The impact of Modern Exploration Science on Overlooked Historical Mineral Fields, Charters Towers District

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AusIMM
Far North Queensland

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How application of State of the Art conventional & innovative exploration techniques are the Bedrock of Modern Scientific Exploration .

There is a dominant focus on exploration under deep cover. However,exposed mineral provinces like Charters Towers ,150 years after their discovery , can be **Overlooked & Under-Drilled** .

Examples

- **Kirk Goldfield /Jones Prospect (Denjim)** **Removed by Denjim**
- **Mingela Project (Wishbone Gold)**
- **Piccadilly (Cannindah Resources)**

EFFECTIVE CONVENTIONAL & INNOVATIVE EXPLORATION TECHNIQUES

(1)Sophisticated processing of high quality geophysics data sets –aeromag, radiometrics,gravity etc.

(2) Modelling of Intrusive scale mineral systems

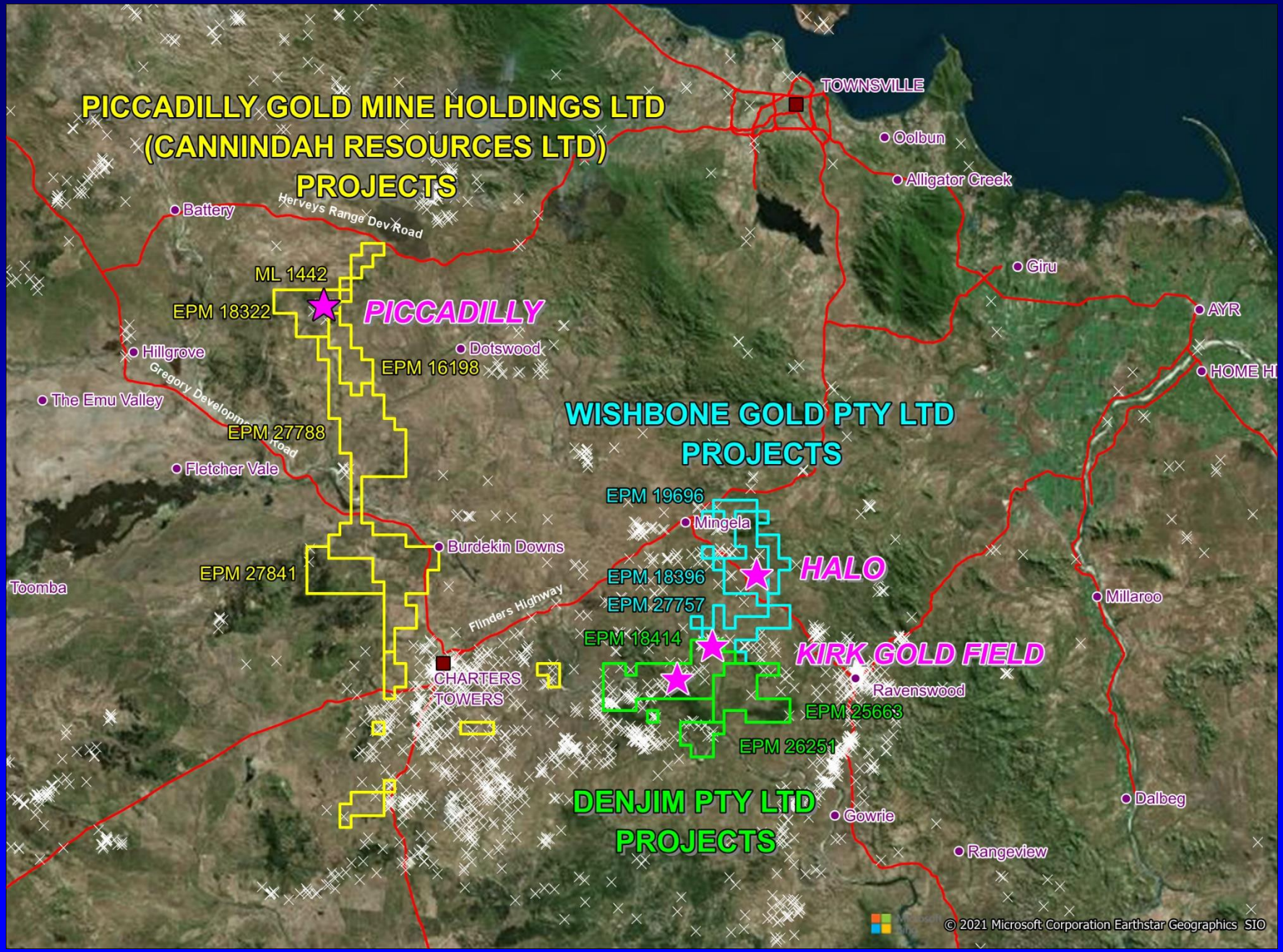
(3) Identification of hydrothermal channelways by means of alteration & structural mapping supported by :

(4) High Resolution Ground Magnetics/Processing,

(5) Delineation of multi-element geochemical zoning , Lab & PXRF analyses

(6) Sophisticated statistics utilizing powerful Principal Component Analysis (PCA).

