



FACIES ANALYSIS, MODELLING & GEOLOGICAL MAPPING OF THE WAGGA TANK-SOUTHERN NIGHTS DEPOSIT

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ACKNOWLEDGEMENTS



- Bob Brown
- Nancy Vickery
- Gerard Tripp
- Rob Tyson
- Angus Hornabrook
- Rachel Casotti
- Our colleagues at Peel: Cameron Seery, Milica Keric, Jason Bryan, Victoria Silverton
- Special thanks: Carol Simpson & Mick Oates

STUDY AIMS

1. Facies analysis
2. Facies architecture
3. Facies model
4. Geological mapping
5. Exploration

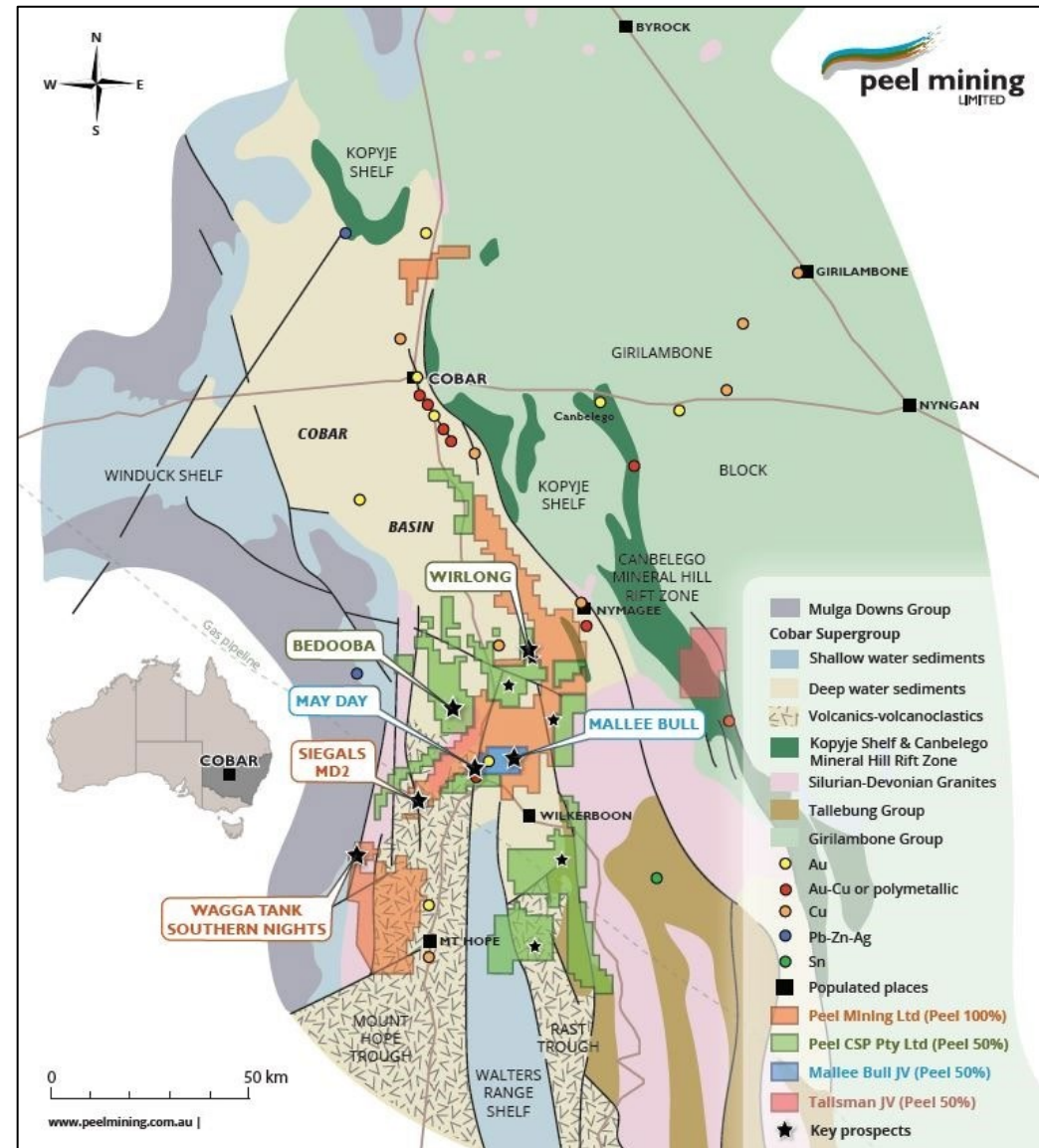
BACKGROUND GEOLOGY

LOCATION

- 150km South of Cobar; 40km to May Day; 50km to Mallee Bull
- Western edge of the Mt Hope Trough

DEPOSIT OVERVIEW

- Polymetallic Zn-Pb-Ag-Cu-Au deposit of VMS affinity
- Steeply WNW/NW dipping, locally overturned to SE (Wagga Tank)
- Hosted within a package of volcanic and sedimentary rocks of the Mt Kennan Volcanics
- Low strain, lower greenschist facies metamorphic grade



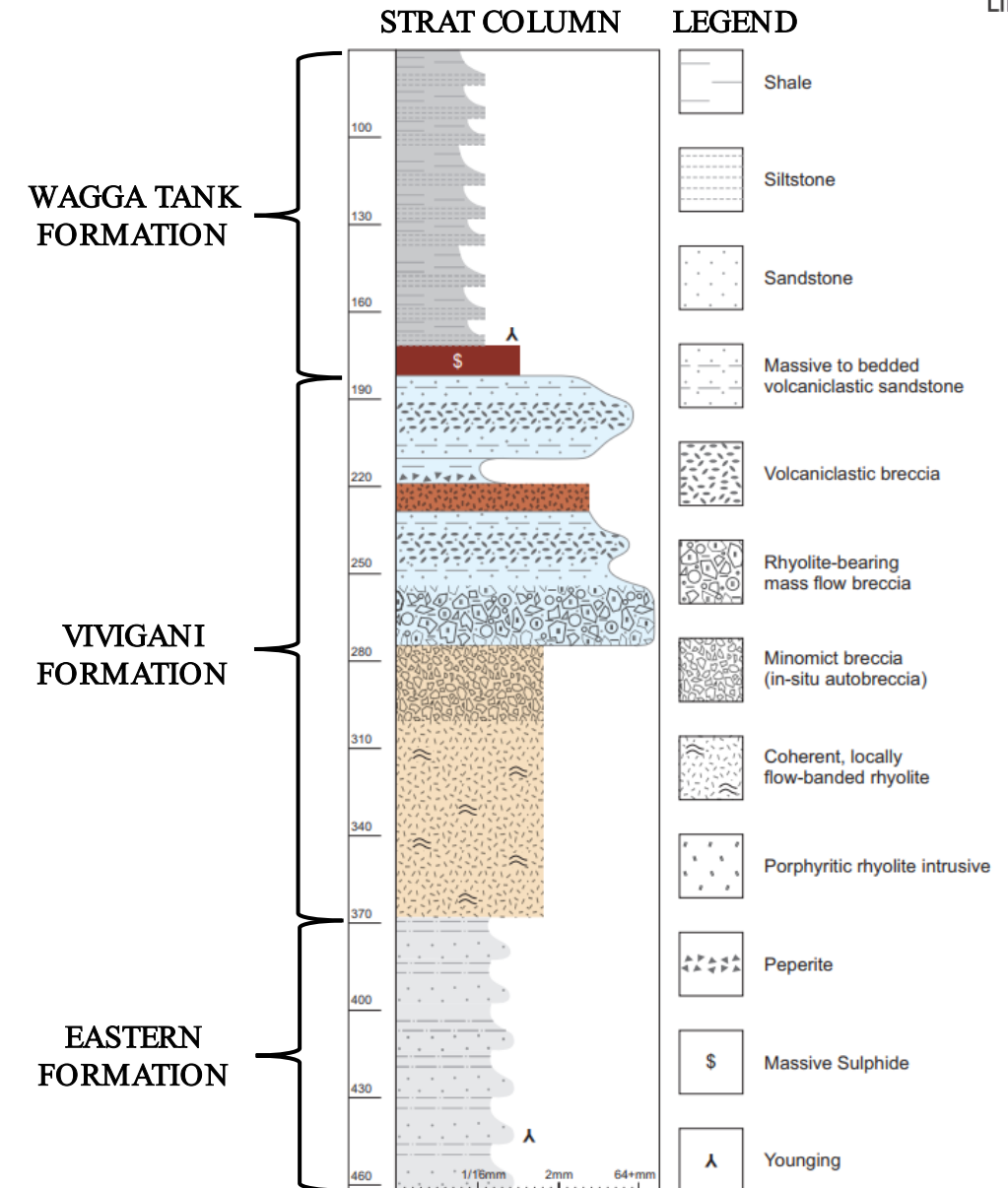
BACKGROUND GEOLOGY

STRATIGRAPHY

- Eastern Formation turbidites (Mt Kennan Volcanics)
- Vivigani Formation volcanics (Mt Kennan Volcanics)
- Wagga Tank Formation turbidites (Mt Kennan Volcanics)
- Unconformably overlain by transported cover (Tertiary & Quaternary) up to >100m thick

MINERALISATION

- Stratiform laminated, banded to massive
 $Sp > Py > Gn > Cpy$
- Discordant, intensely altered stockworks of disseminated and vein sulphides



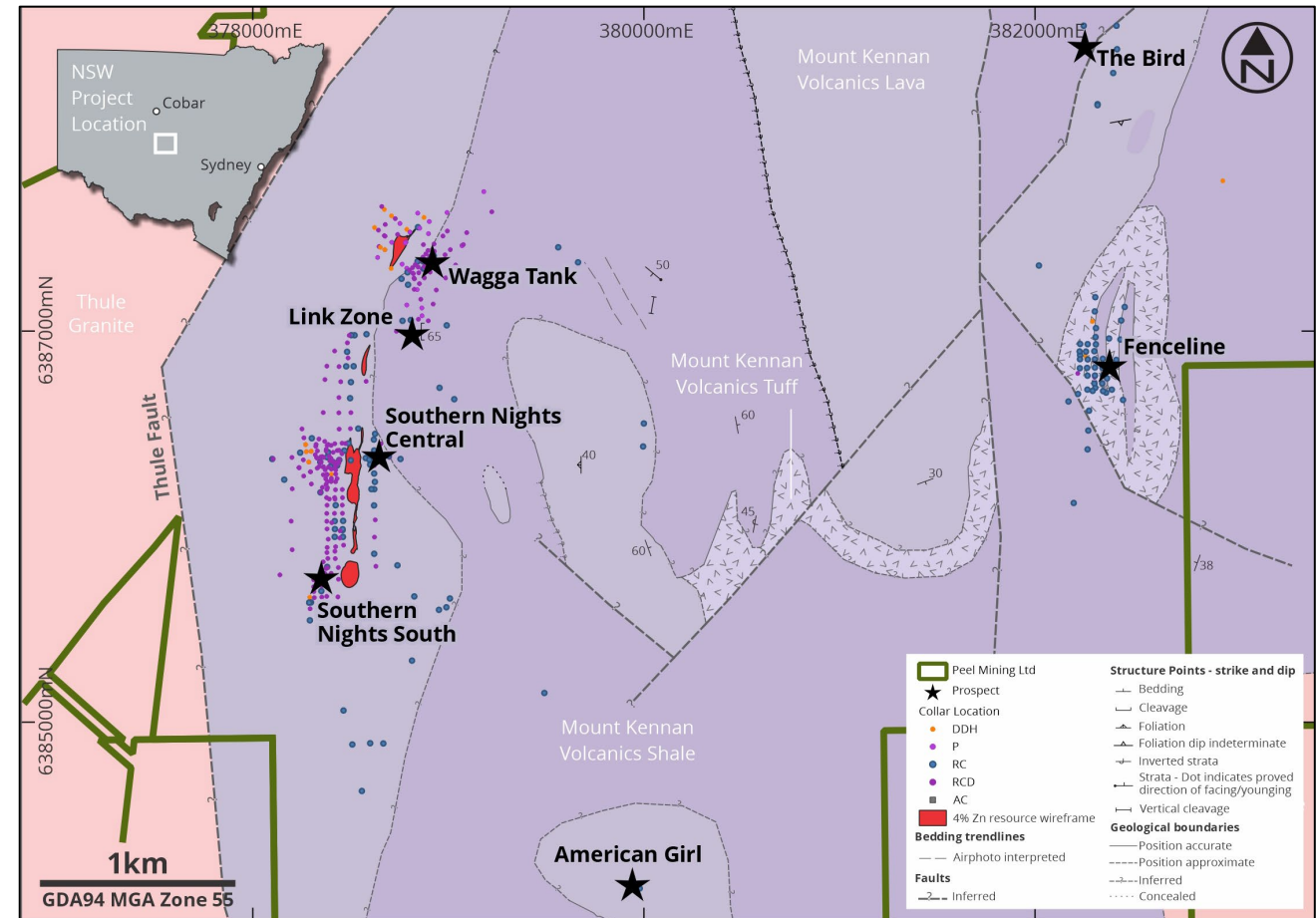
BACKGROUND GEOLOGY

LOCATION OF MINERALISATION

- Discontinuous, 2km strike length
- Wagga Tank
- Link Zone
- Southern Nights Central
- Southern Nights South

CONTAINED MINERALISATION

- Wagga Tank & Link Zone: 0.81Mt @ 5% Zn, 2.4% Pb, 81g/t Ag, 0.4% Cu & 0.5g/t Au
- Southern Nights Central & Southern Night South: 4.14Mt @ 5% Zn, 2% Pb, 77g/t Ag, 0.2% Cu & 0.3g/t Au



GNSW Seamless Geology

MINERAL RESOURCE ESTIMATE

MARCH 2020



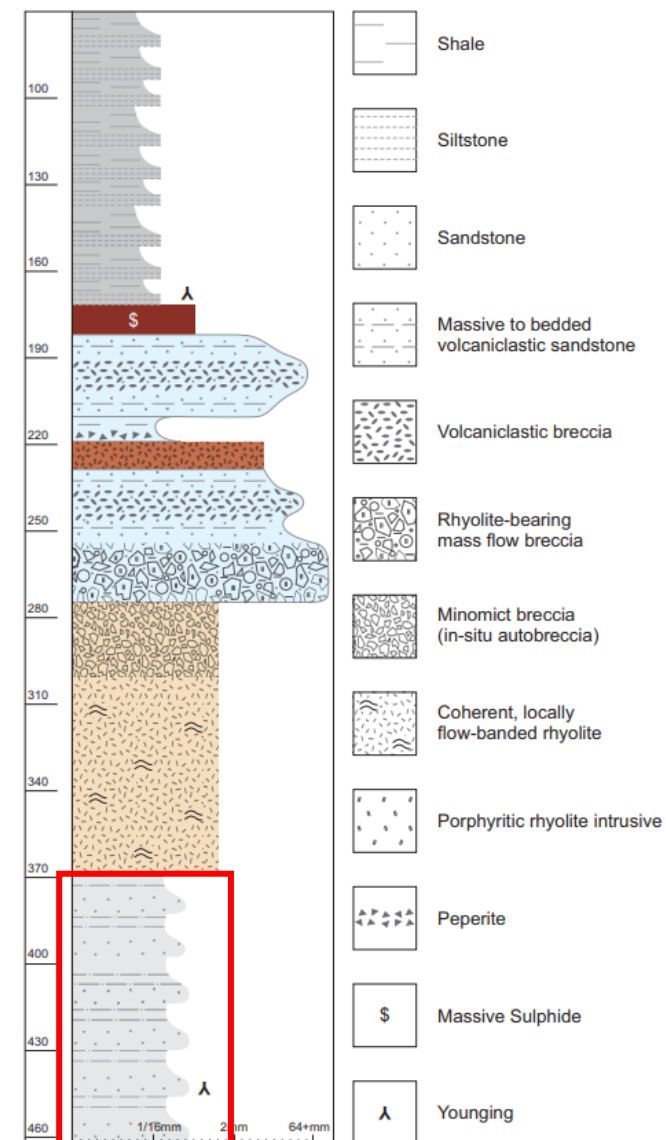
- **INDICATED:** 2.95Mt @ 5.73% Zn, 2.33% Pb, 0.23% Cu, 85.5g/t Ag & 0.36g/t Au
- **INFERRED:** 2Mt @ 4.0% Zn, 1.6% Pb, 0.3% Cu, 67g/t Ag & 0.3g/t Au
- **TOTAL RESOURCE:** 4.95Mt @ 5.0% Zn, 2.0% Pb, 0.3% Cu, 78g/t Ag & 0.4g/t Au

