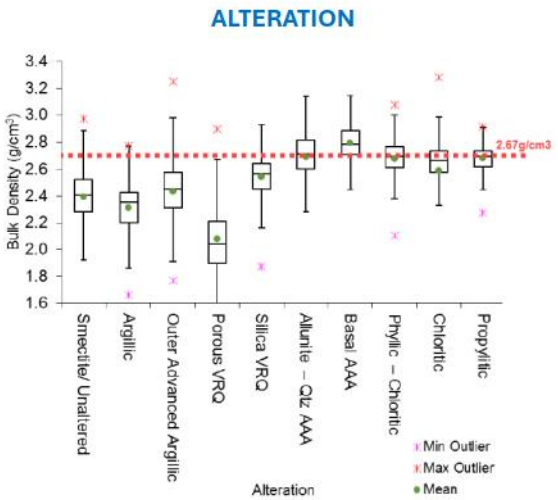
Gravity

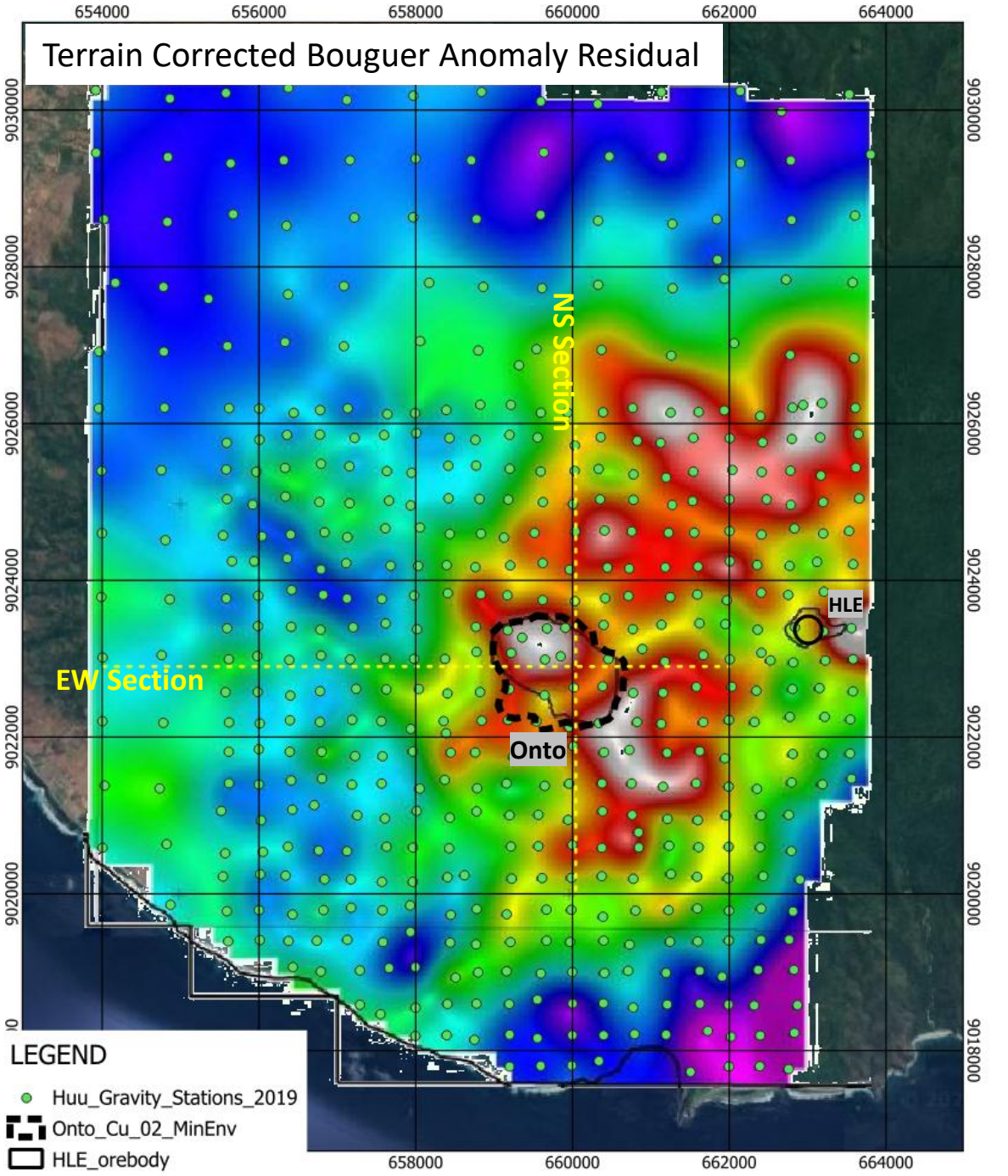
In conjunction with the 2019 MT survey a gravity survey was also undertaken.