(7) End result is much more effective drill targeting which can be greatly enhanced with geophysics (EM,IP, etc)


PICCADILLY GOLD MINE HOLDINGS LTD
(CANNINDAH RESOURCES LTD)
PROJECTS
TOWNSVILLE
Oolbun
Alligator Creek
Giru
AYR
HOME HI
Battery
Hervey Range Dev Road
ML 1442
EPM 18322
PICCADILLY
Dotswood
EPM 16198
Hillgrove
Gregory Development Road
The Emu Valley
EPM 27788
Fletcher Vale
WISHBONE GOLD PTY LTD
PROJECTS
EPM 19696
Mingela
Burdekin Downs
EPM 27841
Toomba
EPM 18396
HALO
EPM 27757
Flinders Highway
Millaroo
EPM 18414
KIRK GOLD FIELD
CHARTERS
TOWERS
Ravenswood
EPM 25663
EPM 26251
DENJIM PTY LTD
PROJECTS
Gowrie
Dalbeg
Rangeview
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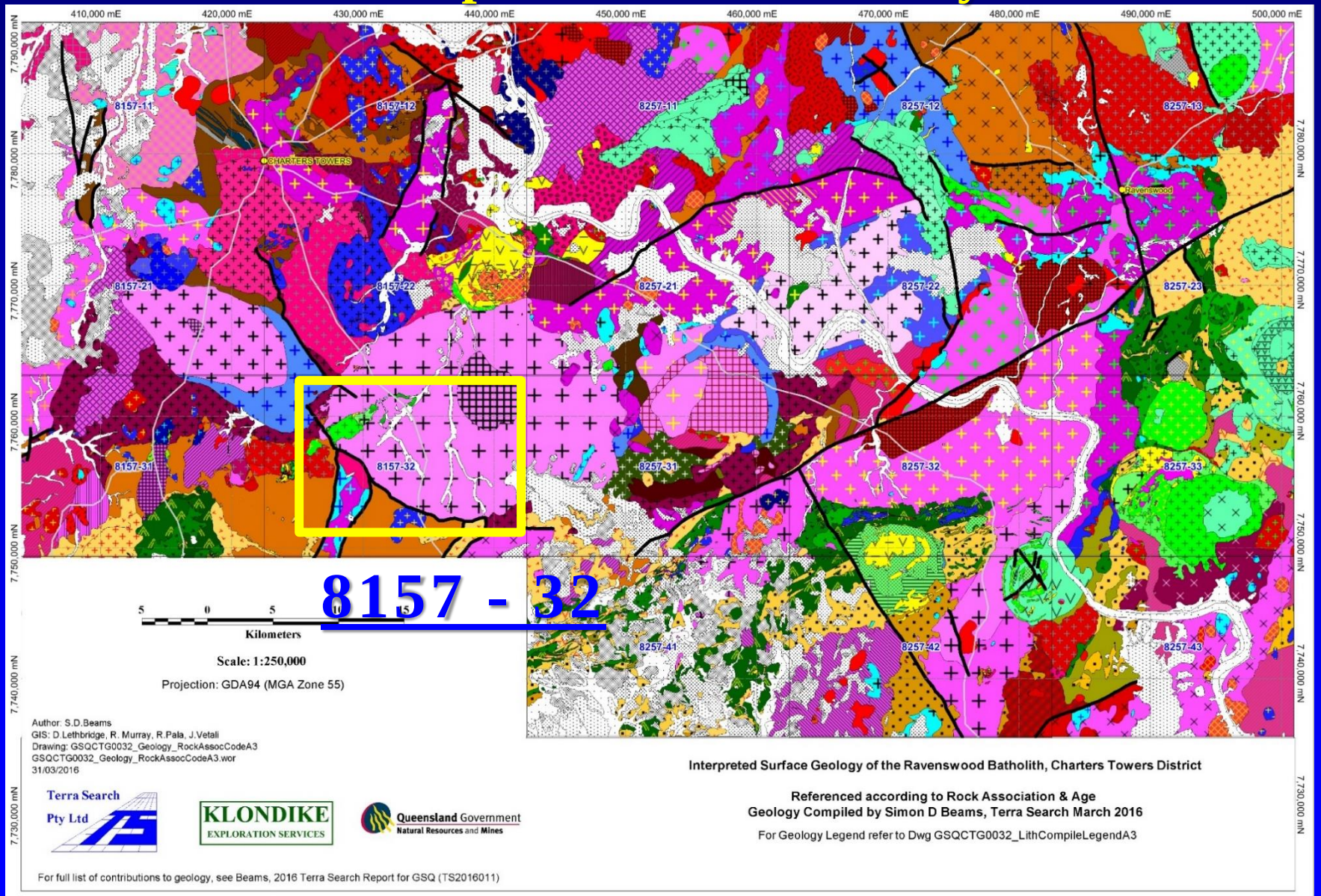
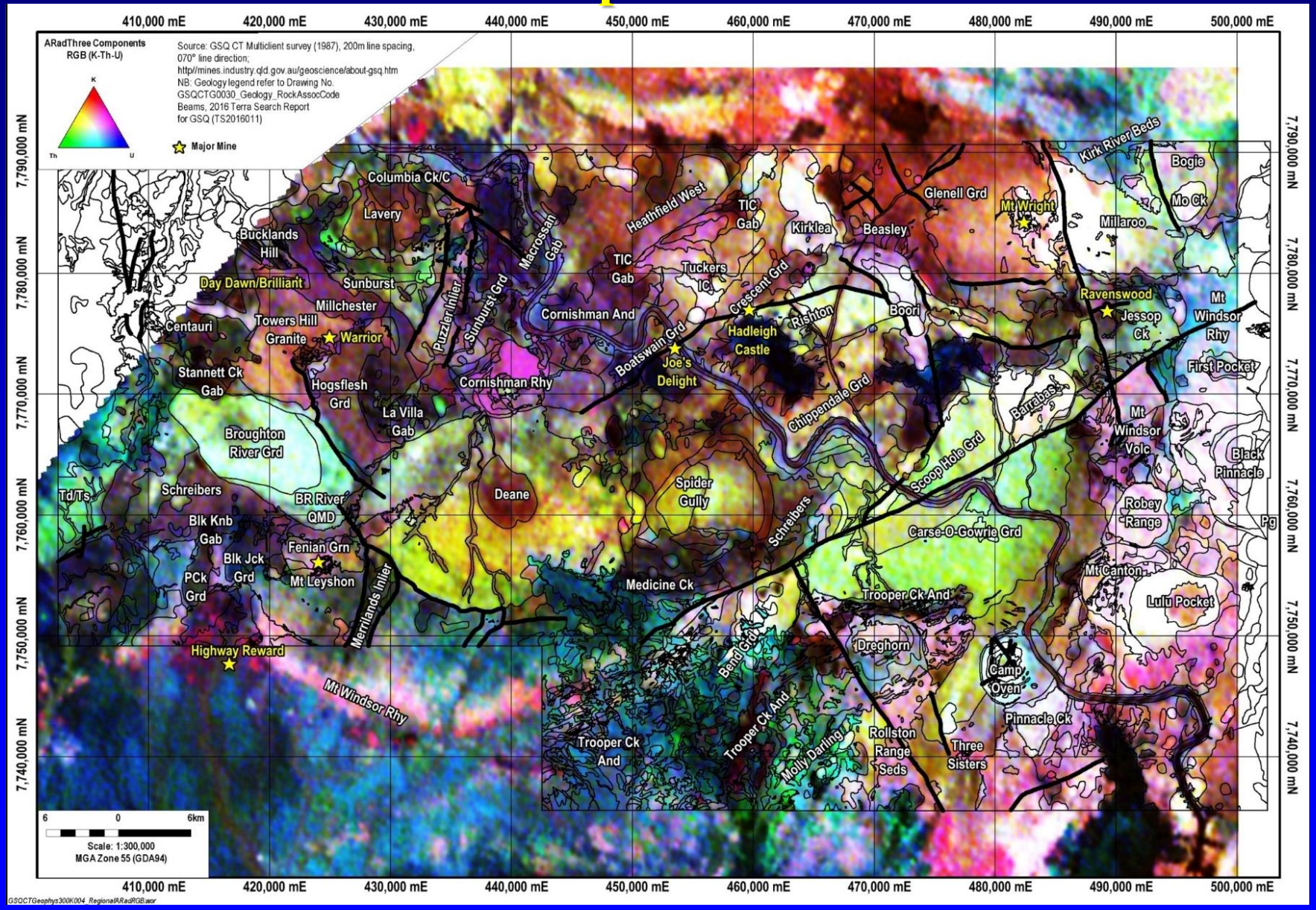
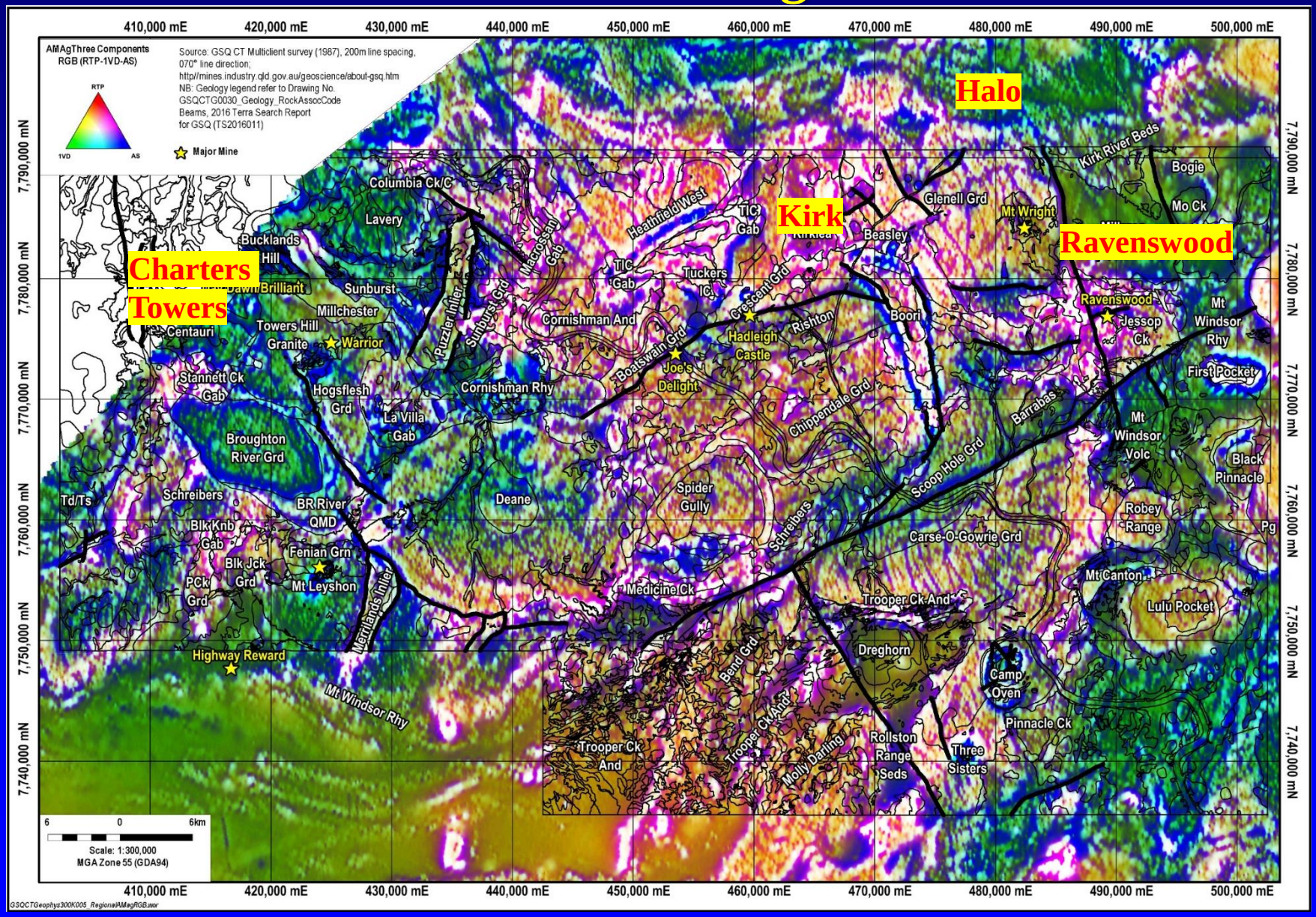
Updated Geology Charters Towers-Ravenswood – Complex Intrusive History-