FACIES ANALYSIS

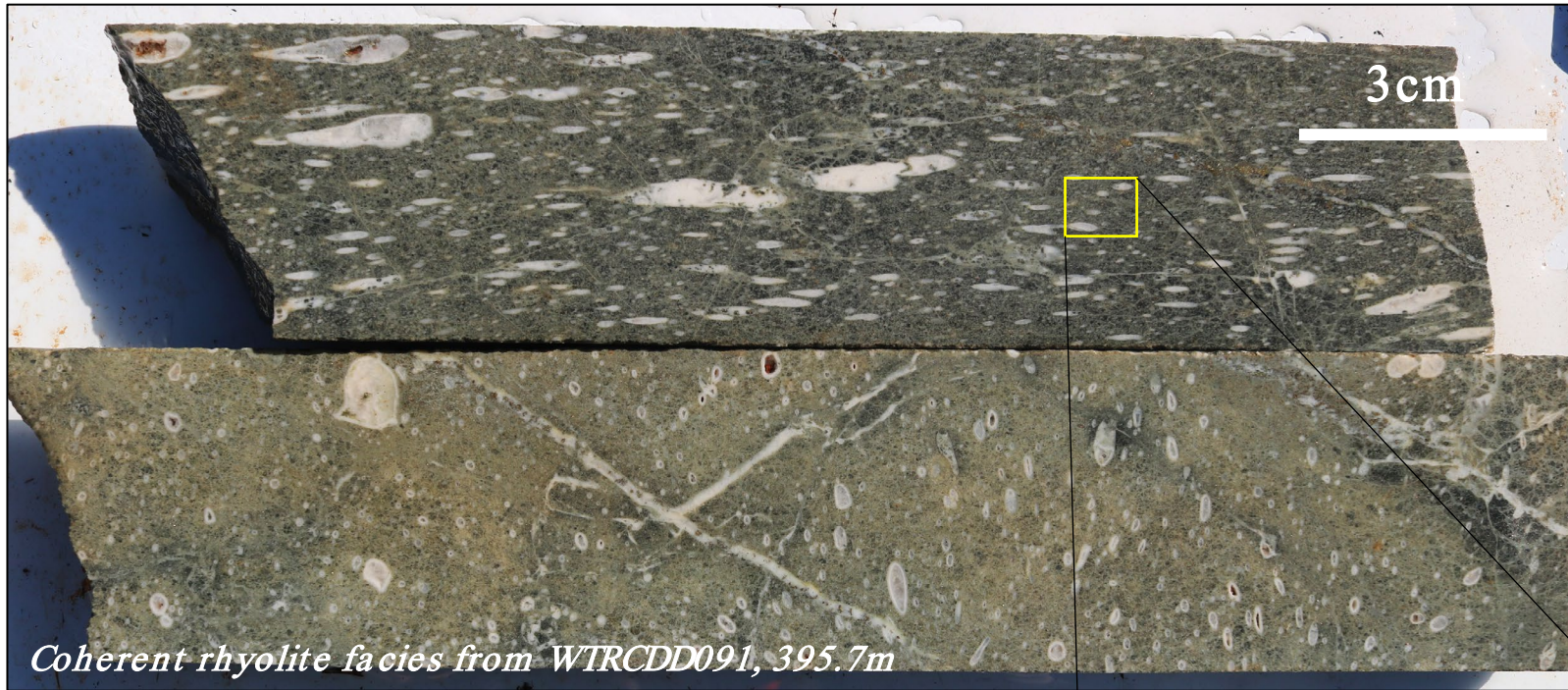
EASTERN FORMATION TURBIDITE FACIES



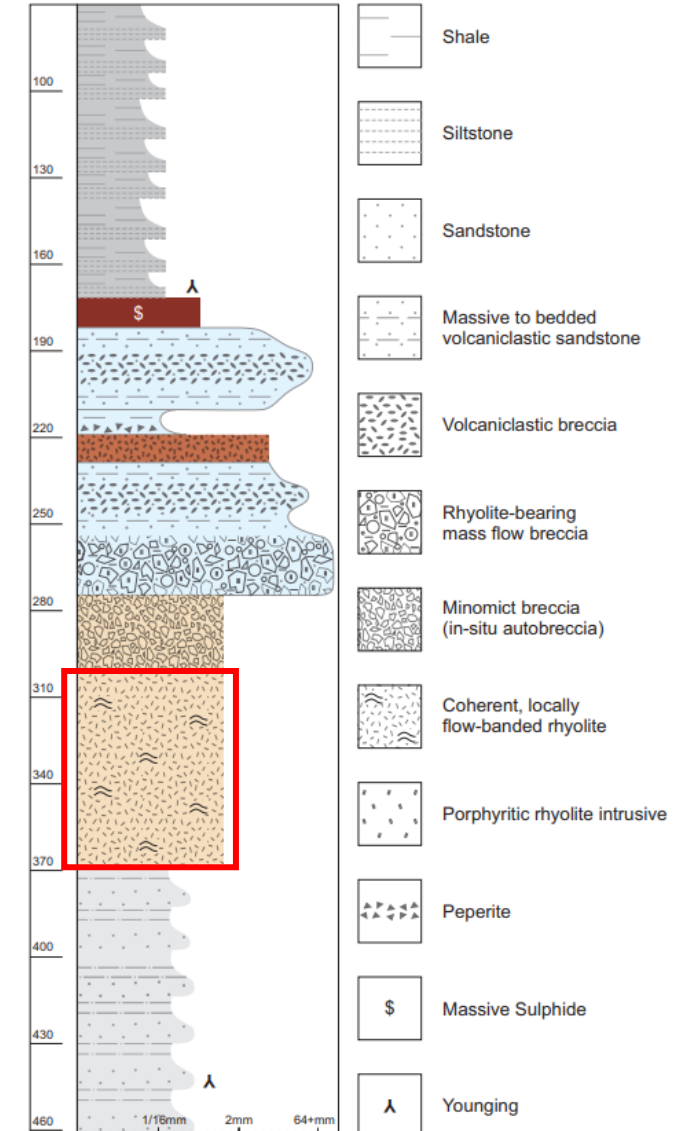
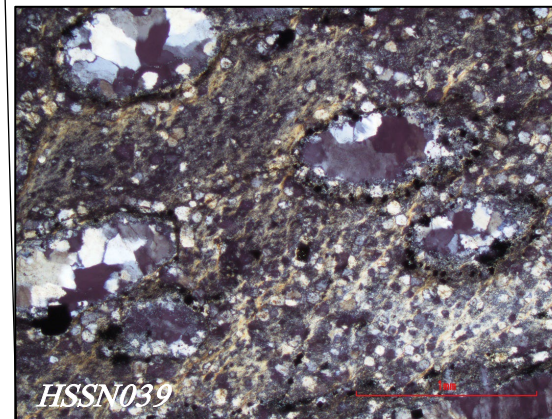
- Deep marine turbidite setting
- Massive to thinly bedded shale, siltstone, sandstone
- Graded bedding common
- Locally hosts polymetallic stringer veining at Wagga Tank



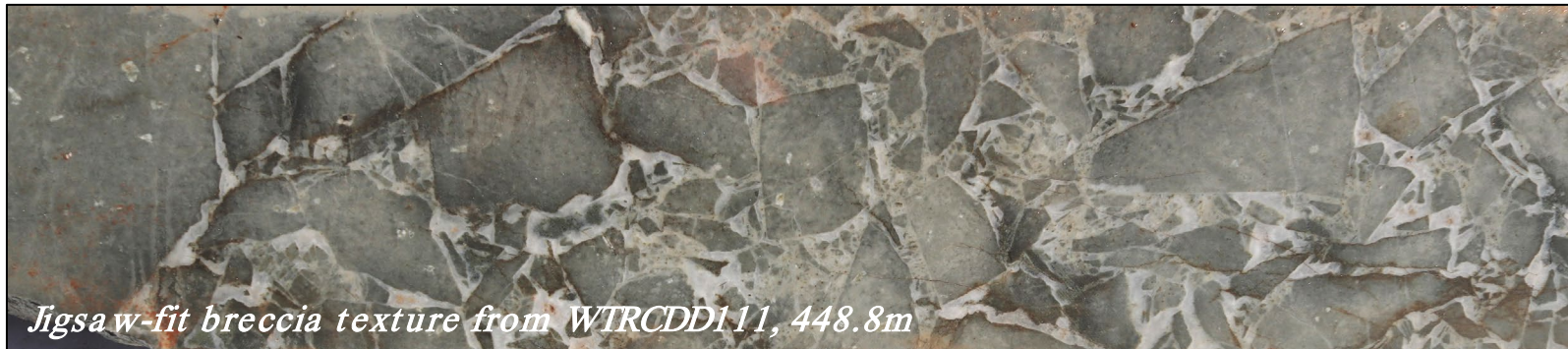
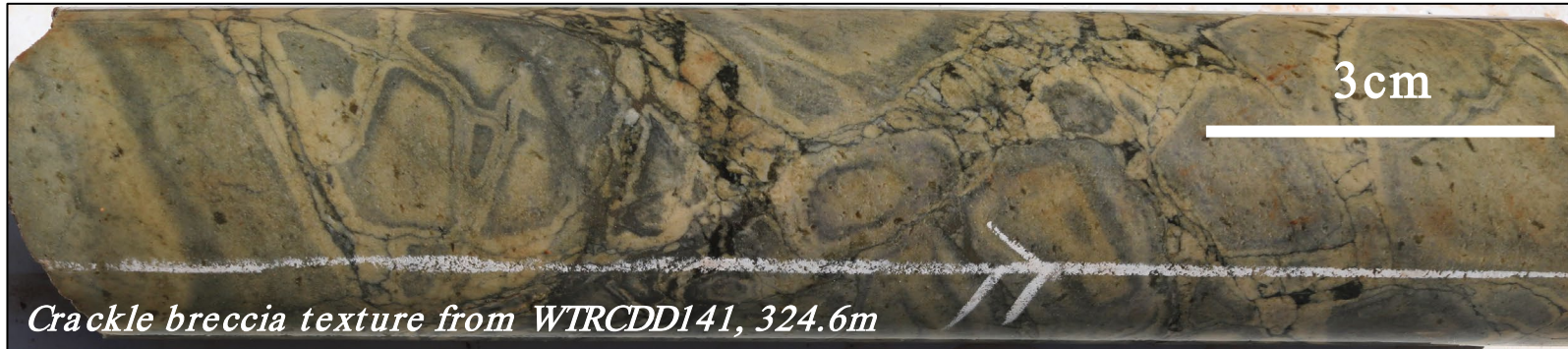
VIVIGANI FORMATION COHERENT RHYOLITE FACIES



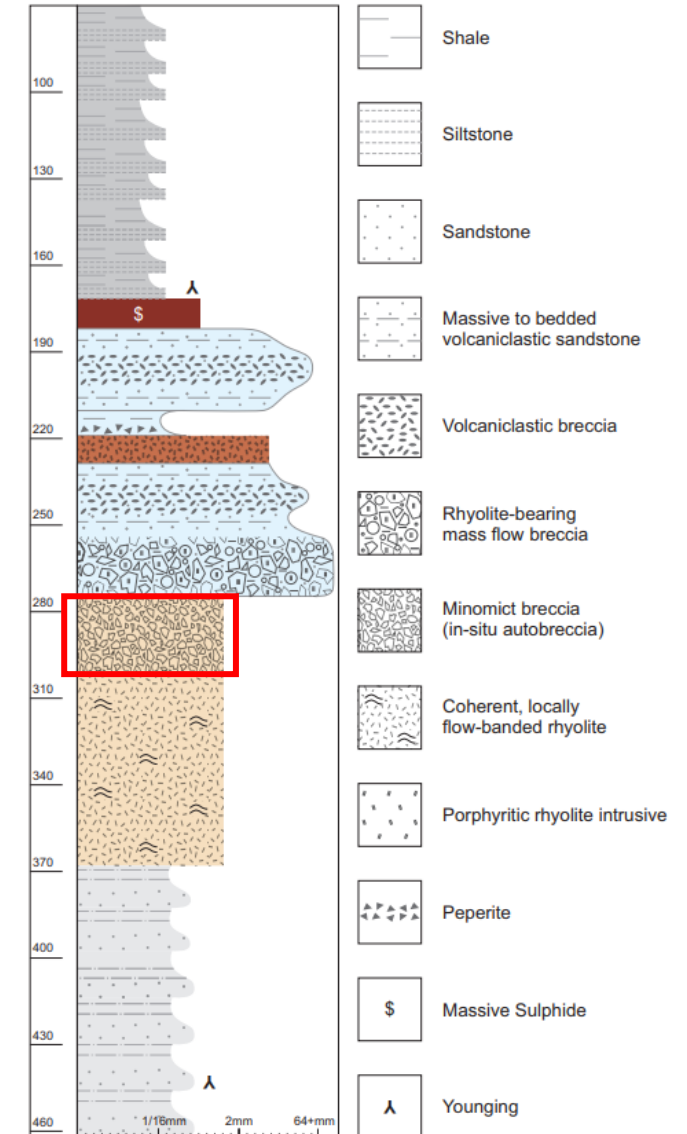
- Aphyric to locally sparsely plagioclase phyric rhyolitic lava
- Abundant quartz-filled amygdales
- Commonly flow-banded
- Devitrified, originally glassy groundmass evidenced by spherulitic and micropoikilitic textures



VIVIGANI FORMATION COHERENT RHYOLITE FACIES



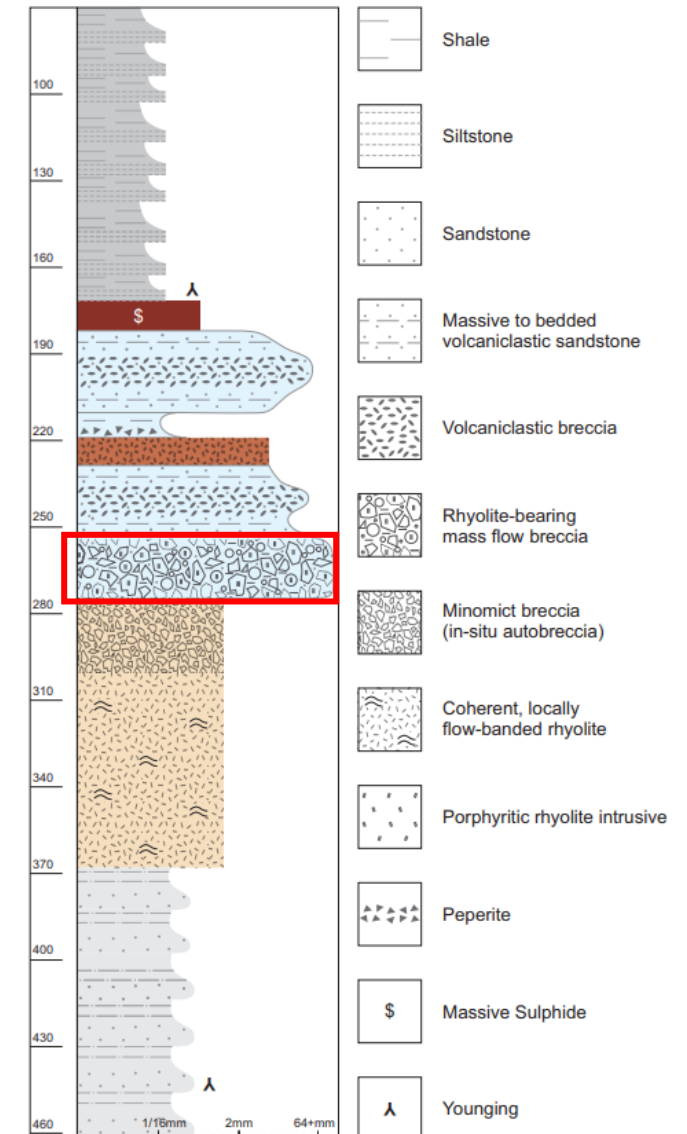
- Crackle to jigsaw-fit breccia textures at lava margins
- Formed from in-situ quench fragmentation of the lava as it flowed into a marine environment
- Forms a dome-like structure on the palaeo-seafloor ~2km in length
- Thickness currently not defined – minimum 250m



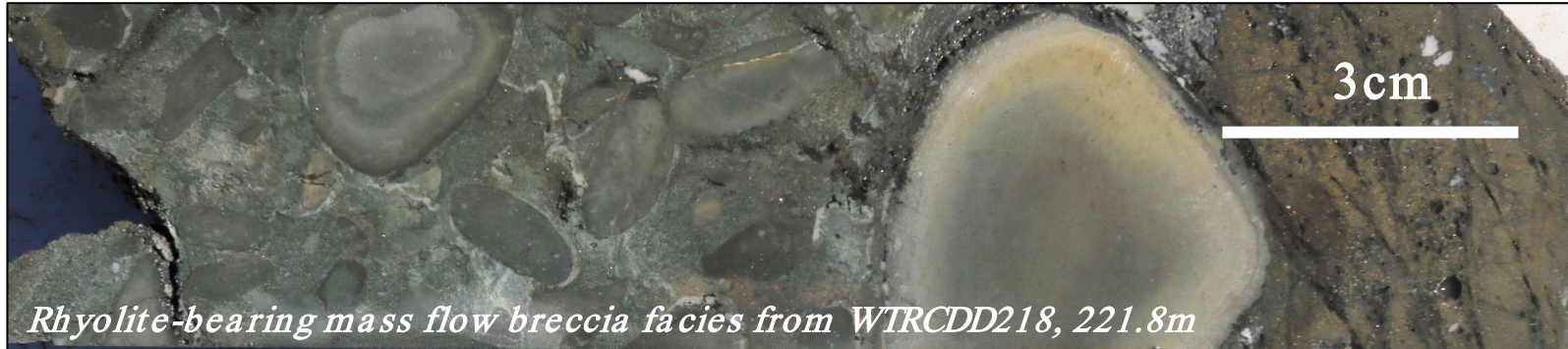
VIVIGANI FORMATION RHYOLITE-BEARING MASS FLOW BRECCIA FACIES



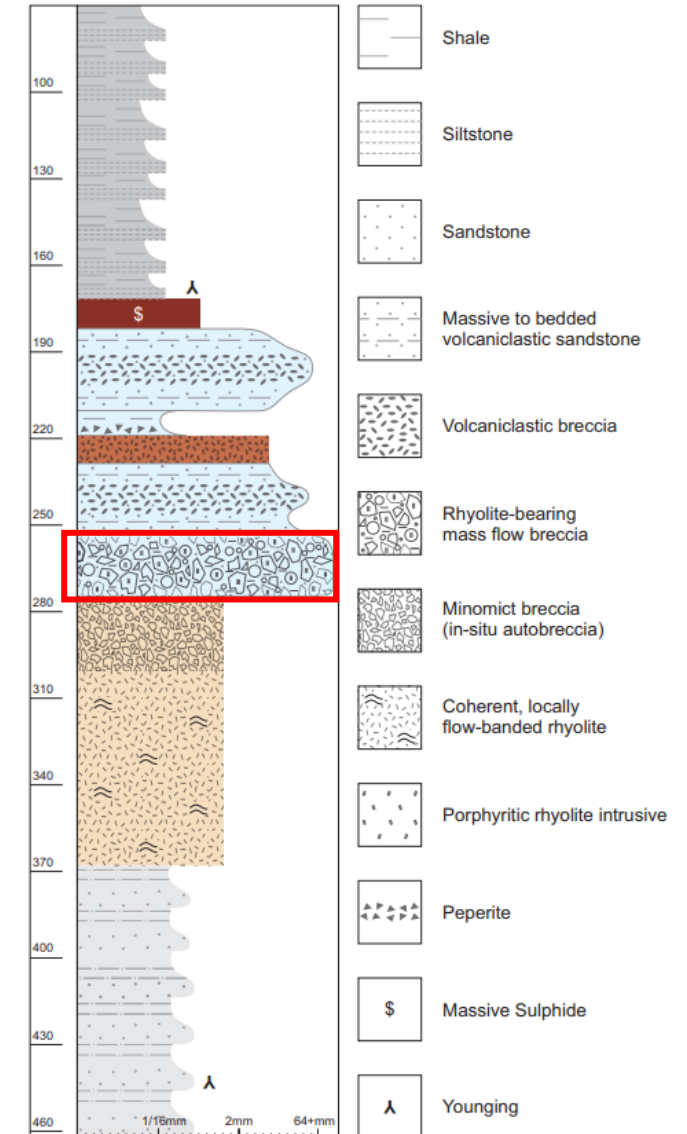
- Sub-angular to sub-rounded clasts of shale/siltstone, sandstone and lesser coherent rhyolite in shale matrix
- Chaotic, matrix to clast-supported
- Formed from subaqueous mass-flows during the collapse of unstable autoclastic breccias at coherent rhyolite margins
- Analogous to facies at Highway-Reward deposit, Queensland



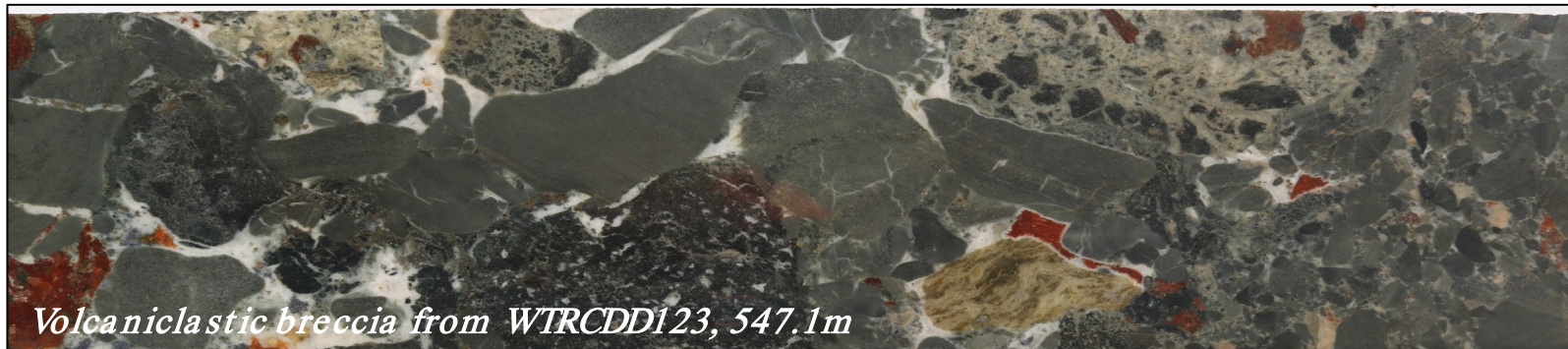
VIVIGANI FORMATION RHYOLITE-BEARING MASS FLOW BRECCIA FACIES



- Smooth, very well-rounded clasts of coherent rhyolite in a sandy matrix
- Clast-supported
- Resedimented lava clasts spalled from steep-sided flow fronts of coherent rhyolite bodies through curvilinear fracturing