The area around the deposit was surveyed using 400m x 400m spaced stations. And then extended towards the north and west with 800m x 800m stations. Good quality data considering the difficult terrain.

Bulk Density measurements taken for resource calculations show the porphyry phases where most of the mineralisation occurs are highest. 2.77g/cm^3 used for resource calculation.





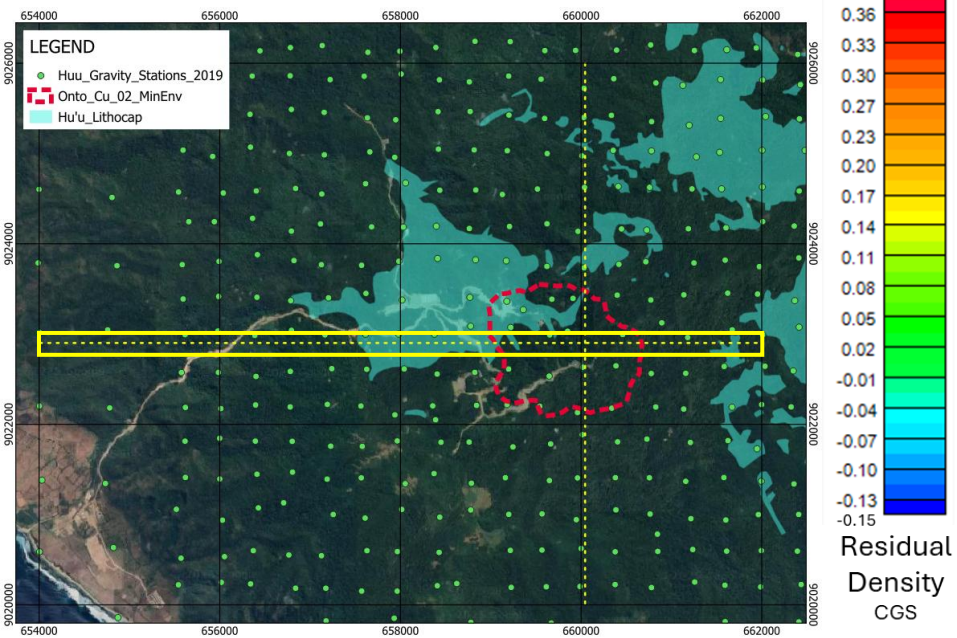


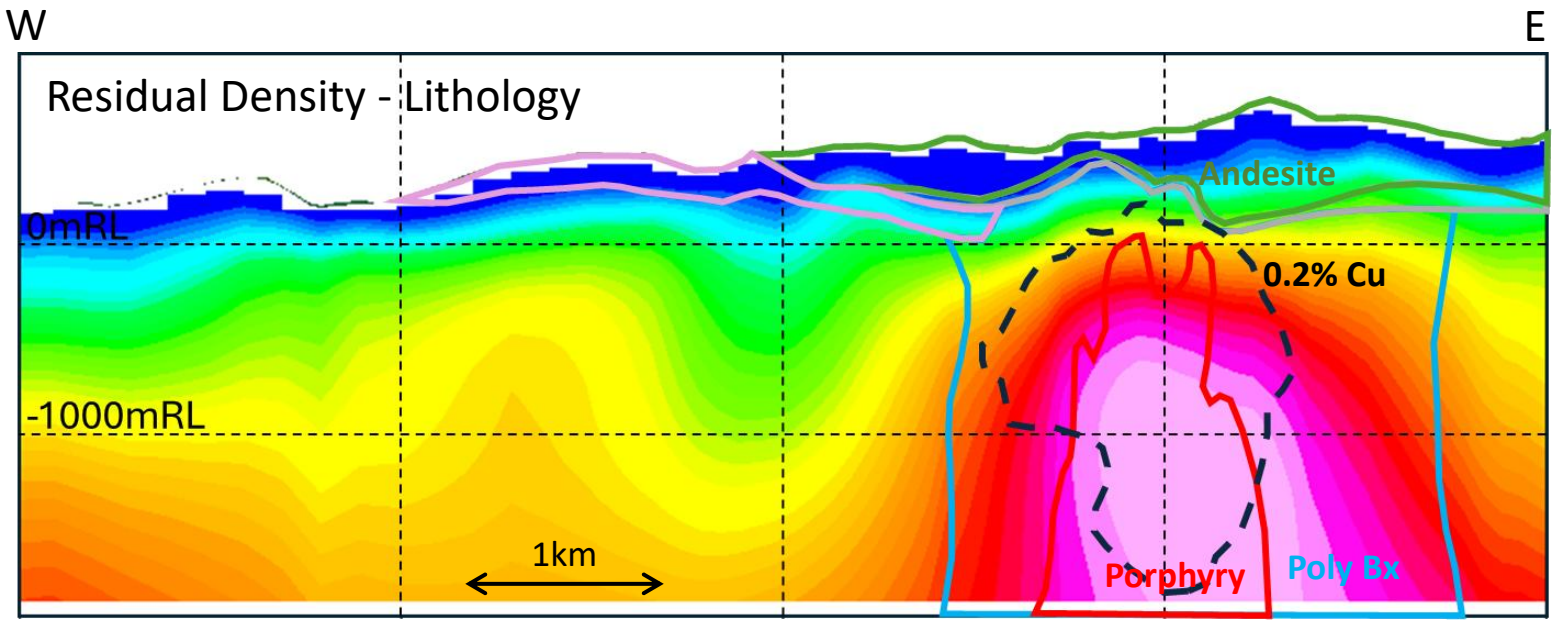
Gravity – EW Section
3D modelled Density

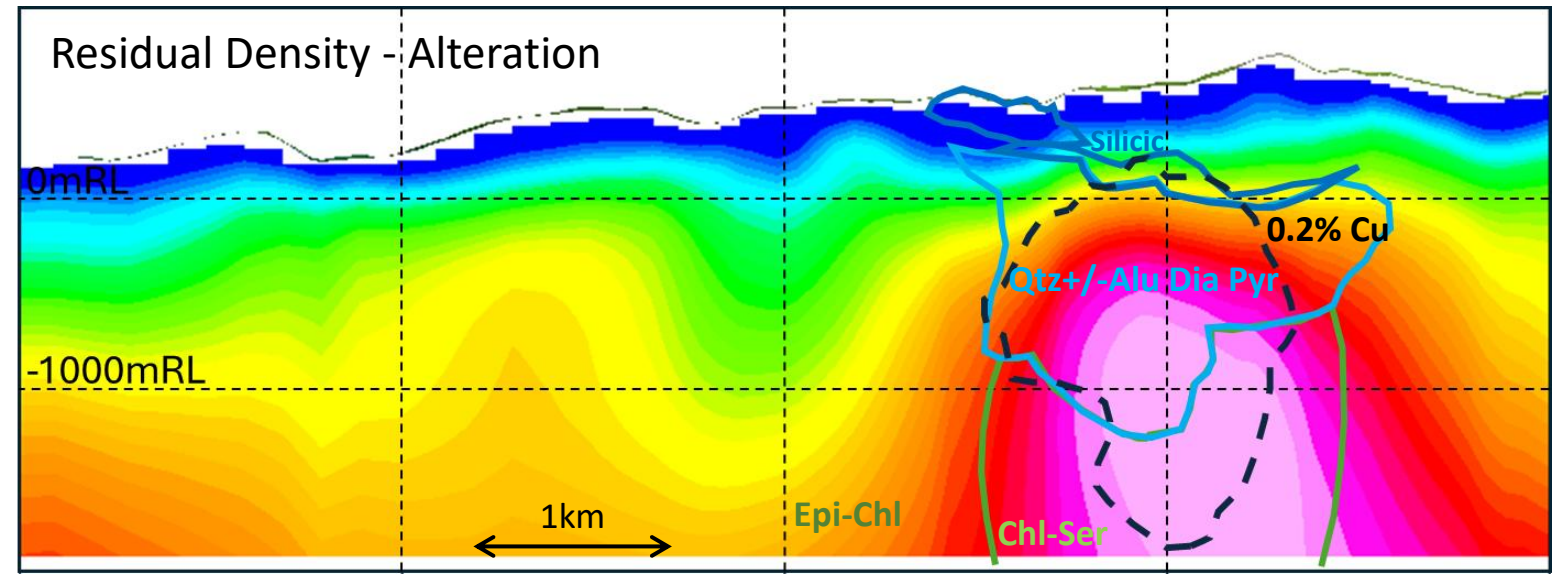
Good correlation between increased density (>2.9 g/cm^3) and both logged porphyry intrusives and mineralization.