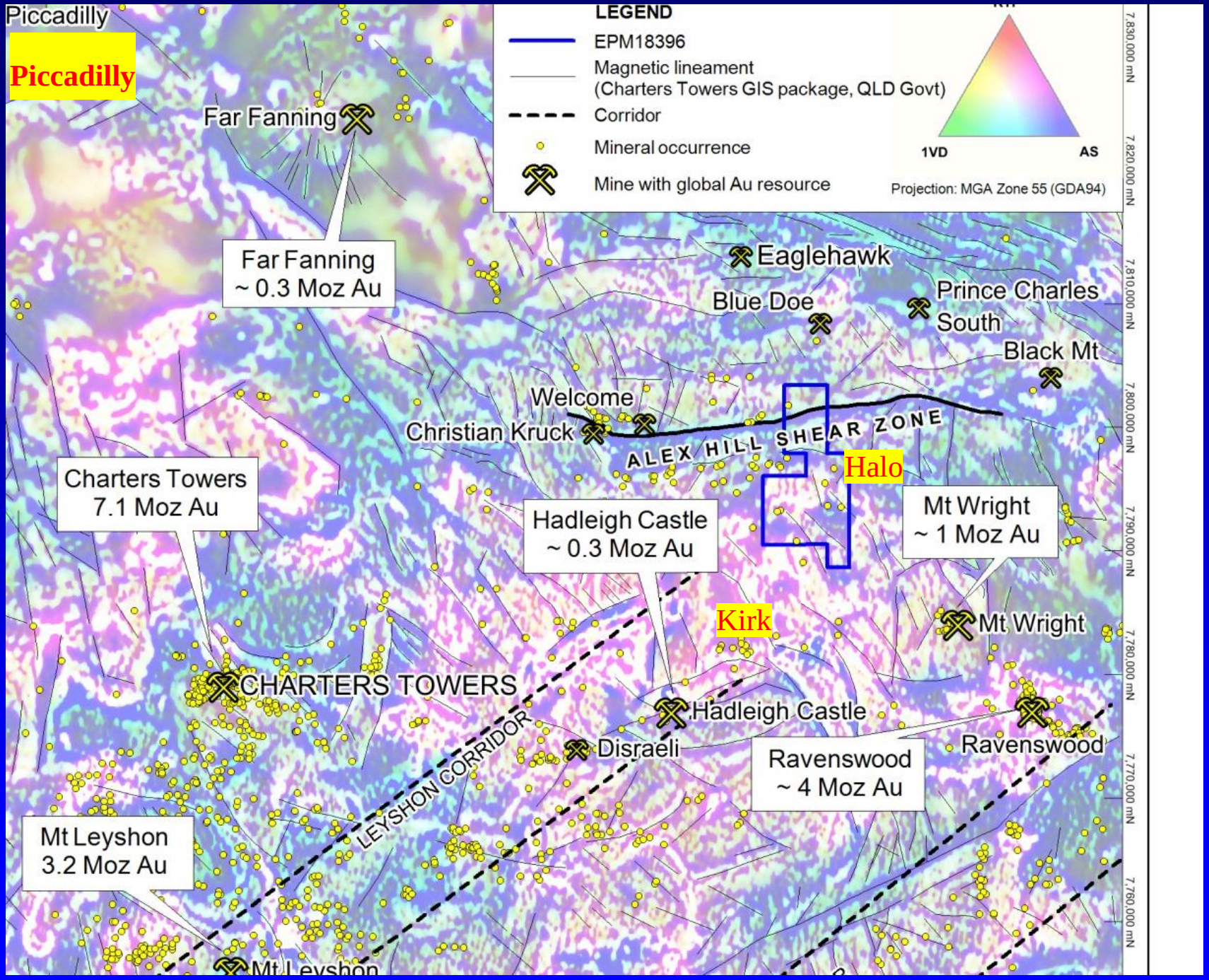


Charters Towers-Ravenswood High Quality Data Sets Available to modern explorer : RGB Radiometrics