VIVIGANI FORMATION VOLCANICLASTIC FACIES

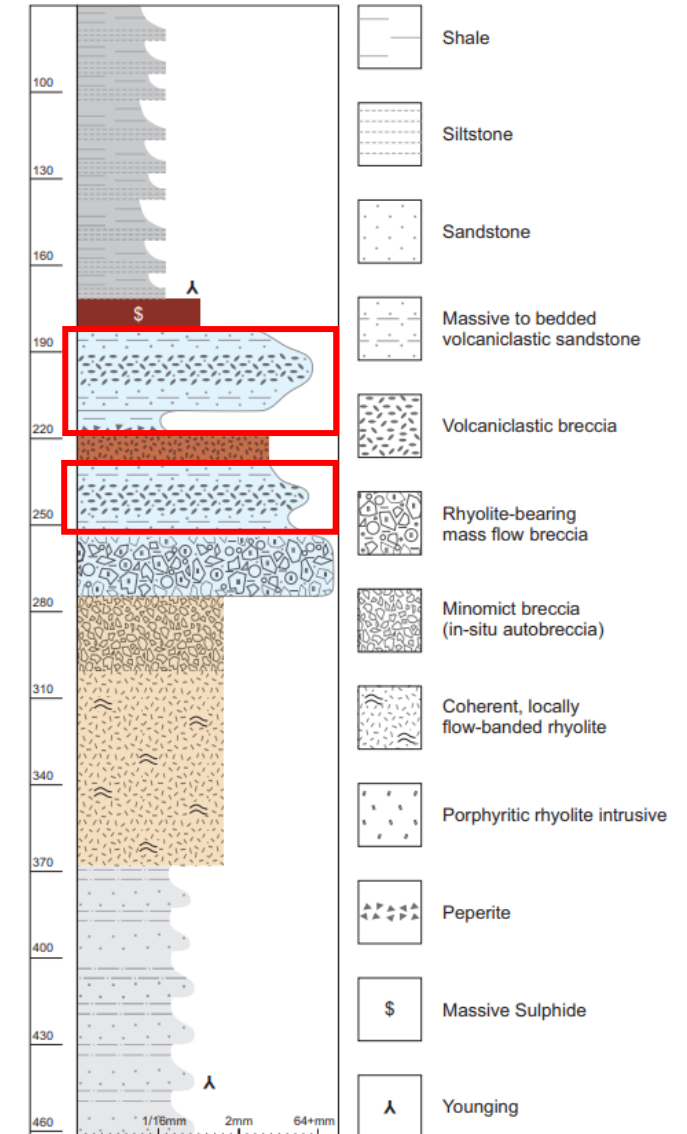


Volcaniclastic sandstone:

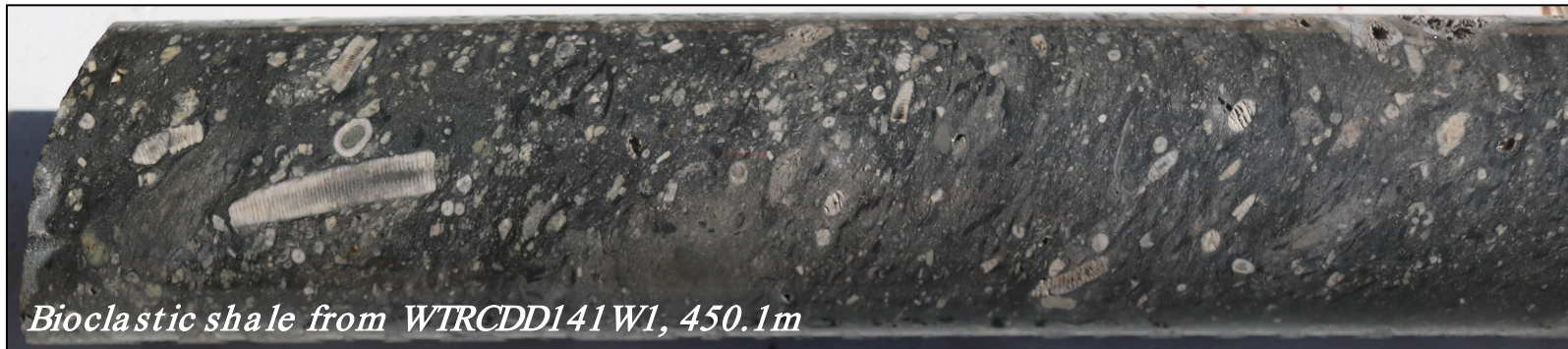
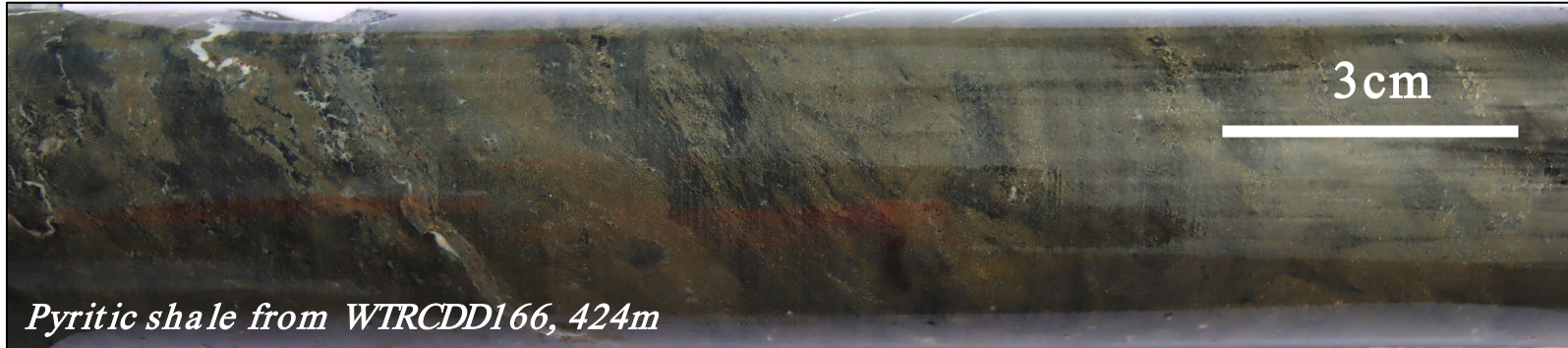
- Comprised of felsic lava, sedimentary grains and volcanic quartz
- Massive to thin-bedded with local cross-bedding and graded beds

Volcaniclastic breccia:

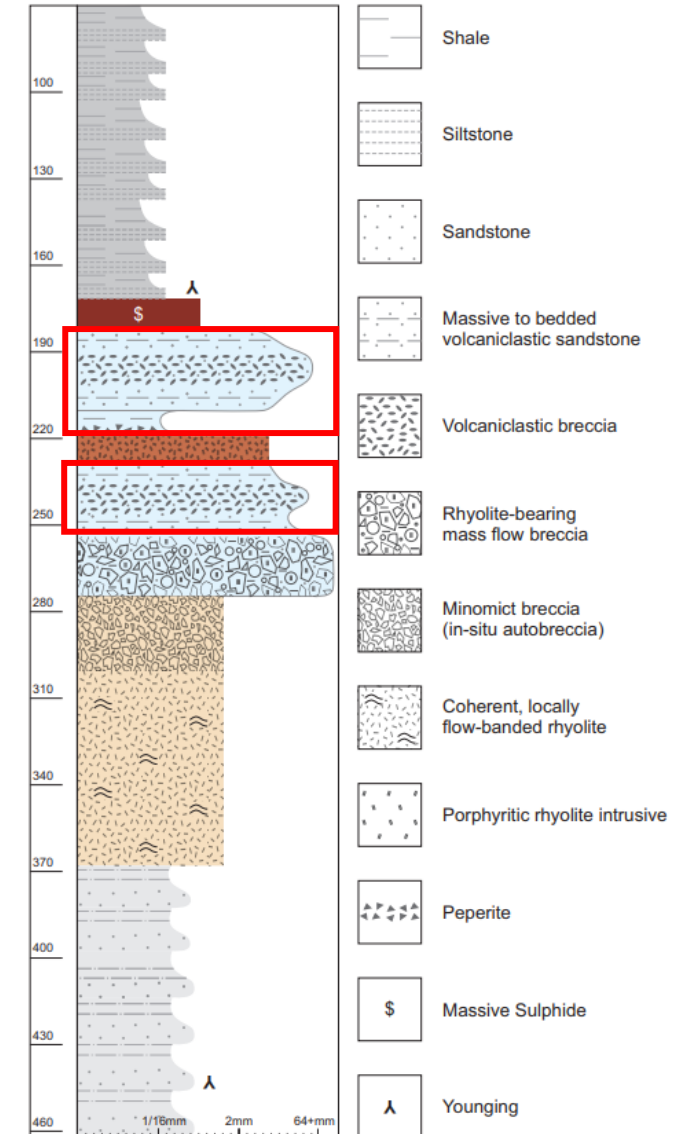
- Polymict with clasts of sedimentary and volcanic provenance
- Chaotic, clast to matrix supported
- Coarse debris-flow deposits



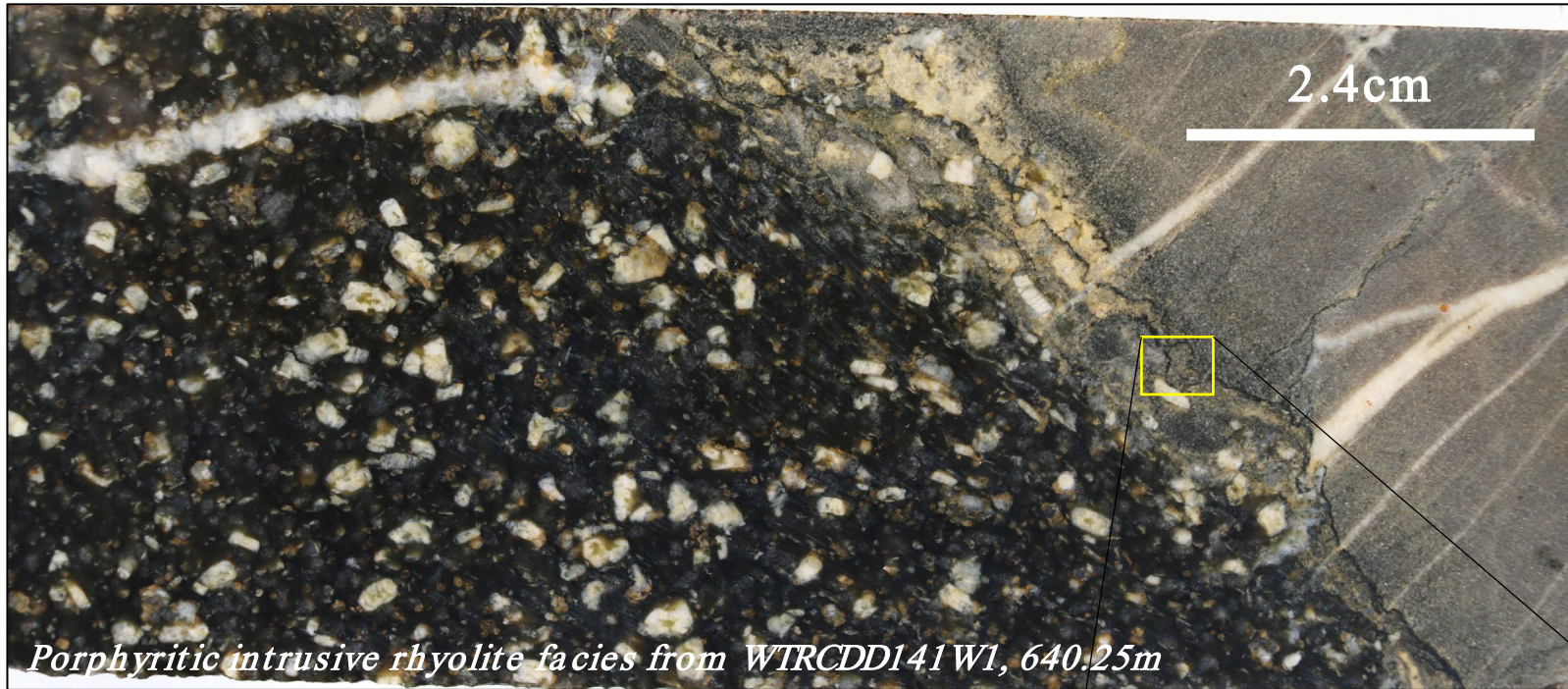
VIVIGANI FORMATION VOLCANICLASTIC FACIES



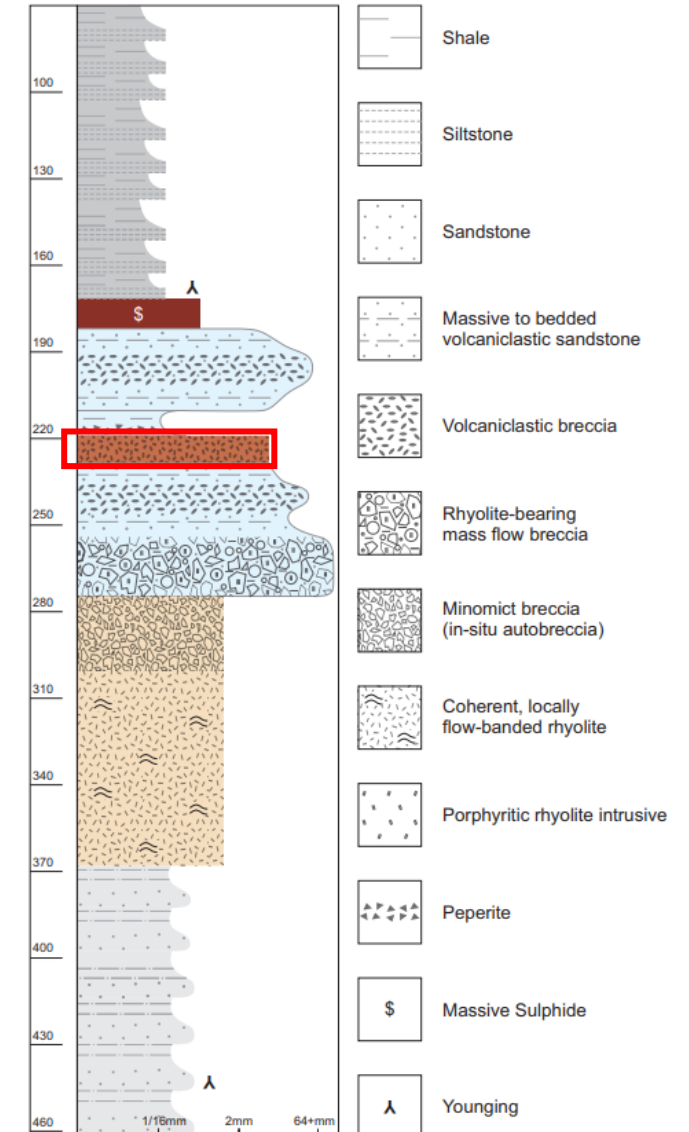
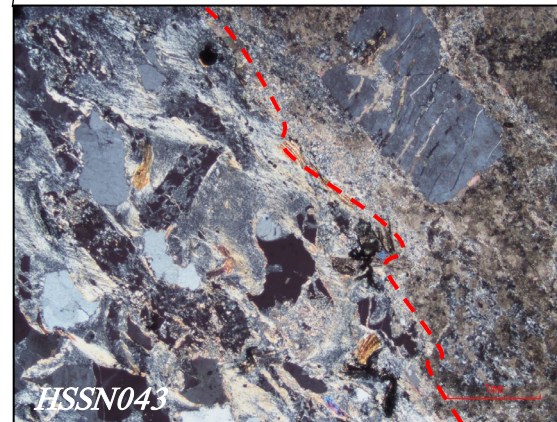
- Episodic deposition - quiescence periods marked by deposition of fine-grained sediments accompanied by fine-grained pyrite
- Local crinoids, corals and limestone = proximity to emergent/near emergent volcanic centre and/or syn-volcanic fault
- Subtle cross-bedding in volcaniclastic sandstone = distal