Measurements for resource calculation indicate the mineralization averages 2.77 g/cm^3.

The deposit averages >15% sulphides.







Conclusions

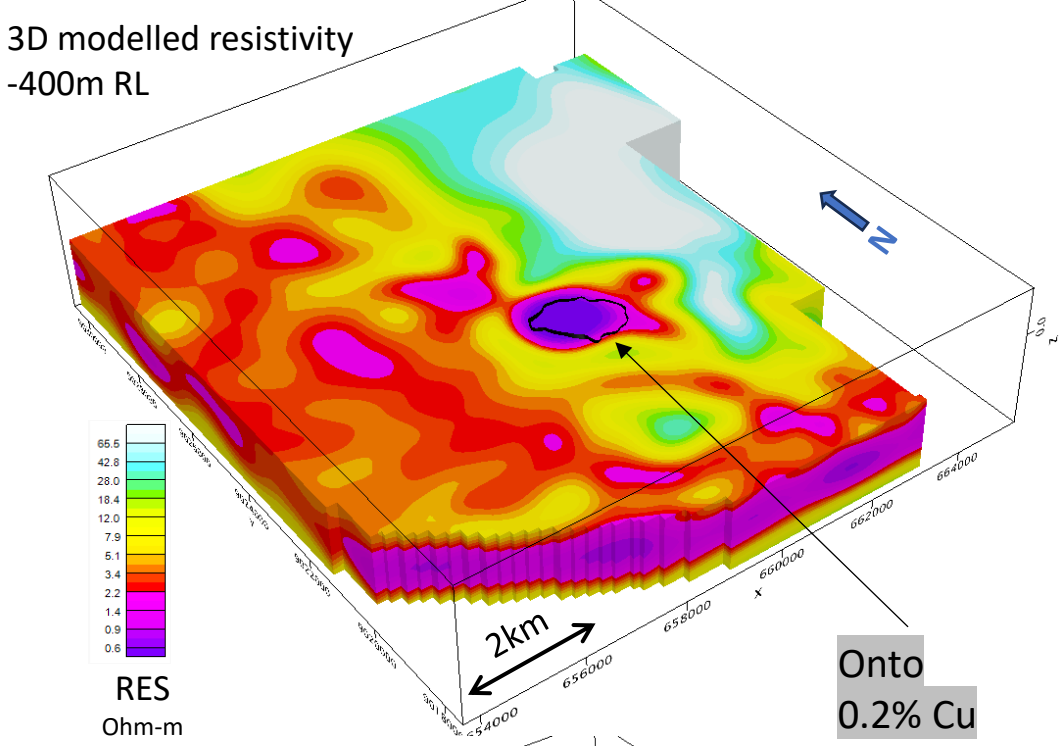
Project scale magnetic data was a primary targeting tool for porphyry mineralisation and proved successful with the discovery of HLE. However, the HS mineralisation at Onto is not magnetic due to magnetite destruction.