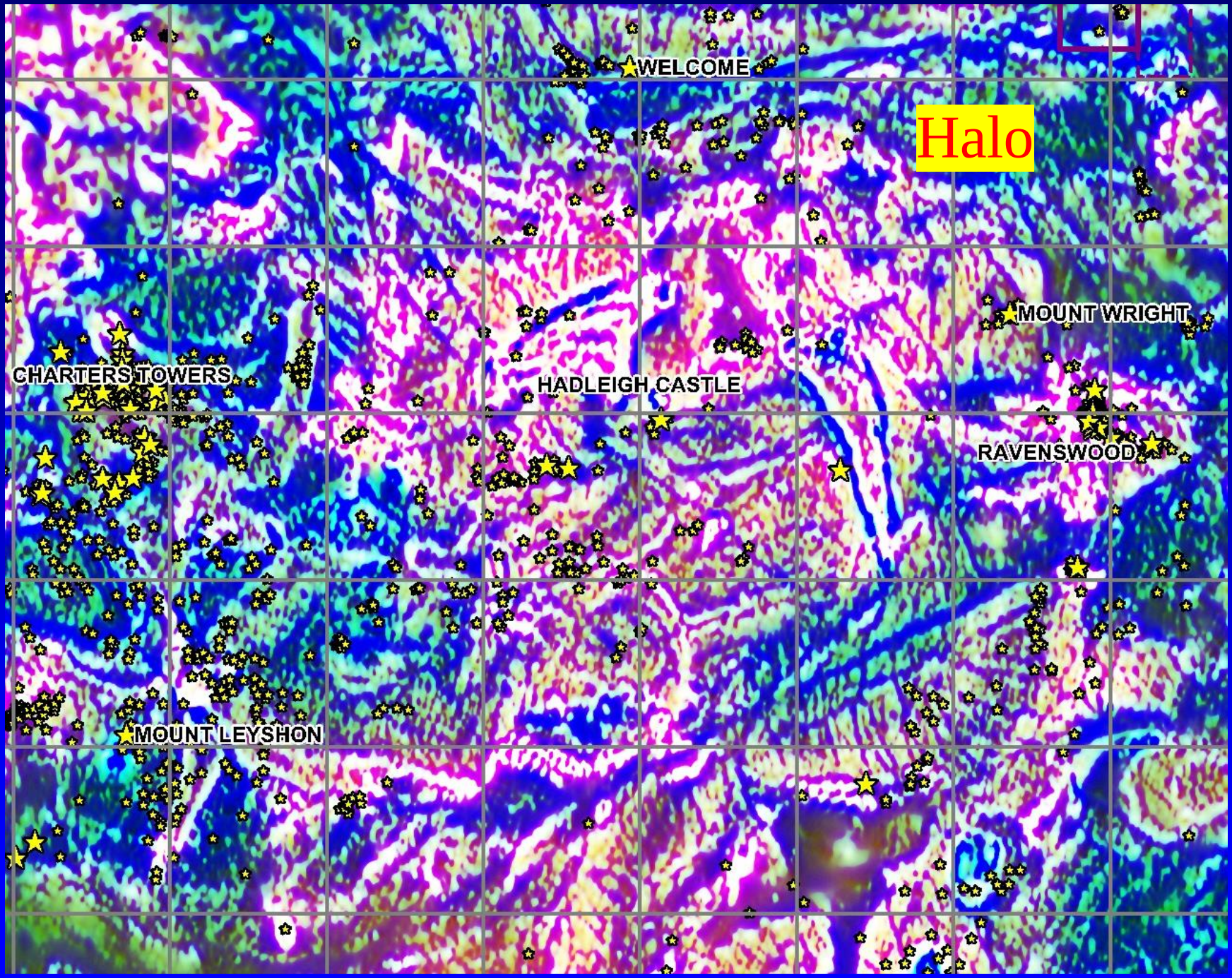


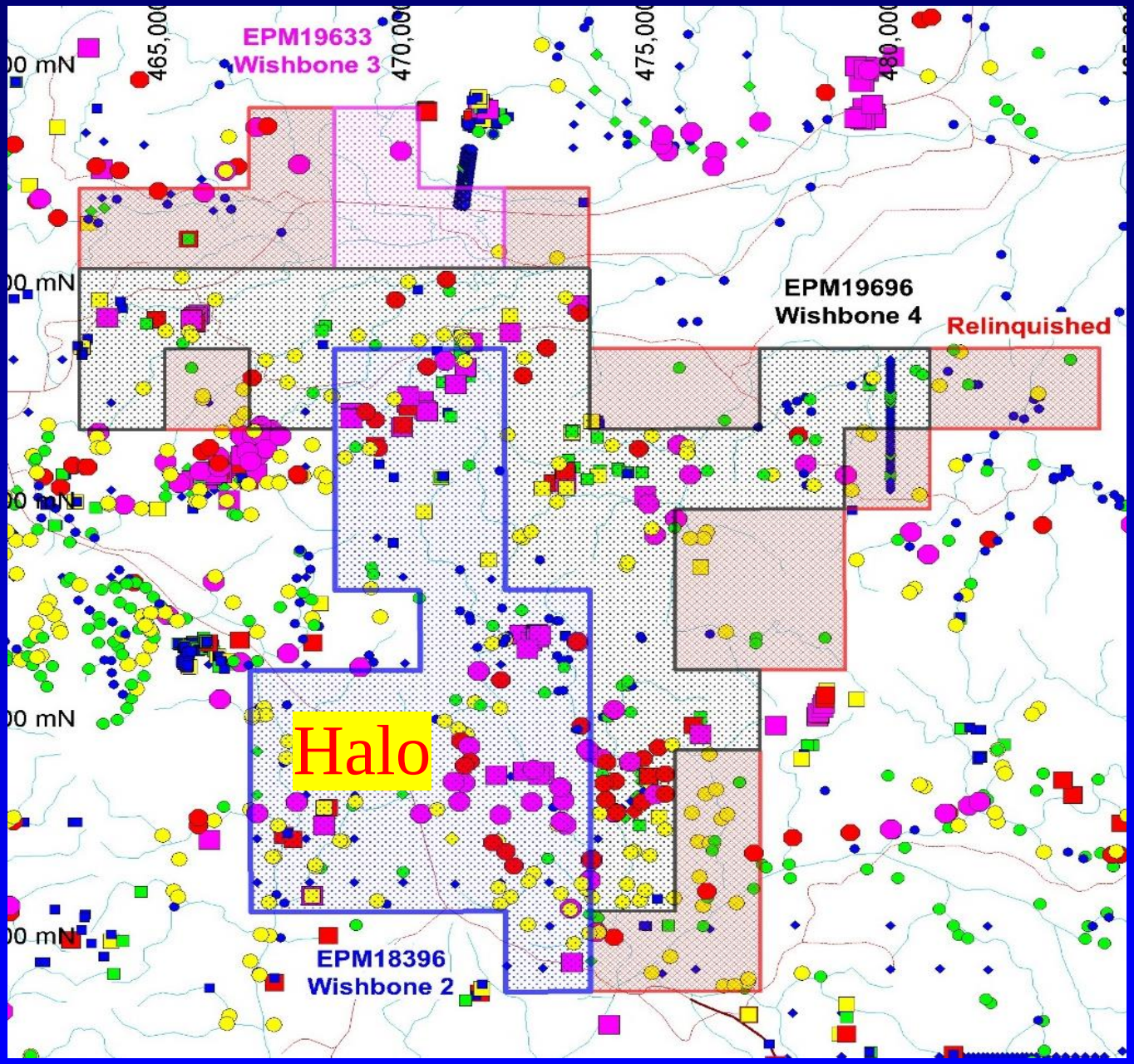
Charters Towers-Ravenswood 3 Component RTP-1VD-AS magnetics