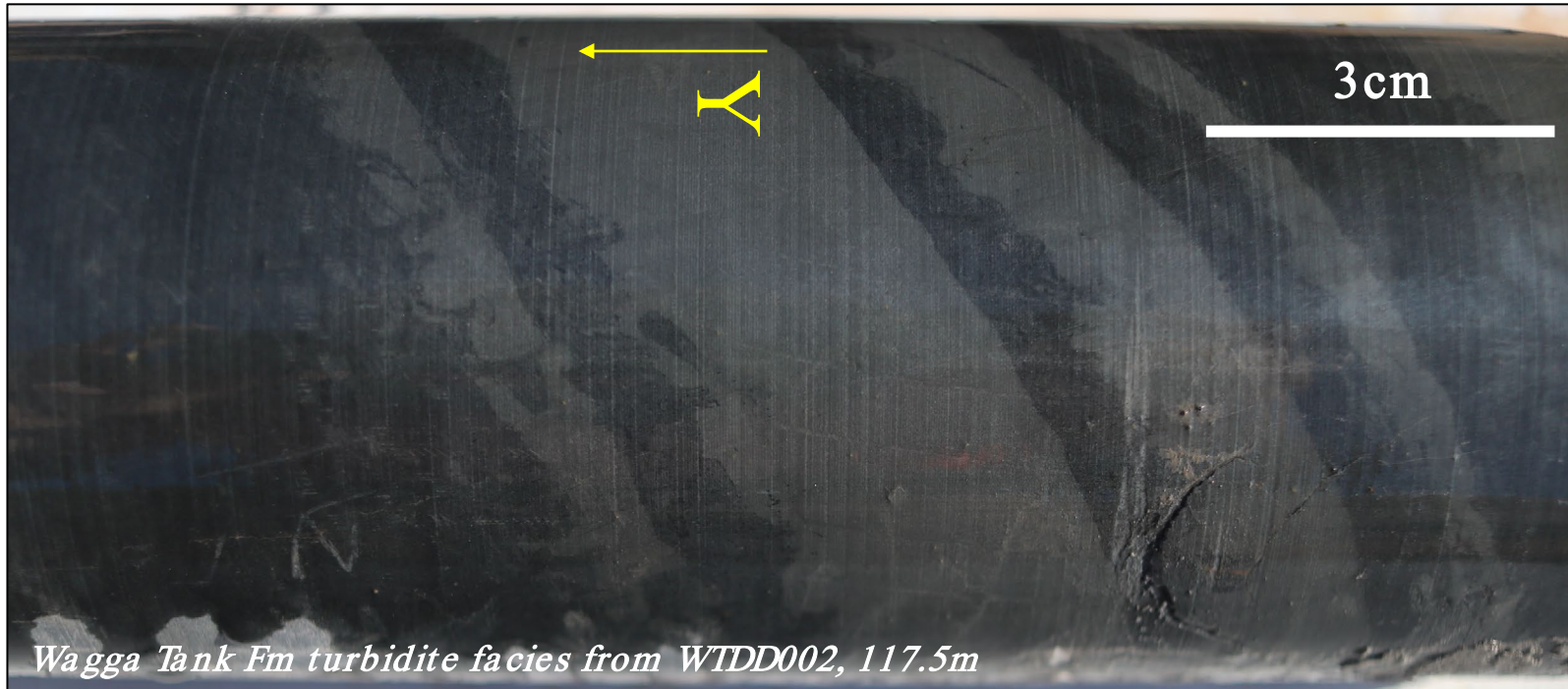
VIVIGANI FORMATION PORPHYRYTIC INTRUSIVE RHYOLITE FACIES



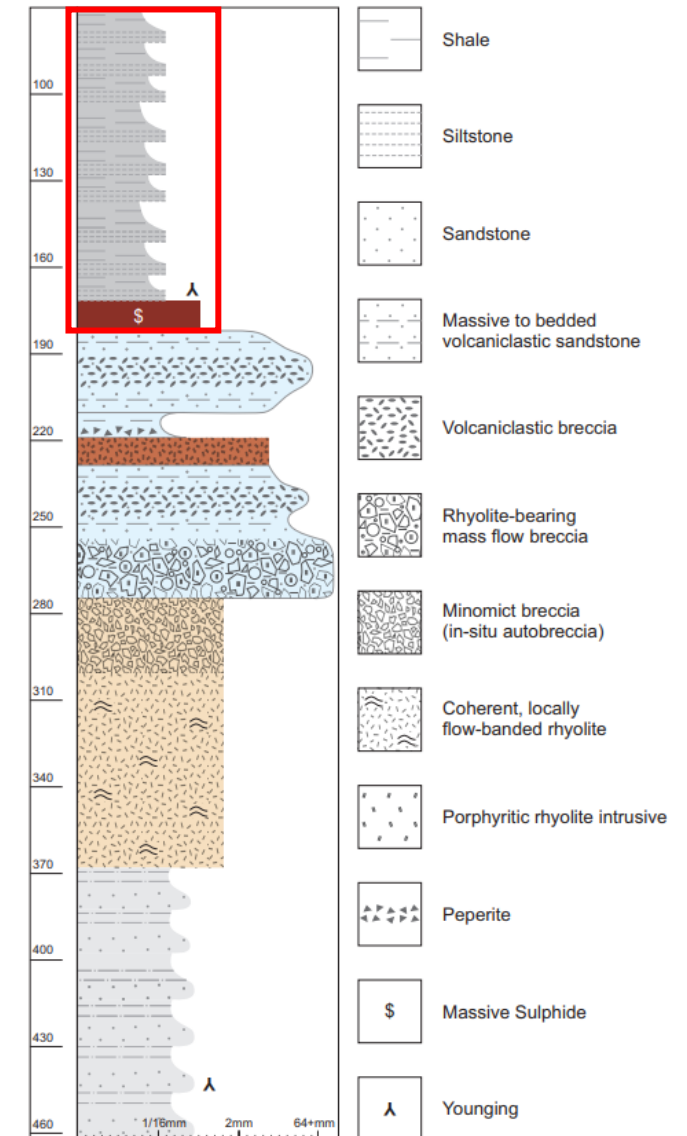
- Occurs locally at the Link Zone
- Crystal-rich, quartz-feldspar+/-biotite phyric rhyolite
- Common peperitic contacts with carbonate altered sediments
- Very high-level syn-volcanic intrusion (dyke or sill) emplaced into unconsolidated sediments



WAGGA TANK FORMATION TURBIDITE FACIES



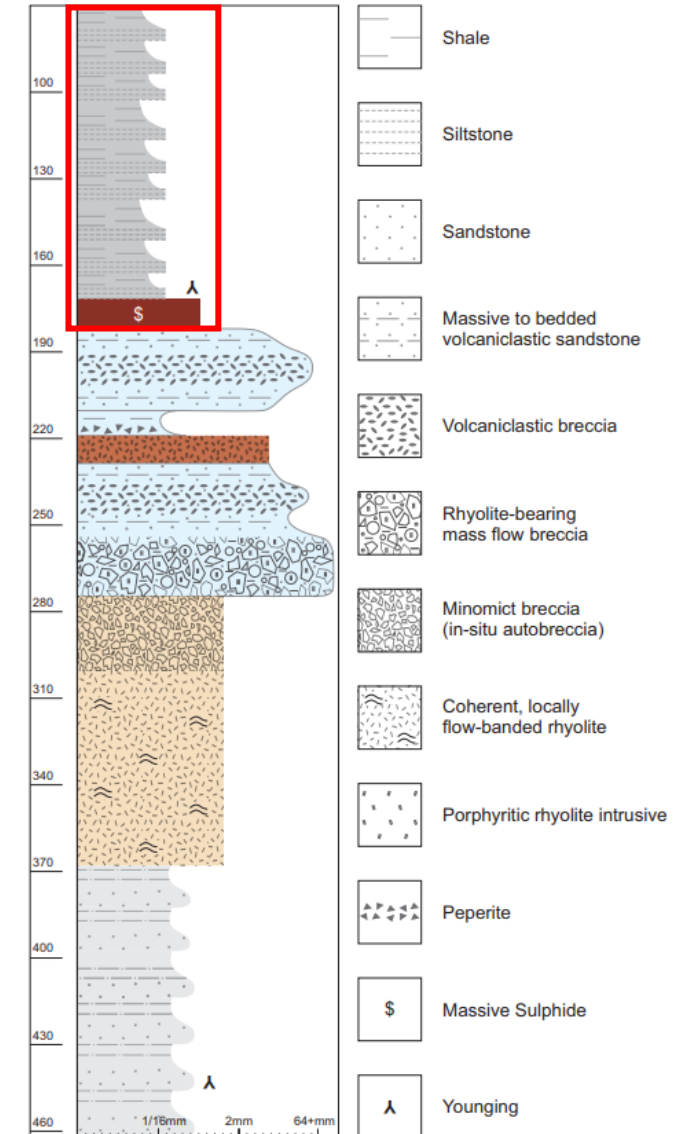
- Deep marine turbidite setting: absence of abundant fg sandstone suggests a more distal setting than Eastern Formation
- Thin bedded shales with subordinate siltstone with common graded bedding, sharp bases, scours and occasional cross bedding
- Common euhedral and recrystallised pyrite proximal to Vivigani Formation contact



WAGGA TANK FORMATION TURBIDITE FACIES



- Stratiform, finely laminated to banded to massive
Sphalerite>pyrite>galena>chalcopyrite
- Hosted at the base of the Wagga Tank Formation turbidite facies at contact with Vivigani Formation



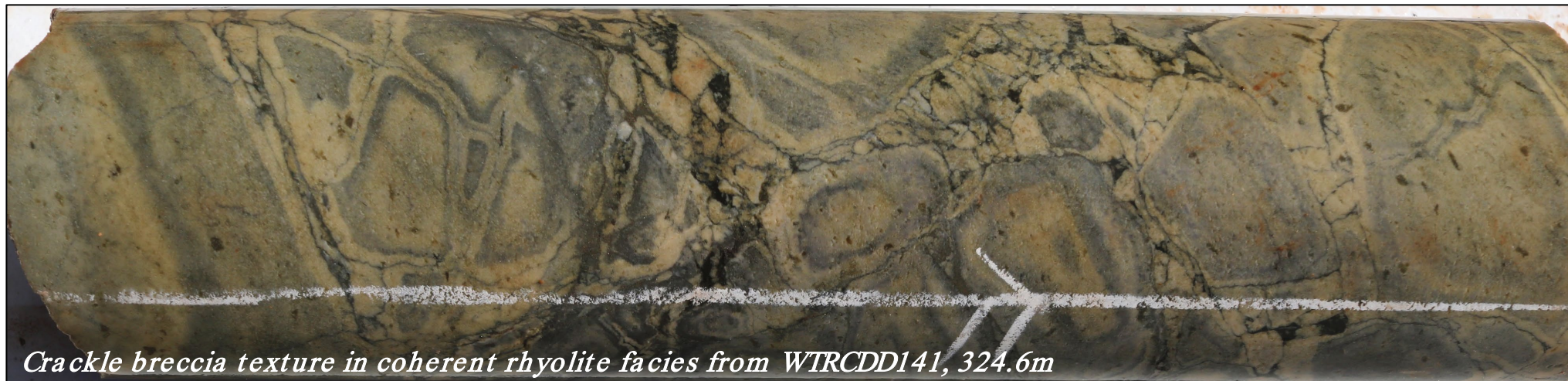
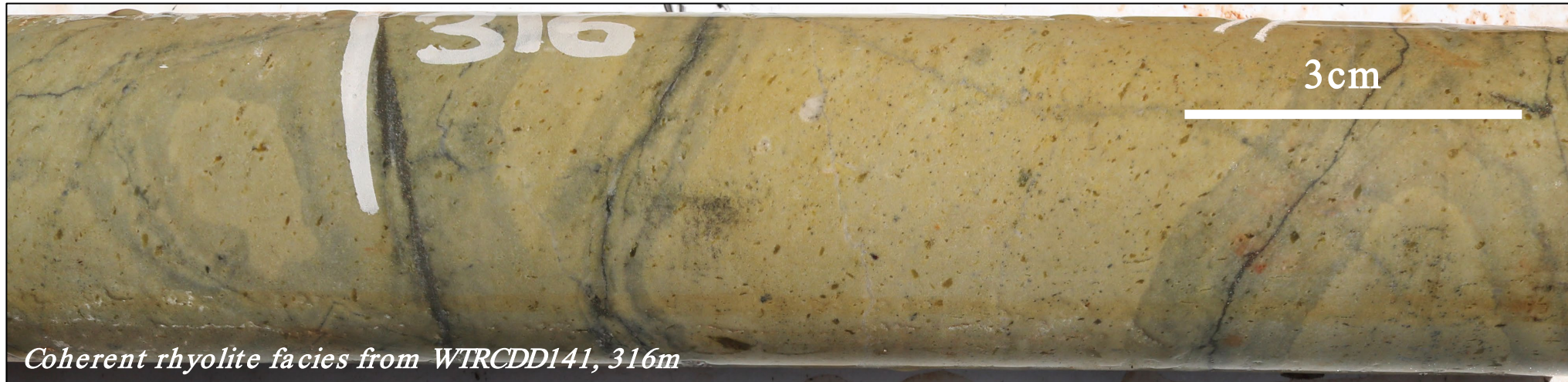
FACIES ARCHITECTURE

FEATURES USEFUL IN THE DETECTION OF SYN-VOLCANIC FAULTS (Franklin et al., 2005)

1. Felsic lava flows, domes and cryptodomes marking volcanic centres
2. Syn-volcanic dykes and dyke swarms
3. Hydrothermal alteration that preferentially develops in dykes that occupy the structure or in their adjacent wall rocks
4. Diachronous wedges of talus; talus blocks; debris flows
5. 'Growth' of footwall sequences over a short lateral distance

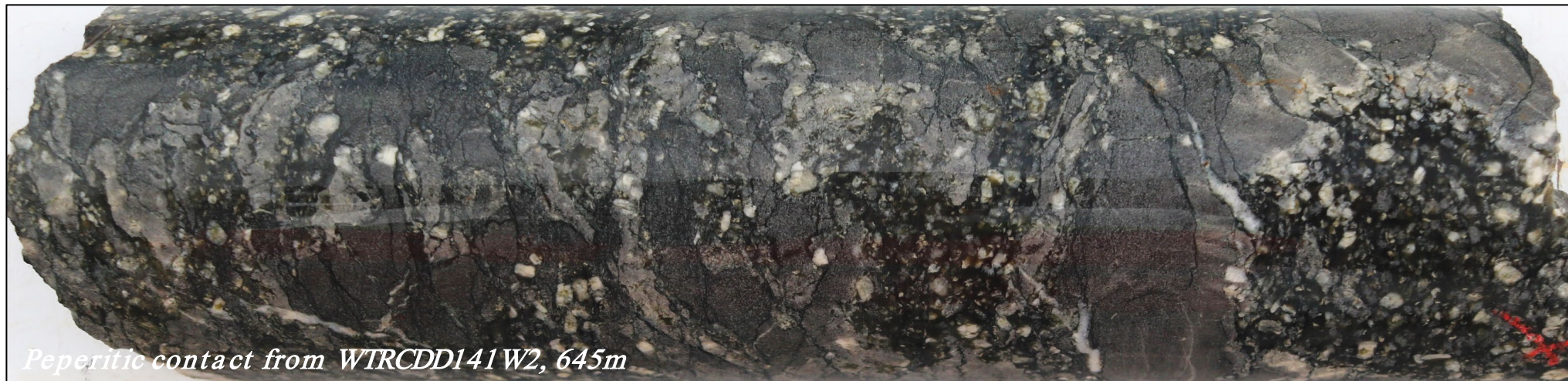
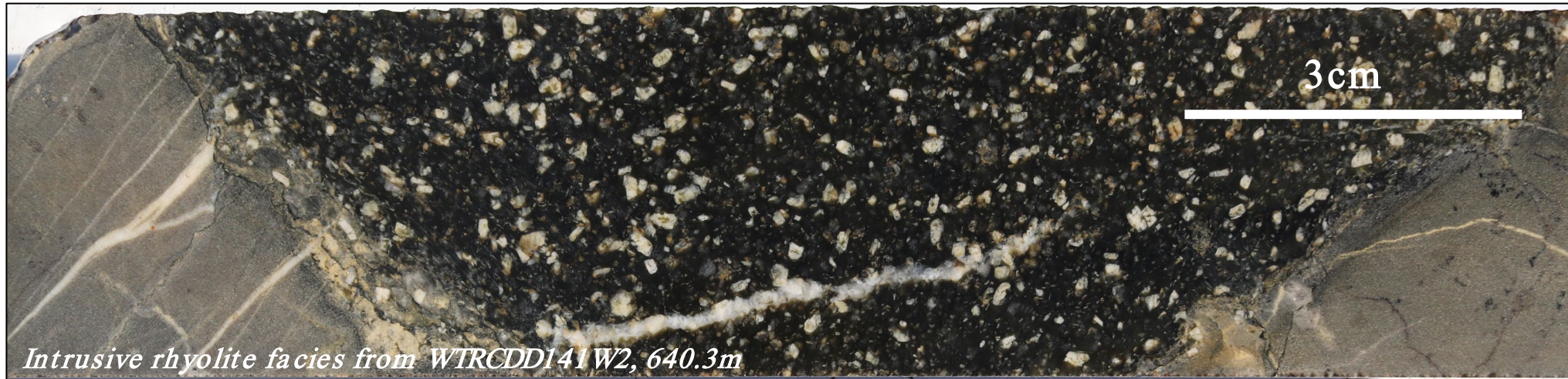
FACIES ARCHITECTURE

1. LINK ZONE – FELSIC LAVA FLOWS, DOMES & CRYPTODOMES MARKING VOLCANIC CENTRES



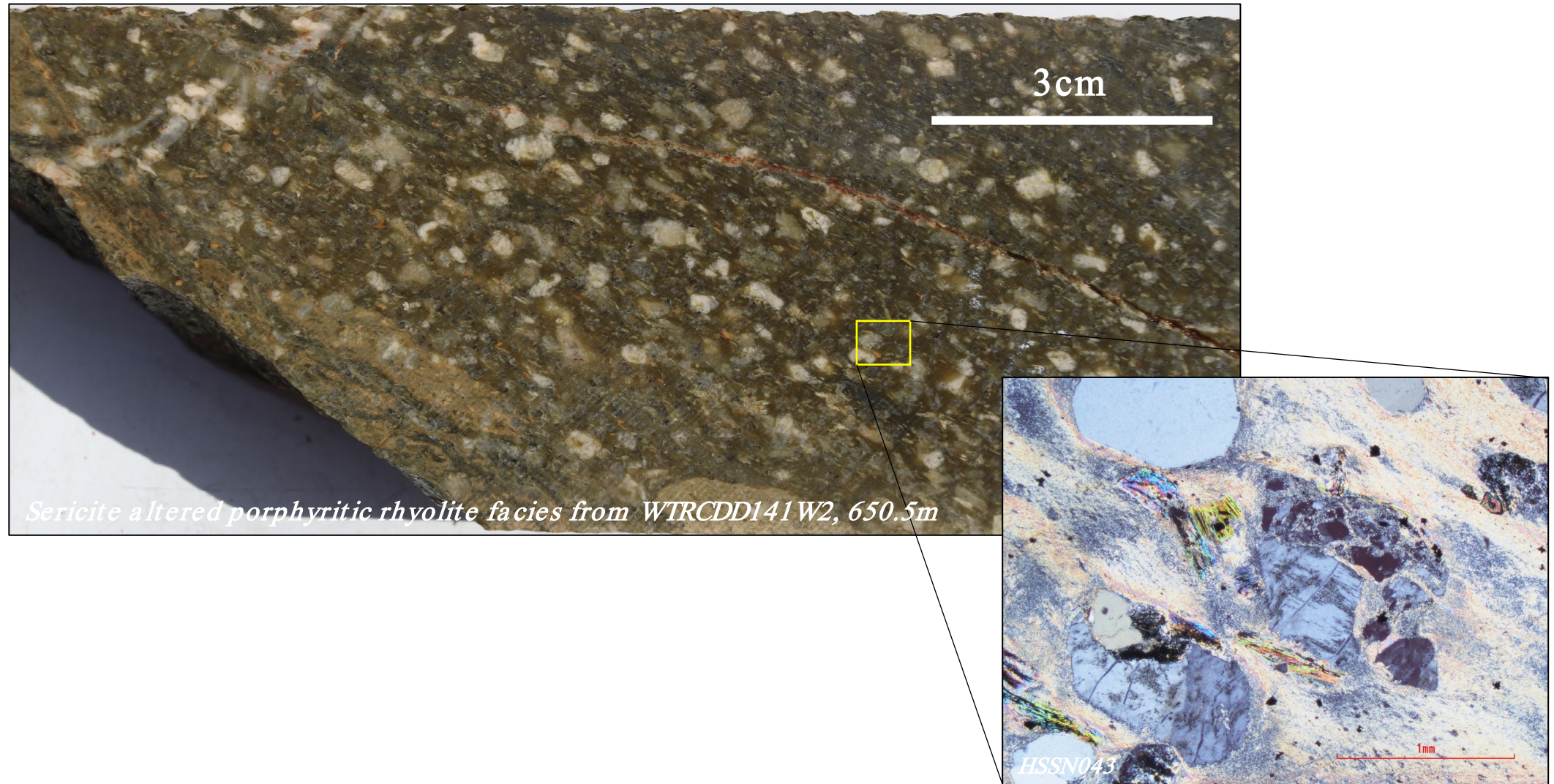
FACIES ARCHITECTURE

2. LINK ZONE – SYN-VOLCANIC DYKES AND DYKE SWARMS



FACIES ARCHITECTURE

3. LINK ZONE – HYDROTHERMAL ALTERATION THAT PREFERENTIALLY DEVELOPS IN DYKES THAT OCCUPY THE STRUCTURE OR IN THEIR ADJACENT WALL ROCKS