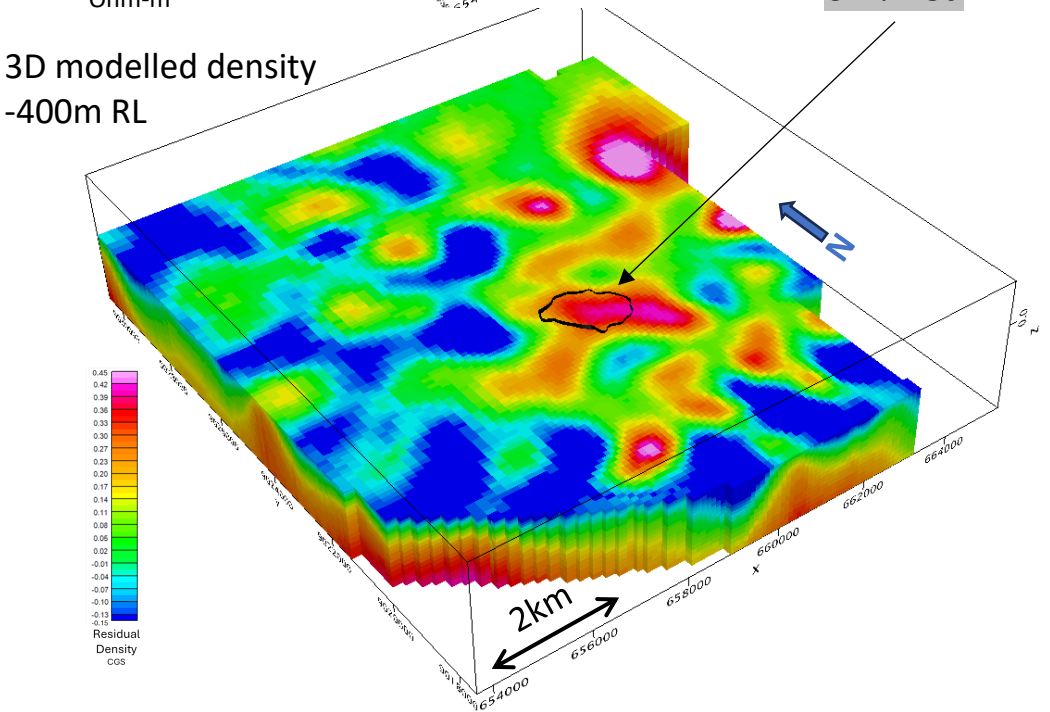
The Onto HS deposit is defined by very low resistivity (<2 Ohm-m) but within low resistivity host rock.

- High sulphide content (>15%)
- Interconnected sulphides after redistribution within a porous rock during the HS event.
- Saline fluids filling significant pore space

The orebody also displays anomalous density contrast although the terrain and orebody depth are complications.

Gravity and MT provide a good combination for defining HS mineralisation at Onto.





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Onto Cu-Au Deposit: Summary

- Onto is a very large, grassroots hybris high sulphidation porphyry discovery
- Current Indicated & Inferred Resources are 3.0 billion tonnes at 0.72 % Cu & 0.39 g/t Au (21.7 Mt Cu, 37.4 M oz Au)
- Copper occurs almost entirely as covellite reflecting very high sulphidation conditions as fluids cooled in advanced argillically-altered rocks
- Extremely young: formed rapidly in last 500,000 years
- The orebody is characterized geophysically by:
  - Very low resistivity (<2 Ohm)
  - Moderately high density
- An amazing team effort in a difficult environment


Nov 2013: Onto Discovery Team

COBRE NUEVO
Exploration

SUMBAWA TIMUR MINING

Onto References

- Resource Statement: https://sumbawatimurmining.co.id/mineral-resource-estimate-statement/
- Results of VHD091 and 096: https://sumbawatimurmining.co.id/pt-sumbawa-timur-mining-onto-copper-gold-deposit-in-sumbawa-indonesia-extended-more-than-500m-vertically-by-recent-drilling/
- PDAC 2020 Presentation: Contact Zoe Bell at PDAC (zbell@pdac.ca)
- The Onto Cu-Au Discovery, Eastern Sumbawa, Indonesia: A Large, Middle Pleistocene Lithocap-Hosted High-Sulfidation Covellite-Pyrite Porphyry Deposit: Economic Geology, November 01, 2020, Vol.115, 1385-1412; https://doi.org/10.5382/econgeo.4766
- Discovery of the Onto Cu-Au deposit, Sumbawa, Indonesia, David Burt, David Burrows, Michael Rennison & Bede Evans: PDAC Presentation March 4th, 2025.
- Geophysics of the Onto Cu-Au High Sulphidation porphyry deposit, David Burt, Dave Toni, David Burrows, Jamin Cristall & Terry Hoschke: MAG25 Presentation November 20th, 2025.