Piccadilly
Piccadilly
LEGEND
EPM18396
Magnetic lineament
(Charters Towers GIS package, QLD Govt)
Corridor
Mineral occurrence
Mine with global Au resource
1VD
AS
Projection: MGA Zone 55 (GDA94)
Far Fanning
Far Fanning
~ 0.3 Moz Au
Eaglehawk
Blue Doe
Prince Charles
South
Black Mt
Welcome
Christian Kruck
ALEX HILL SHEAR ZONE
Halo
Charters Towers
7.1 Moz Au
Hadleigh Castle
~ 0.3 Moz Au
Mt Wright
~ 1 Moz Au
Kirk
Mt Wright
CHARTERS TOWERS
Hadleigh Castle
Disraeli
LEYSHON CORRIDOR
Ravenswood
Ravenswood
~ 4 Moz Au
Mt Leyshon
3.2 Moz Au
Mt Leyshon
7,830,000 mN
7,820,000 mN
7,810,000 mN
7,800,000 mN
7,790,000 mN
7,780,000 mN
7,770,000 mN
7,760,000 mN

Between Ravenswood & Charters Towers both 5 million plus ounce gold fields.10-20km from Mt Wright and Ravenswood


WELCOME
Halo
MOUNT WRIGHT
CHARTERS TOWERS
HADLEIGH CASTLE
RAVENSWOOD
MOUNT LEYSHON



Open File Seds by Cu (ppm)

- >50
- 25 to 50
- 10 to 25
- 5 to 10
- <5

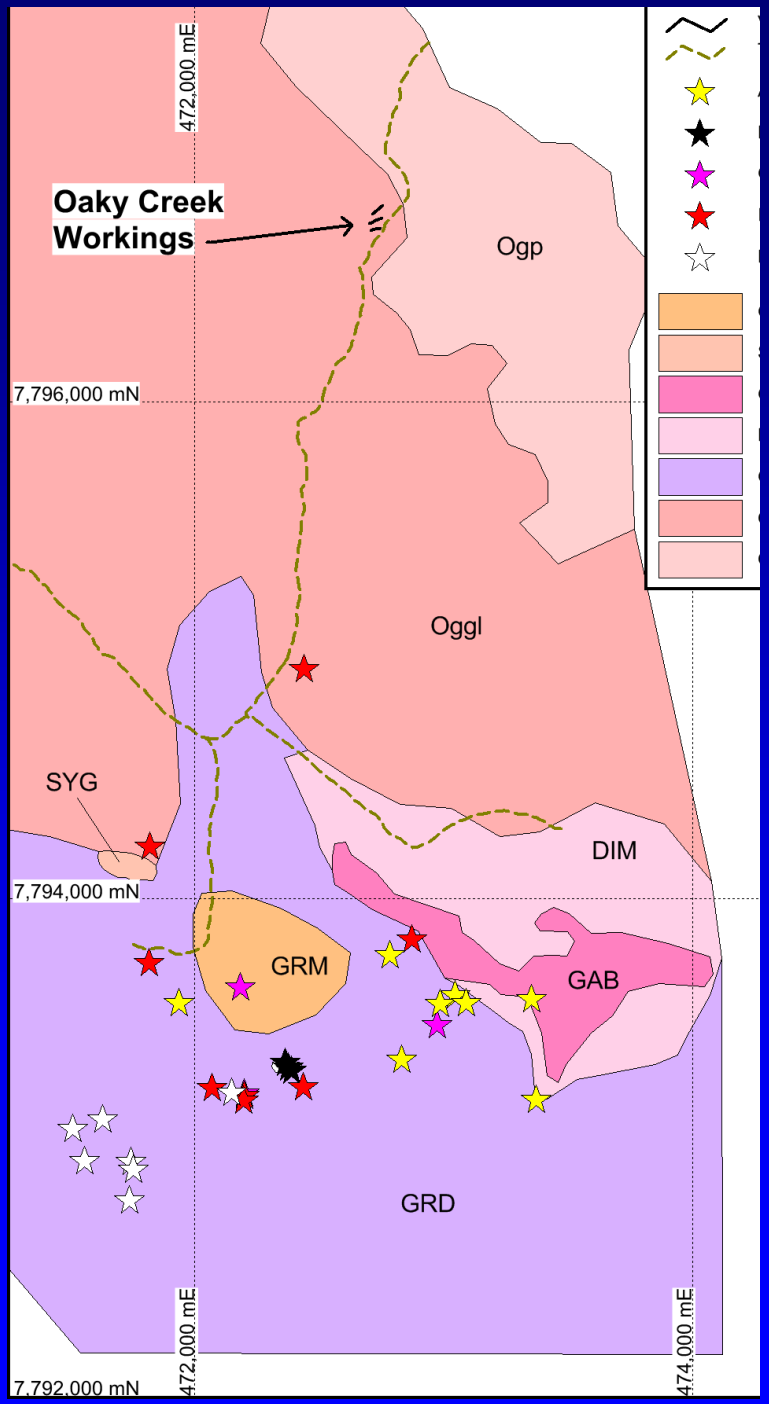
Open File Soils by Cu (ppm)

- >350
- 150 to 350
- 75 to 150
- 25 to 75
- <25

Open File Rocks by Cu (ppm)

- >250
- 100 to 250
- 50 to 100
- 25 to 50
- <25

Open File geochem Wishbone highlighting Cu prospects. Halo was followed up with geological prospecting then mapping