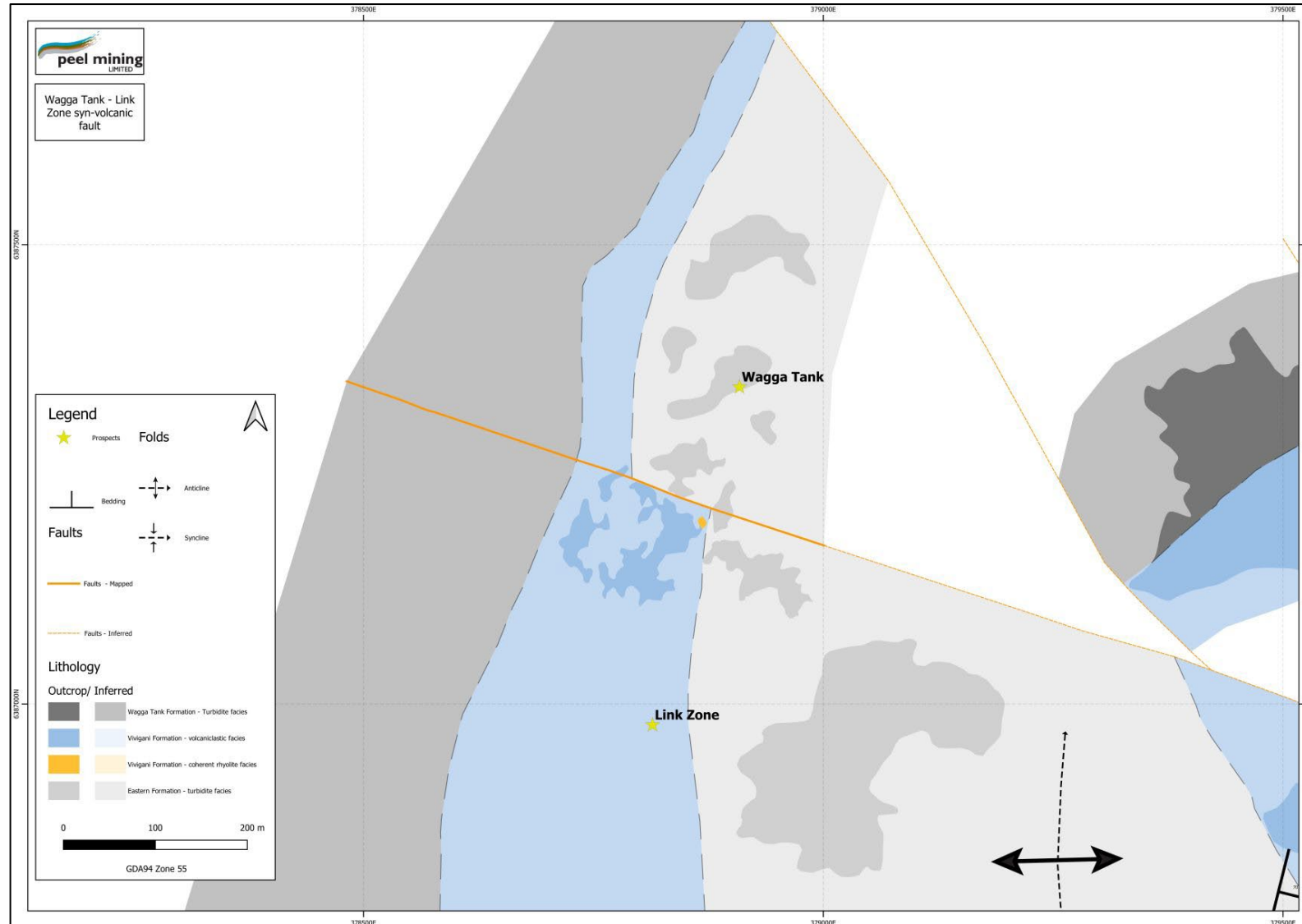
FACIES ARCHITECTURE

4. LINK ZONE – DIACHRONOUS WEDGES OF TALUS; TALUS BLOCKS; DEBRIS FLOWS



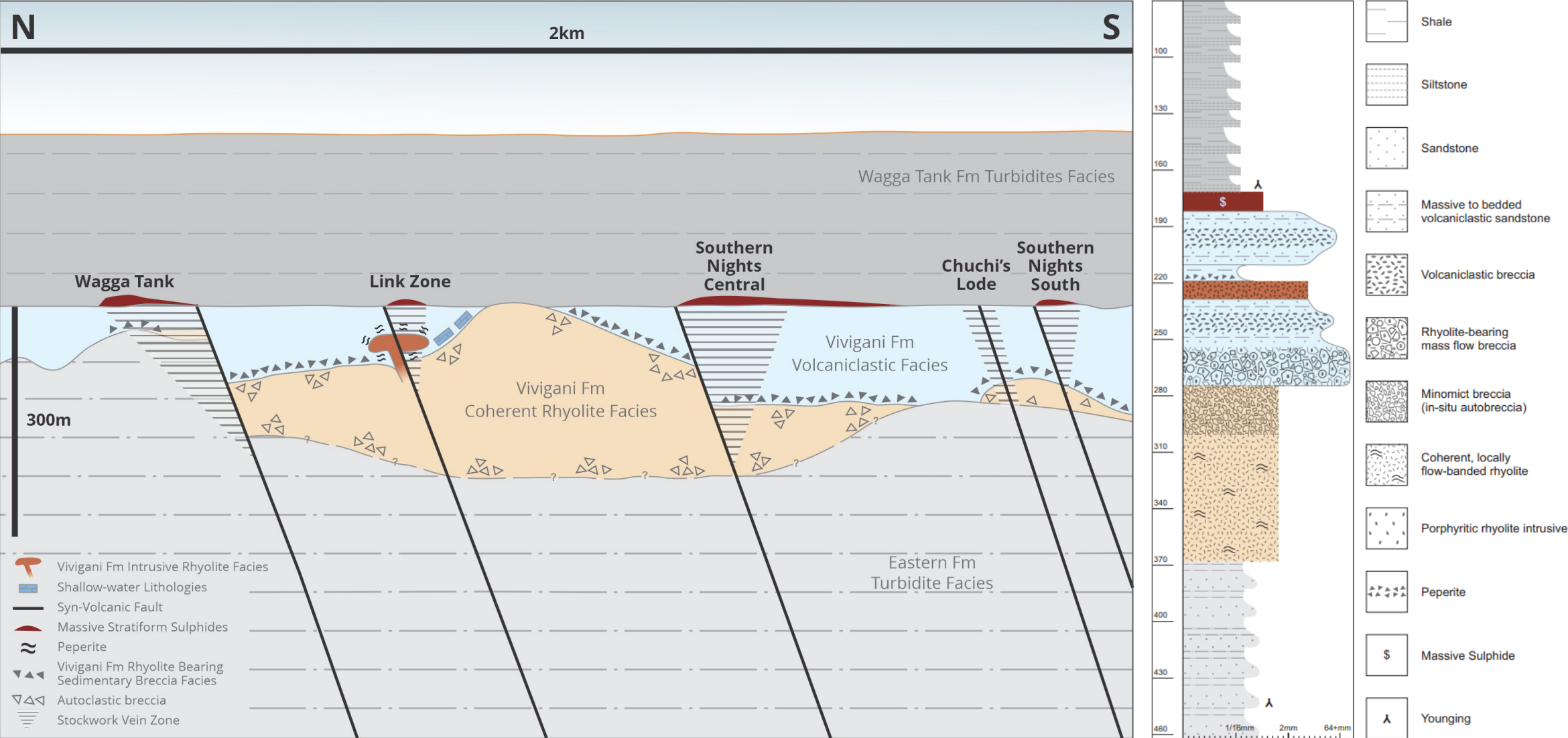
FACIES ARCHITECTURE

5. WAGGA TANK/LINK ZONE – ‘GROWTH’ OF FOOTWALL SEQUENCES OVER A SHORT LATERAL DISTANCE



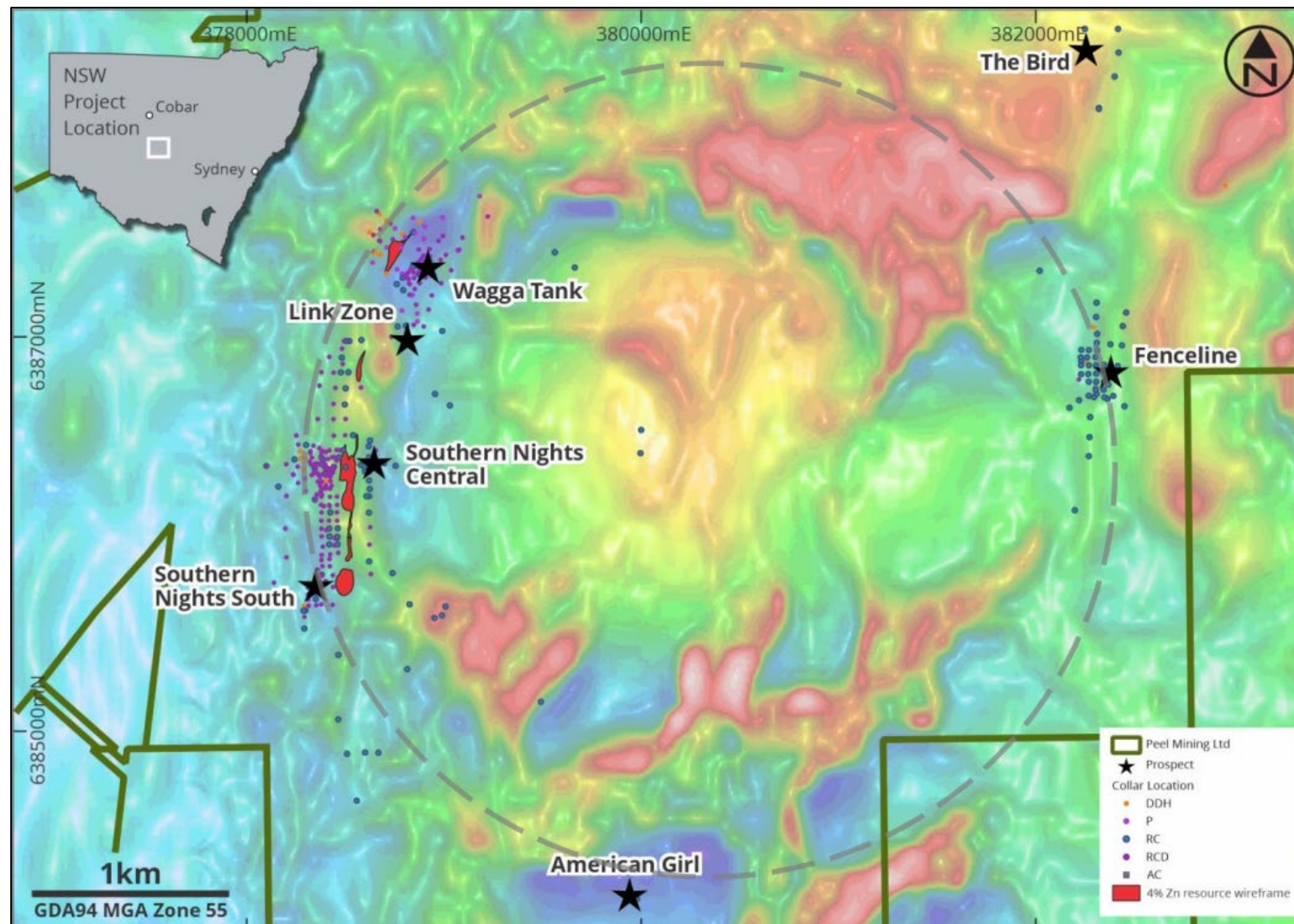
FACIES ARCHITECTURE

WAGGA TANK-SOUTHERN NIGHTS MODEL



FACIES ARCHITECTURE

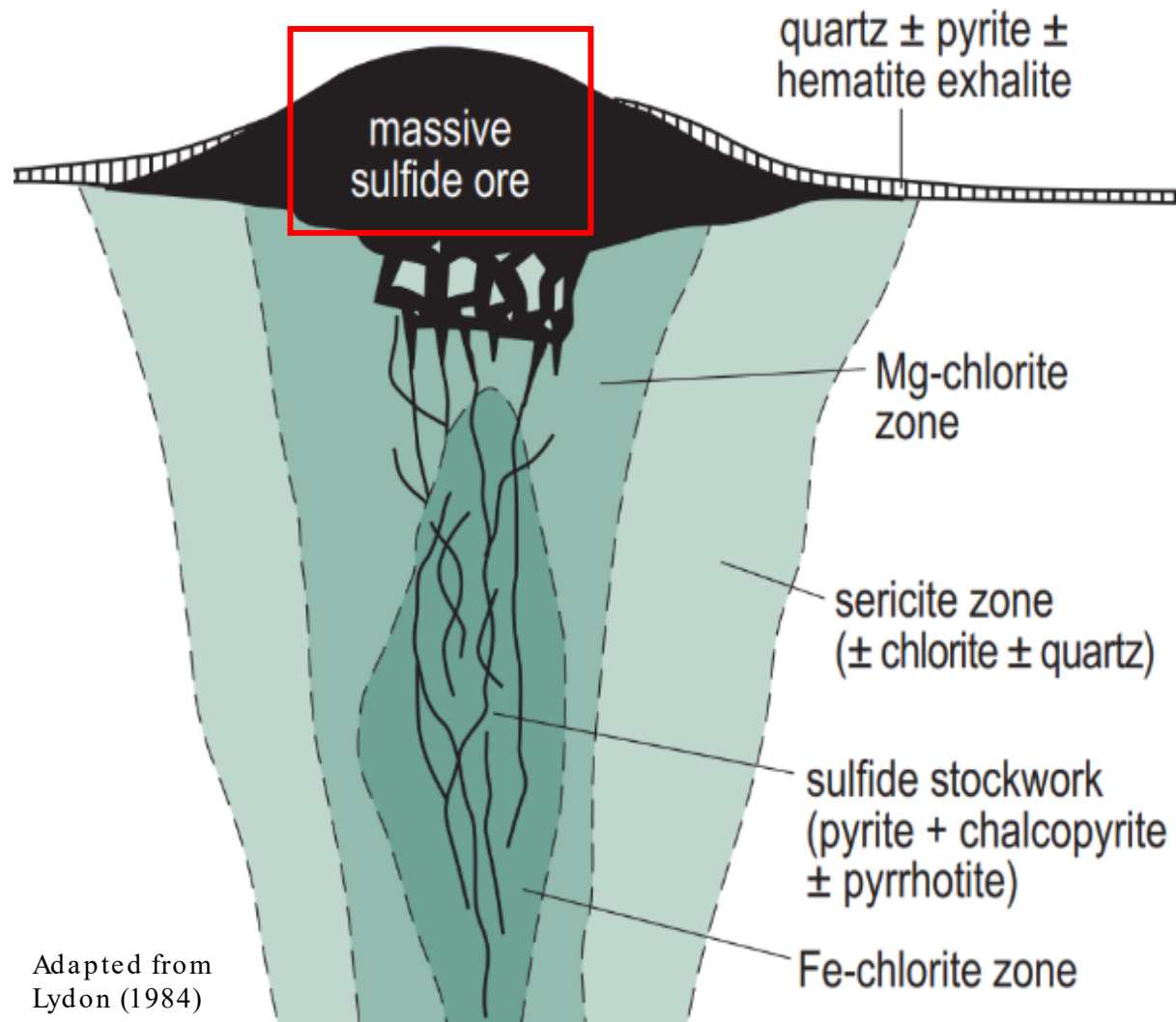
FEEDER SUB-VOLCANIC INTRUSION?



MINERALISATION & HYDROTHERMAL ALTERATION

MINERALISATION

STRATIFORM LAMINATED TO MASSIVE SULPHIDES



Adapted from
Lydon (1984)



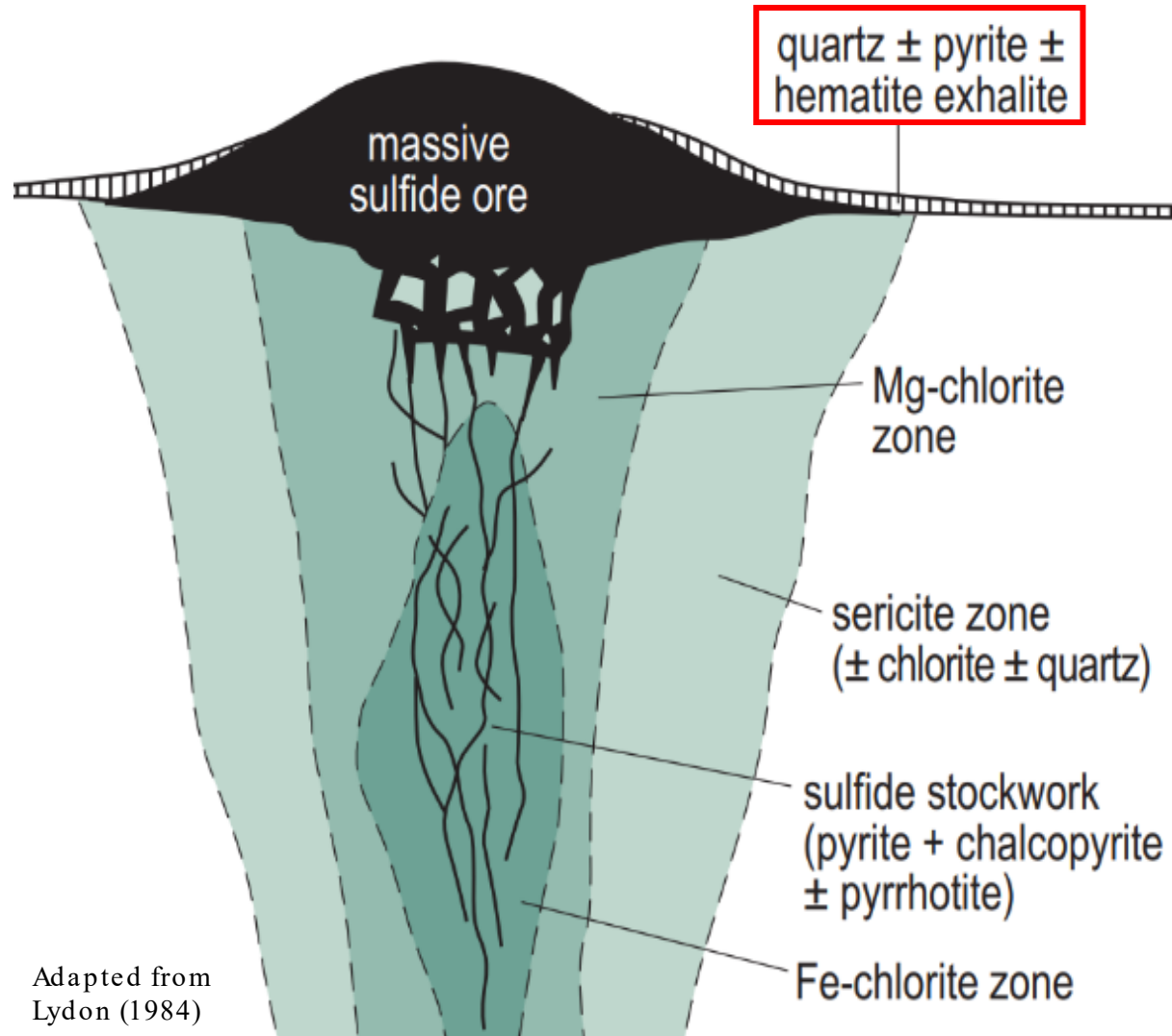
Stratiform massive sulphides from WTRCDD199, 224m



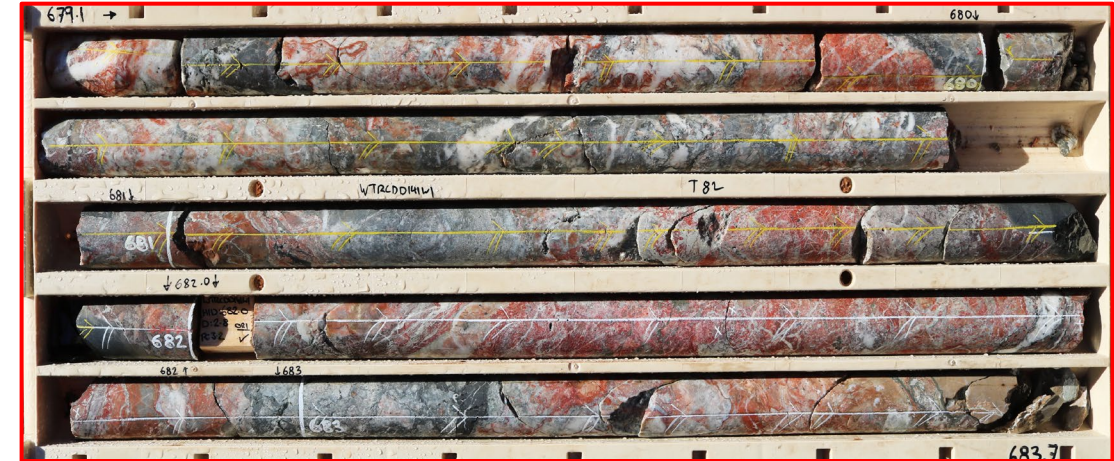
Laminated sphalerite-pyrite-galena-chalcopyrite from WTRCDD192, 358m. From Edgecombe et al. (2019)

MINERALISATION

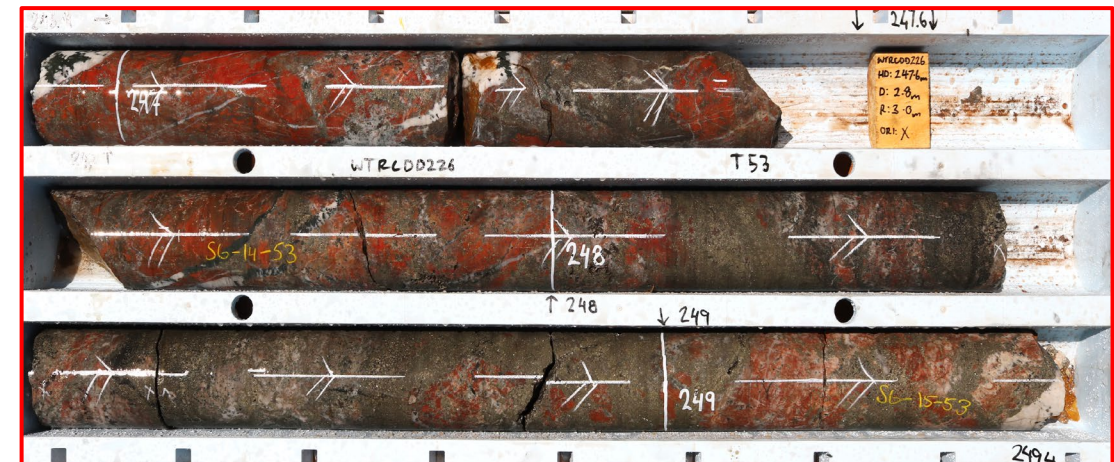
EXHALITE HORIZONS



Adapted from
Lydon (1984)



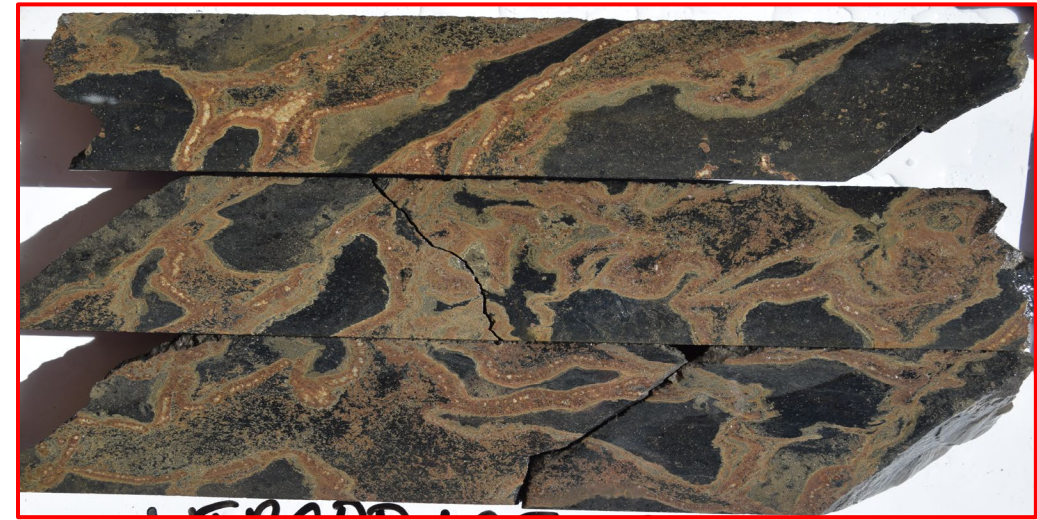
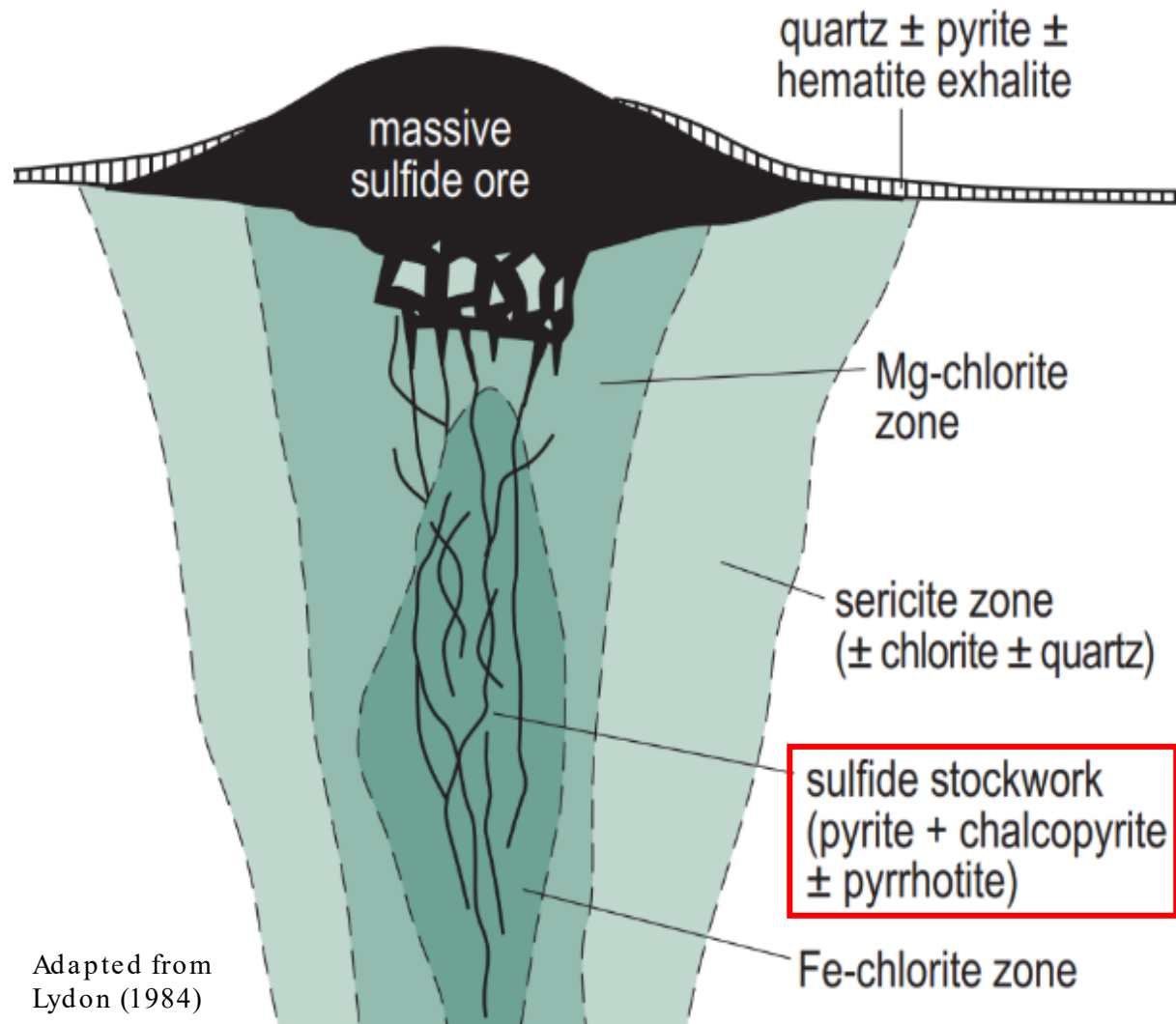
Quartz-haematite exhalite horizon from WTRCDD141W1, 679m



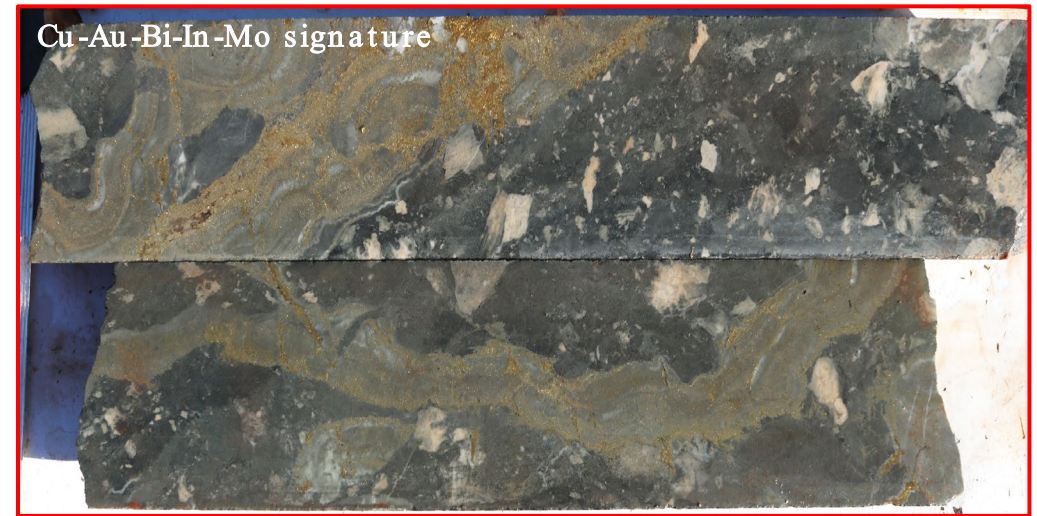
Quartz-haematite-pyrite exhalite horizon from WTRCDD226, 247m

MINERALISATION

SULPHIDE STOCKWORK ZONE



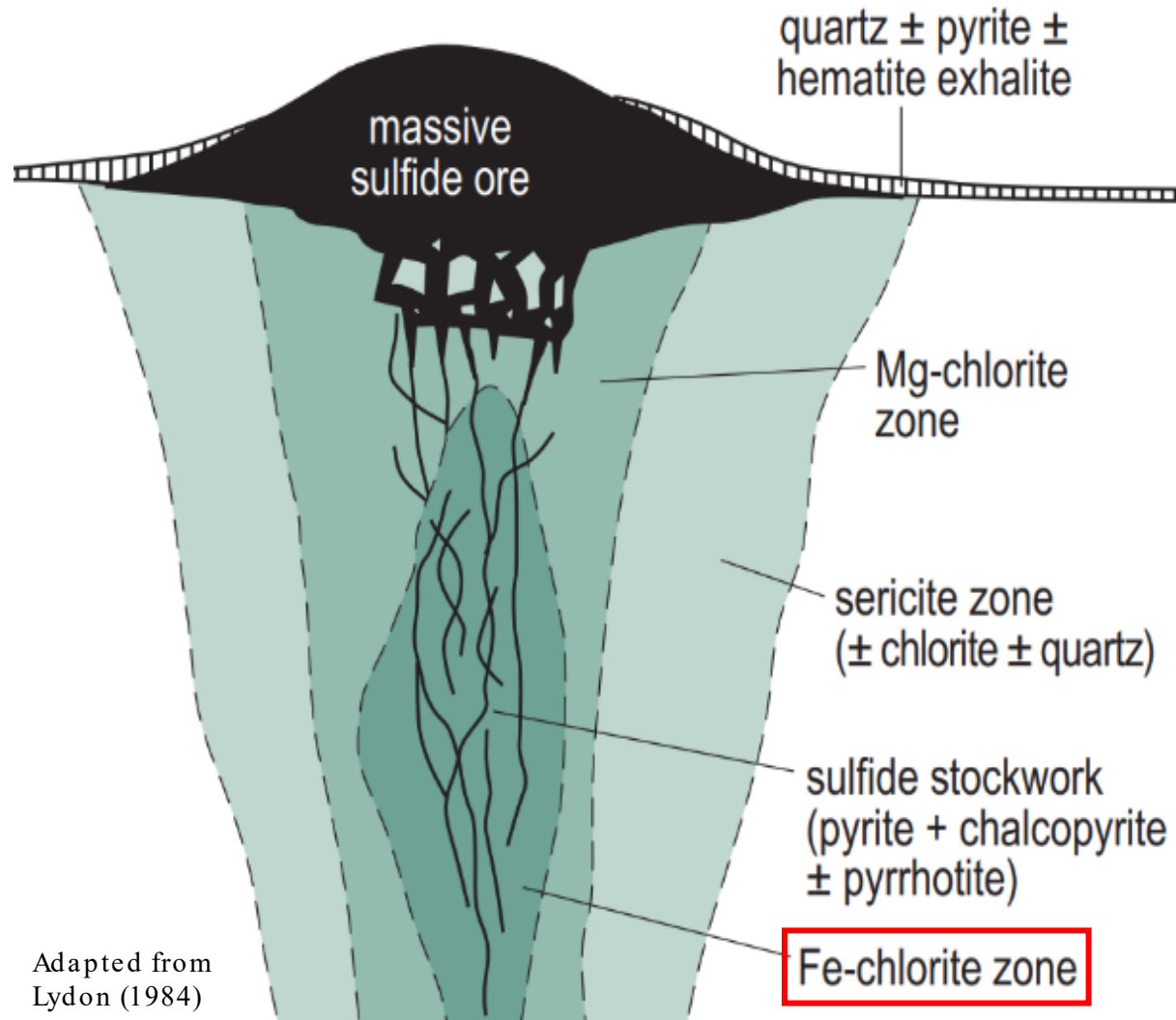
*Sphalerite-pyrite stringer veining from WTRCDD105, 265-266m.
From Edgecombe et al. (2019)*



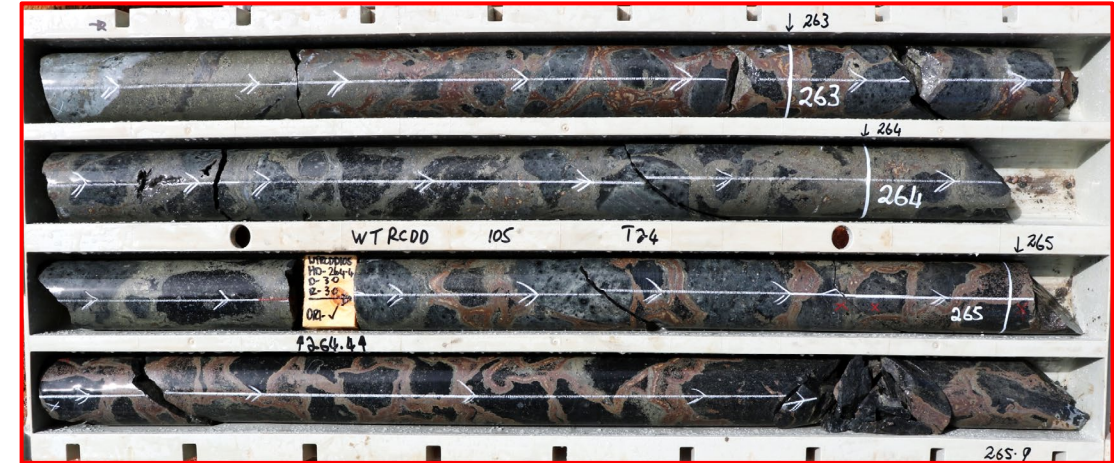
Pyrite-chalcopyrite stringer veining from WTRCDD161, 326.4-327.4m

HYDROTHERMAL ALTERATION

Fe-CHLORITE ZONE



Adapted from
Lydon (1984)