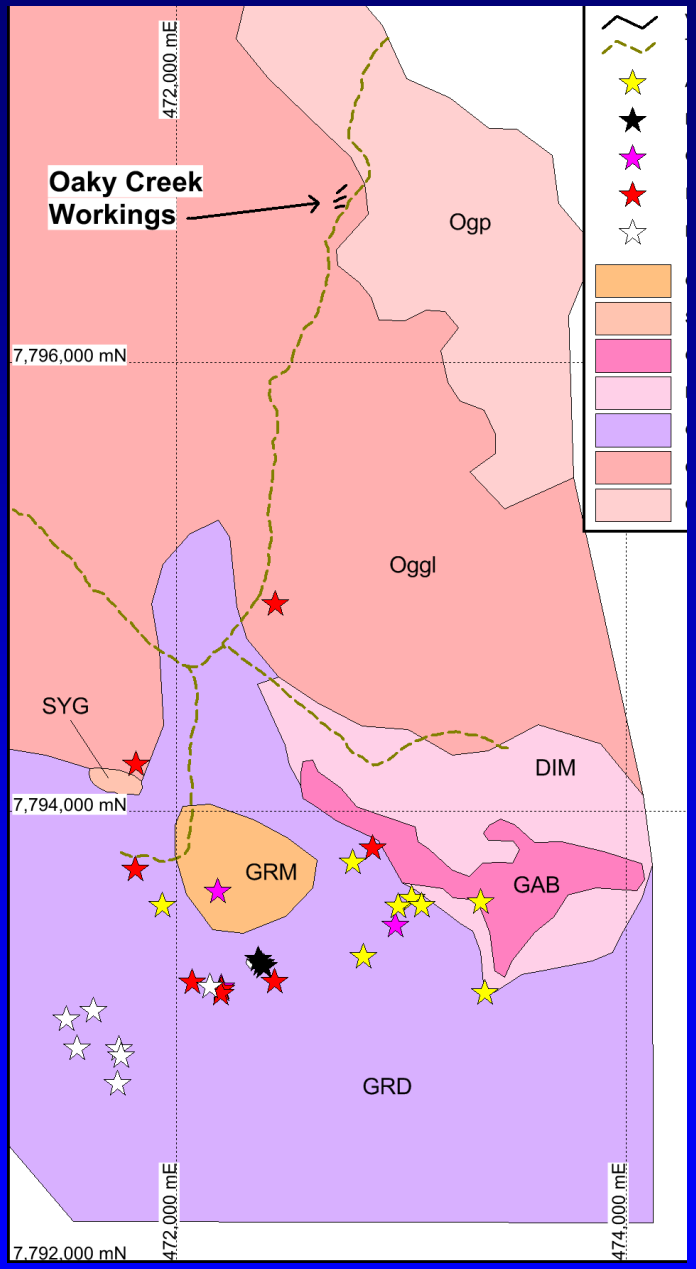


Vein
Track
Ankeritic veins and alteration
Biotite-quartz matrix hydrothermal breccia
Greaisen + malachite
Intense potassic alteration
Miarolitic microgranodiorite + chalcopyrite

GRM Microgranite Silurian
SYG Syenogranite Silurian
GAB Hornblende gabbro Silurian
DIM Biotite microdiorite Silurian
GRD Biotite-hornblende granodiorite Silurian
Oggl Biotite-hornblende granite Ordovician
Ogp Biotite granite Ordovician

GRID: MGA94 Zone 55

Halo _Oaky Creek Workings
Updated Geology Nick Tate , 2018



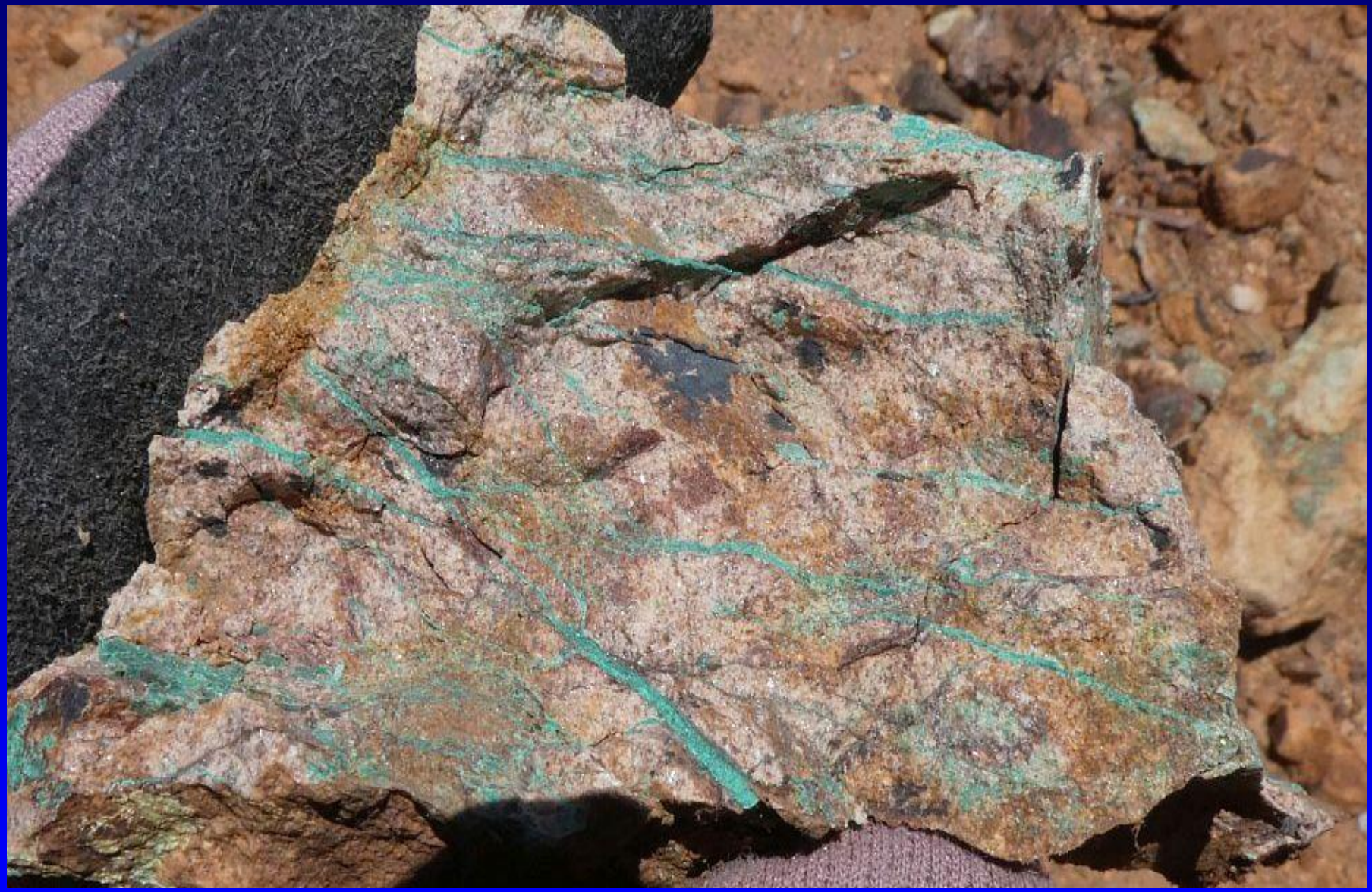
Halo Geology comparison GSQ 1990s & Nick Tate , 2018