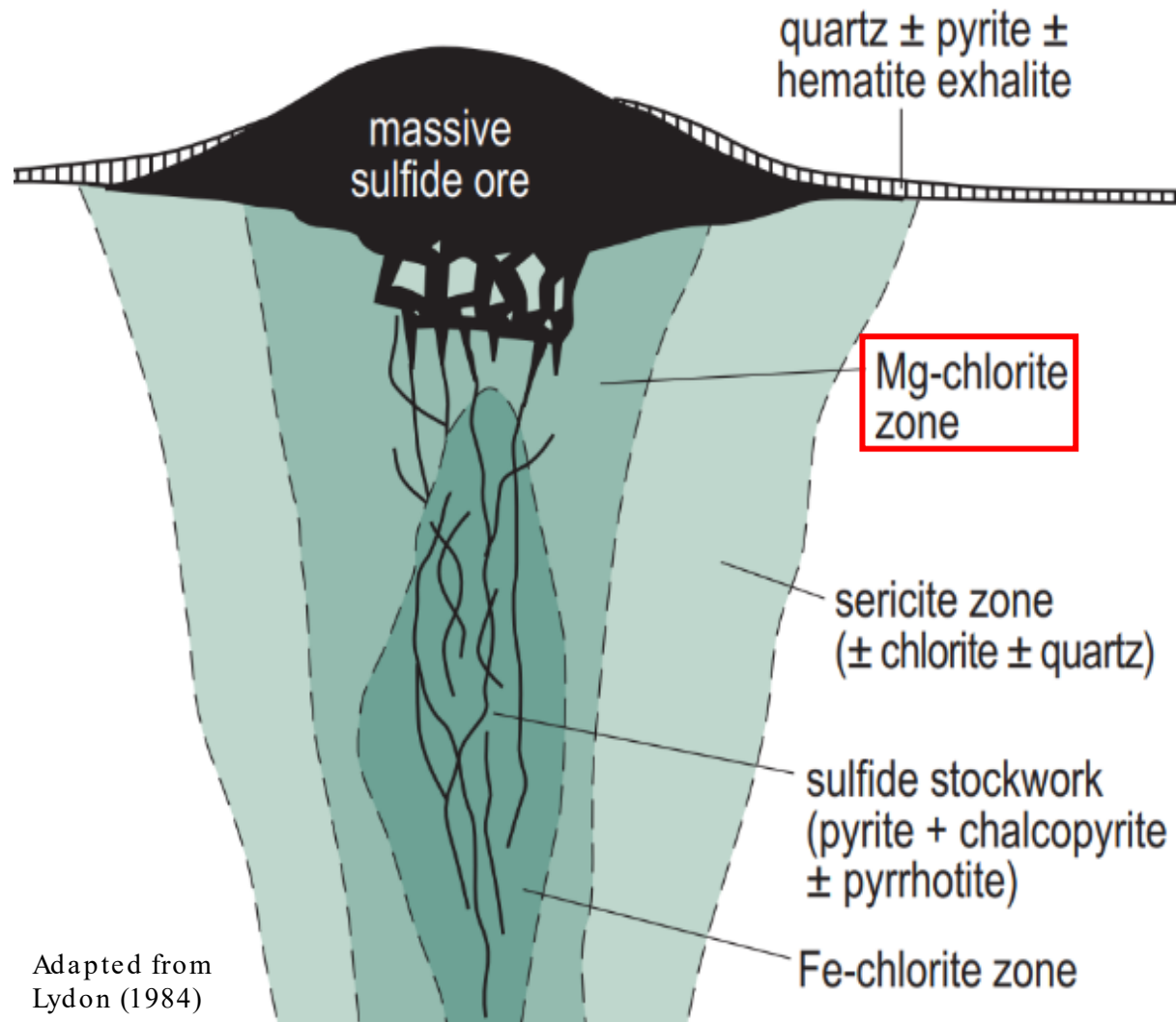
Fe-chlorite altered volcaniclastic sandstone from WTRCDD105, 263m



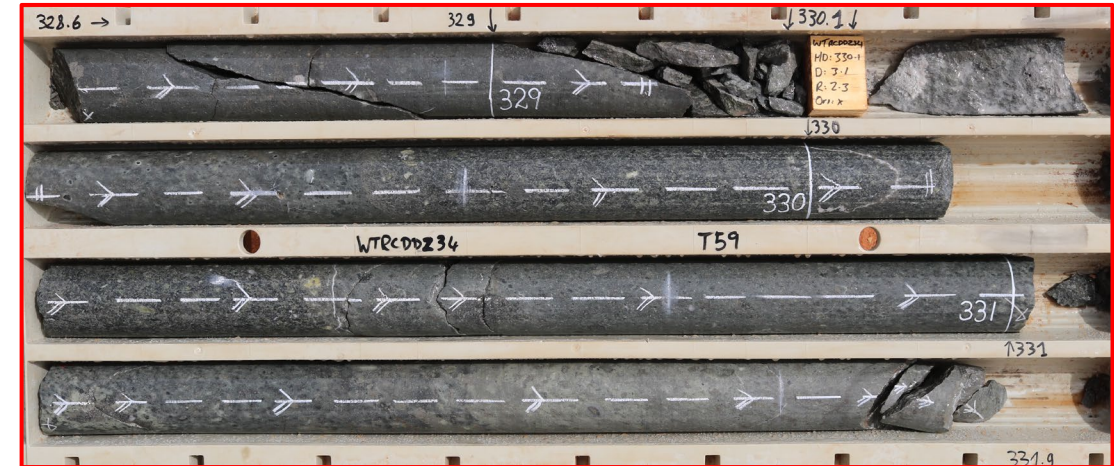
Fe-chlorite altered volcaniclastic sandstone from WTRCDD059, 255m

HYDROTHERMAL ALTERATION

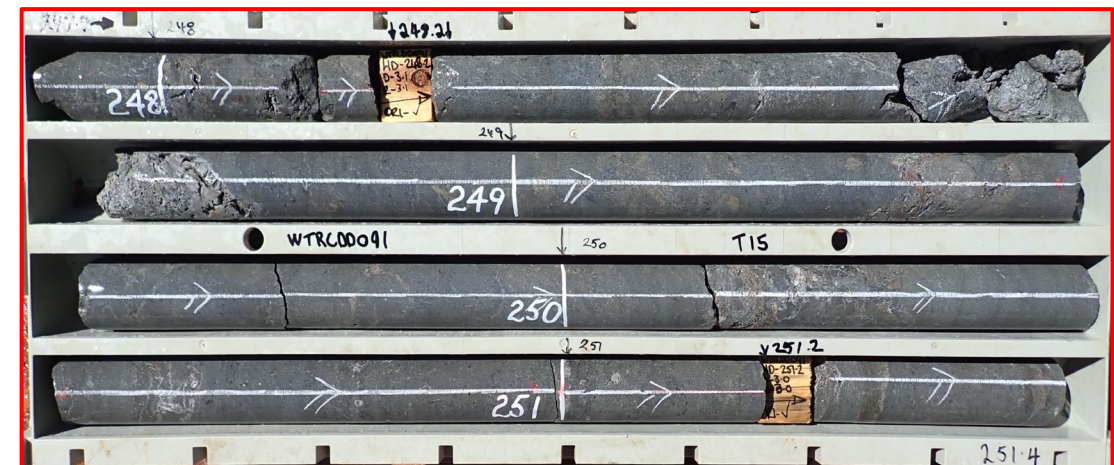
Mg-CHLORITE ZONE



Adapted from
Lydon (1984)



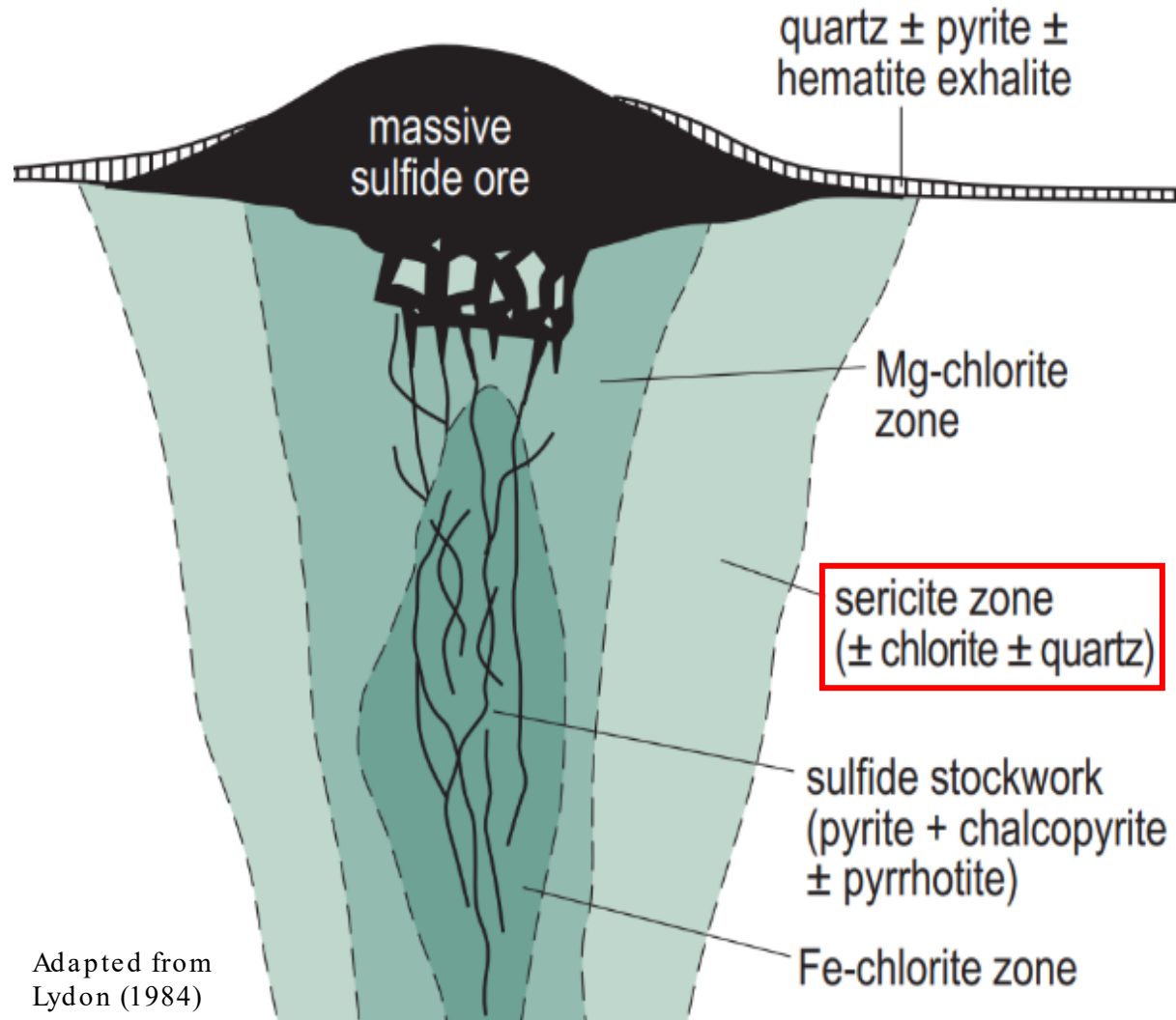
Mg-chlorite altered volcaniclastic breccia from WTRCDD234, 329m



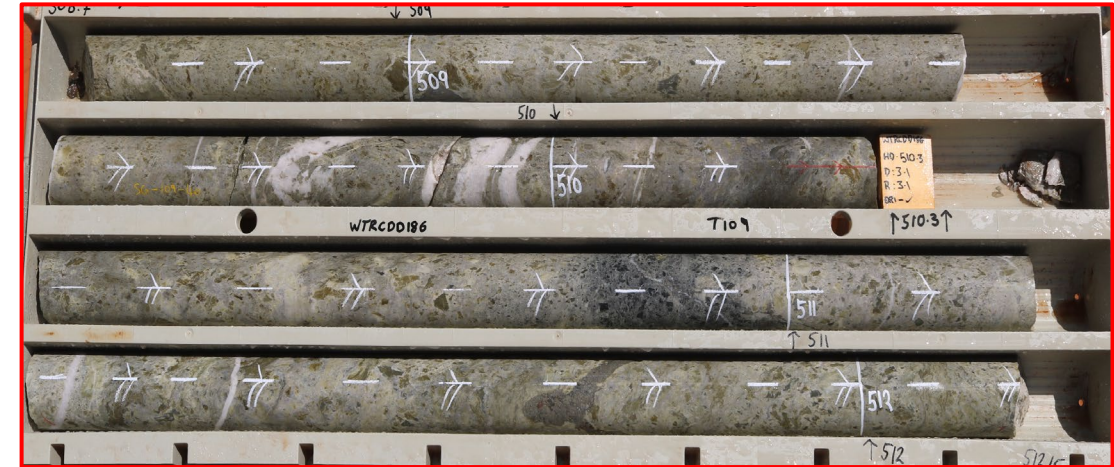
Mg-chlorite altered volcaniclastic sandstone WTRCDD091, 248m

HYDROTHERMAL ALTERATION

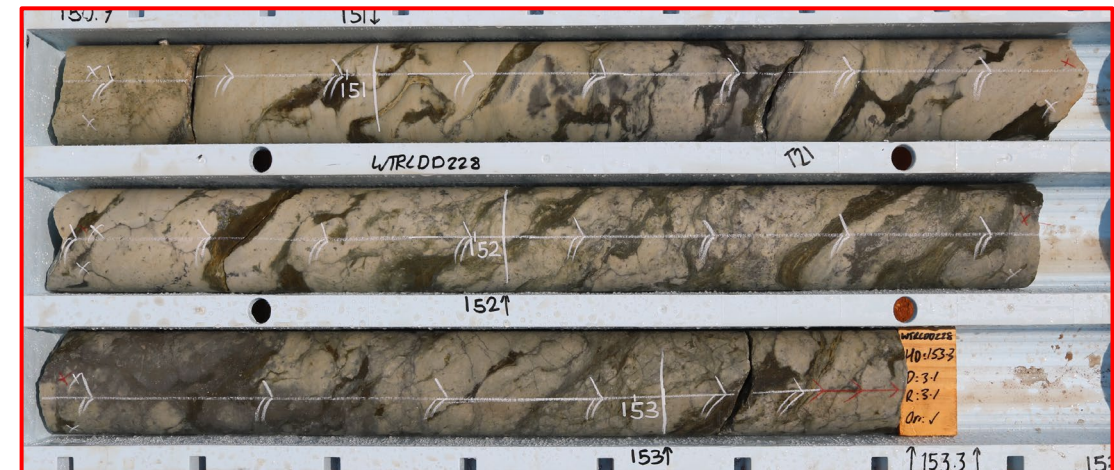
SERICITE ZONE



Adapted from
Lydon (1984)



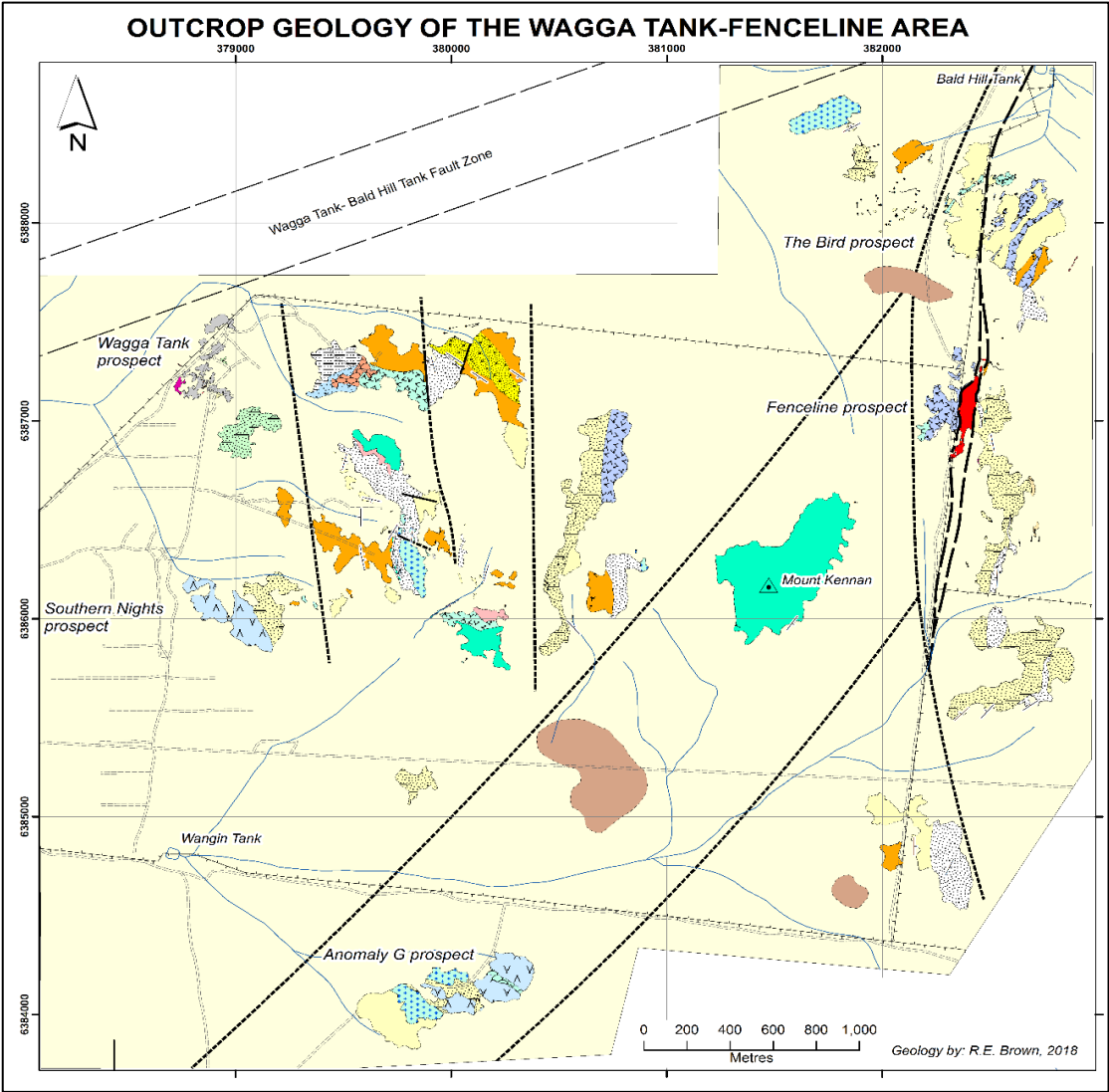
Sericite altered volcanoclastic breccia from WTRCDD186, 509m



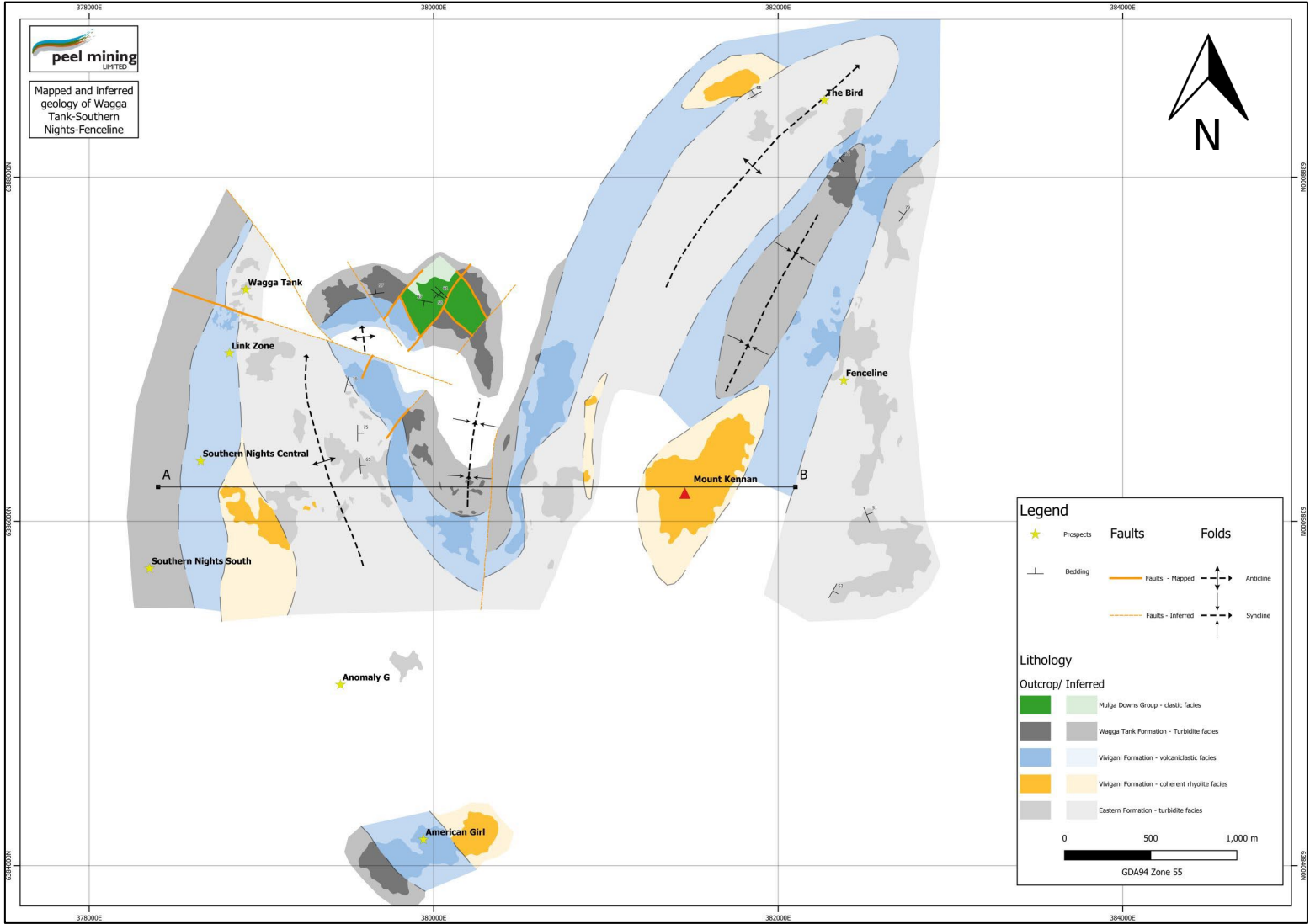
Silica-sericite altered coherent rhyolite from WTRCDD228, 151m

GEOLOGICAL MAPPING

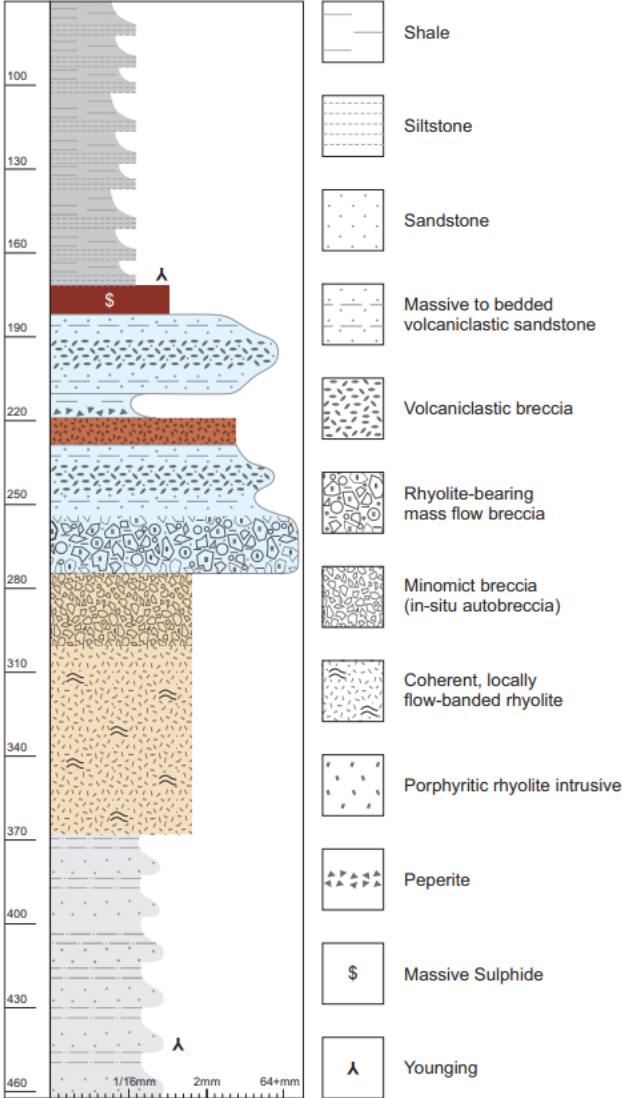
HISTORICAL MAPPING



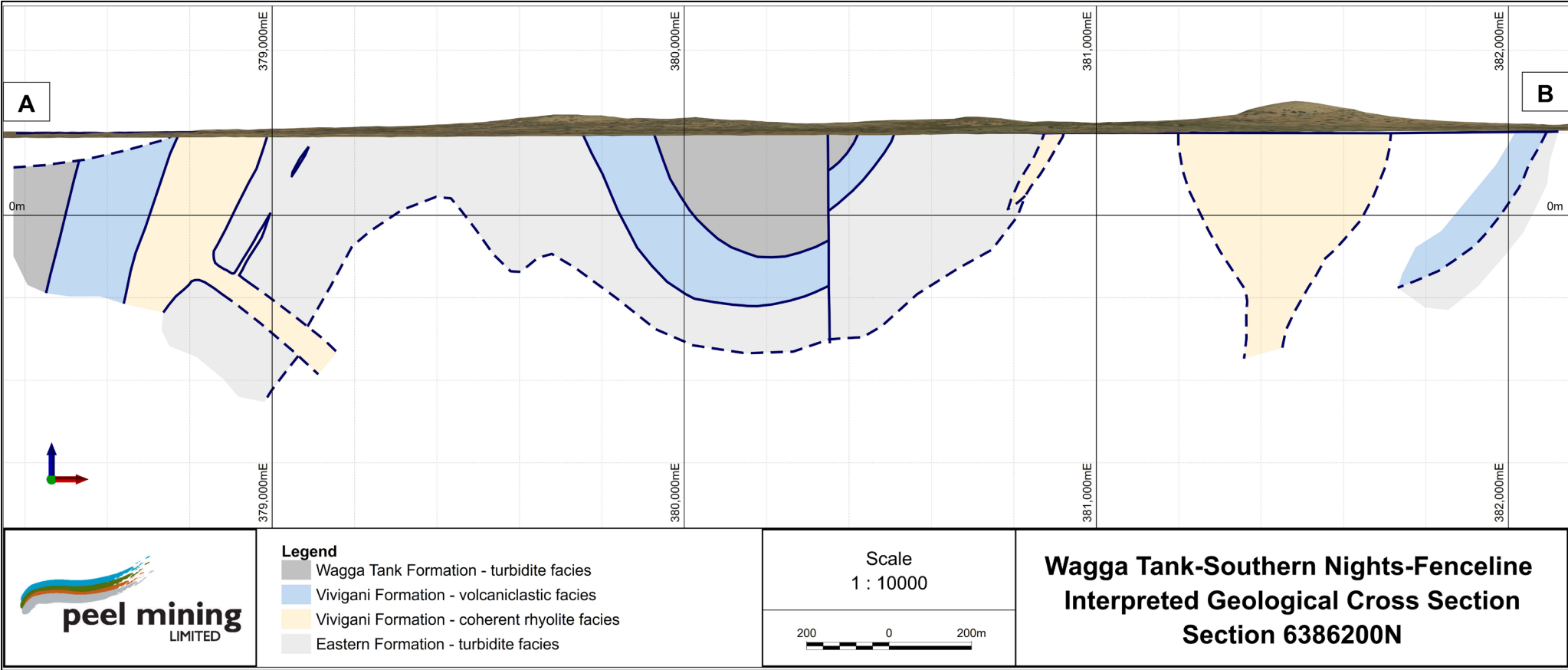
WAGGA TANK – SOUTHERN NIGHTS – FENCELINE GEOLOGICAL MAP



STRAT COLUMN LEGEND



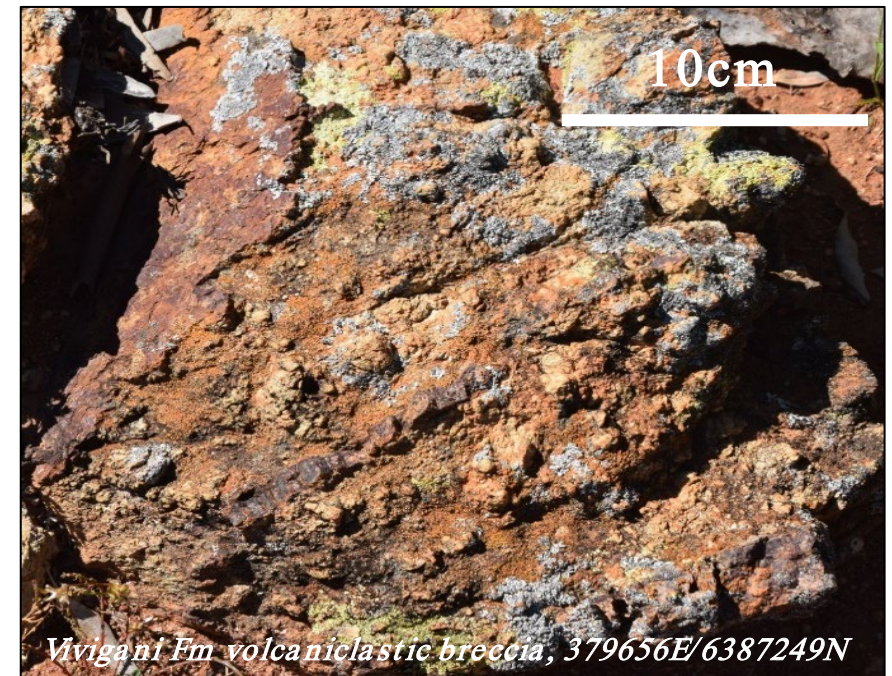
WAGGA TANK – SOUTHERN NIGHTS – FENCELINE INTERPRETED CROSS-SECTION



GEOLOGICAL MAPPING

OUTCROPS

- Outcropping Wagga Tank Formation shales
- Outcropping Vivigani Formation volcanoclastic breccia
- Gossanous volcanoclastic breccia and shale, Vivigani Formation/Wagga Tank Formation contact zone, pXRF: 153 ppm As, 2,280 ppm Bi, 628 ppm Cu, 133 ppm Mo, 83 ppm Pb, 230 ppm W, 6 ppm Zn



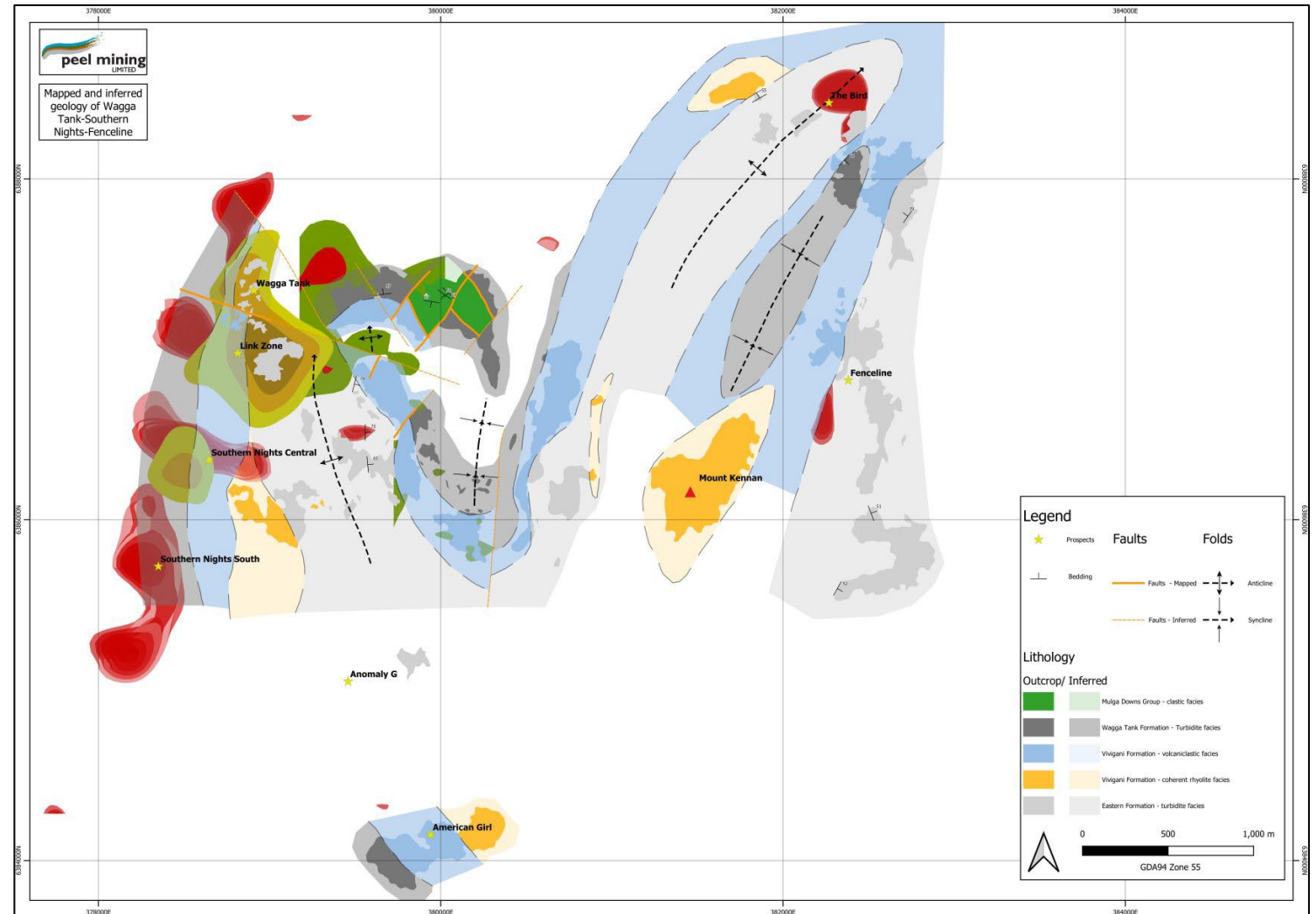
EXPLORATION

EXPLORATION

2021 DIPOLE-DIPOLE I.P SURVEY

TARGETS

- Major chargeable anomaly coincident with Link Zone volcanic centre and mapped syn-volcanic fault
- Significant chargeable anomaly SW of Southern Nights South, N of Wagga Tank and at The Bird and Fenceline
- Chargeable anomaly with coincident FLEM & AEM anomaly proximal to Wagga Tank anticline hinge
- Minor chargeable anomaly at Pine Valley syncline hinge



EXPLORATION

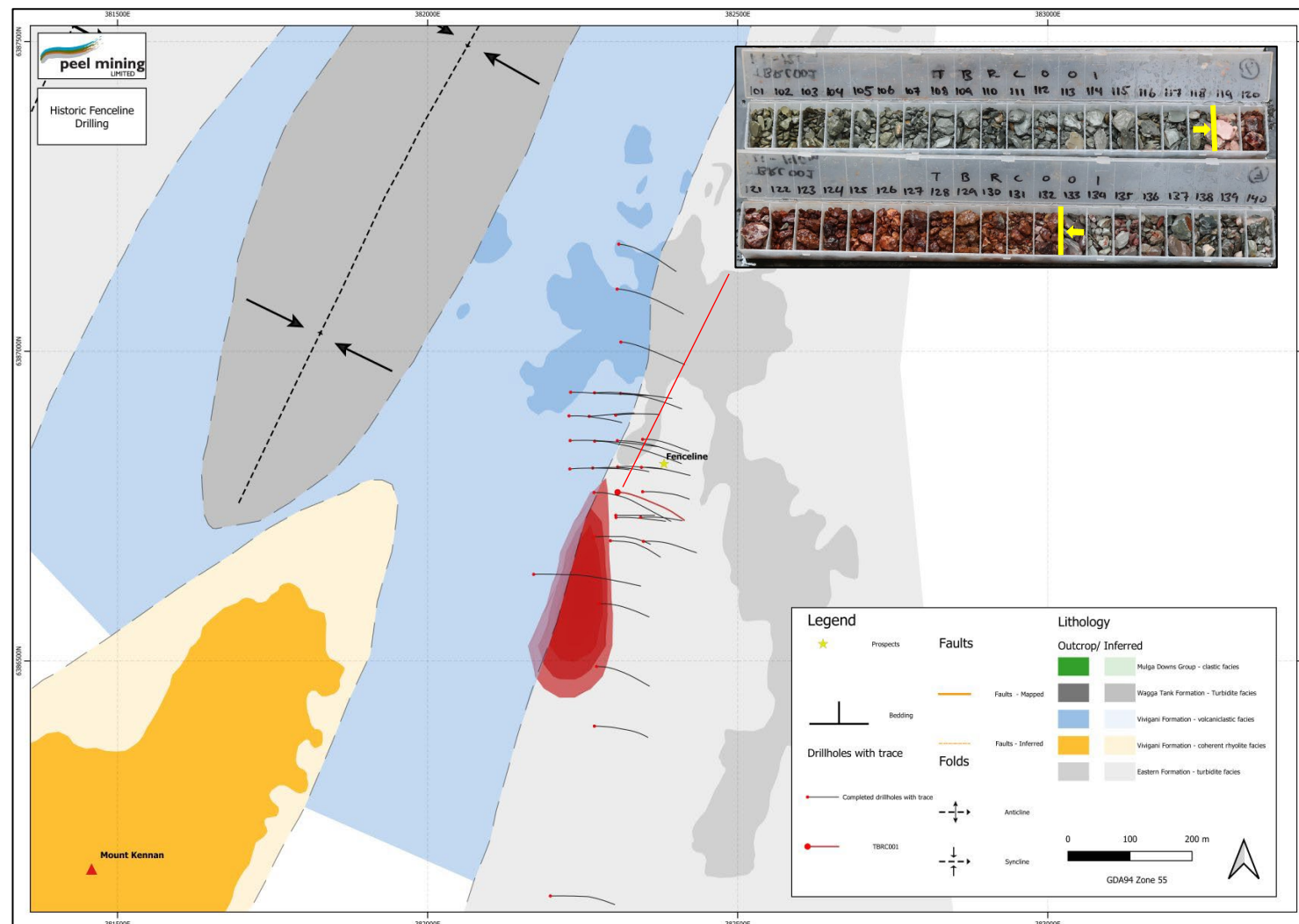
HISTORIC FENCELINE PROSPECT (Pb-Ag-Au) DRILLING

HIGHLIGHTS

- 13m @ 21.49% Pb, 120 g/t Ag & 4.36 g/t Au from 119m in TBRC001
- Previous drilling now considered to be in footwall stockwork vein zone at Vivigani Fm – Eastern Fm contact
- Prospective Wagga Tank Fm – Vivigani Fm contact is west of previous drilling

Recommendation

Drill the prospective Wagga Tank Fm-Vivigani Fm contact to the west, above TBRC001 and proximal to in-situ coherent rhyolite (Mt Kennan)



CONCLUSION

1. Used facies analysis to identify the Link Zone volcanic centre and multiple syn-volcanic faults
2. Produce a 2D facies model of the deposit that highlights their control on mineralization
3. Used geological mapping in conjunction with the model to delineate over 3.5km of prospective stratigraphy, outside of the current resource
4. Further refined targets with a dipole-dipole I.P survey
5. Used geological mapping and the facies model to show drilling at Fenceline was likely in the footwall stockwork zone and the higher-grade Wagga Tank Fm/Vivigani Fm contact remains untested

REFERENCES

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THANK YOU FOR LISTENING