Nick Tate (2018) Observations : Mineralisation Styles

- **Potential styles of mineralisation within the map area include:**
  - **Greisen +/- sheeted quartz veins with disseminated copper sulphides in the carapaces of fractionated intrusives.**
  - **Copper sulphides in miarolitic cavities in microgranodiorite plugs and marginal phases of the Tonalite.**
  - **Disseminated copper sulphides in potassic alteration zones.**
  - **Gold in Charters Towers style quartz veins (at the Oaky Creek Workings prospect.)**

Copper stained greisen outcrop , Halo Prospect

Malachite disseminated through muscovite rich greisen , Halo Prospect



Malachite veined carbonate altered microgranite , Halo Prospect

•Chalcopyrite filled miarolitic cavity , secondary biotite altered micro granodiorite , Halo Prospect

Wishbone Gold

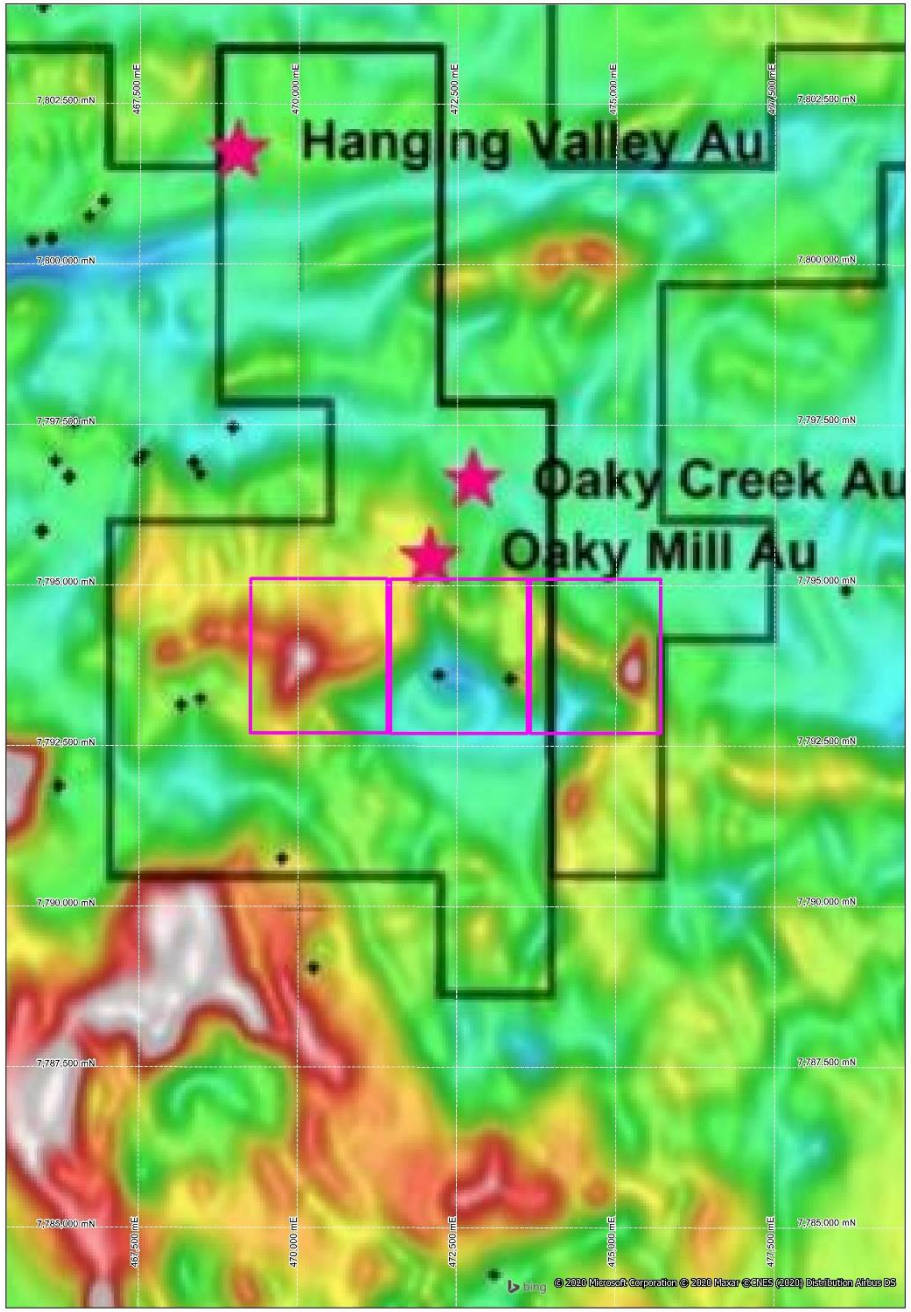
Malachite disseminated in secondary biotite and K feldspar altered tonalite. Halo Prospect

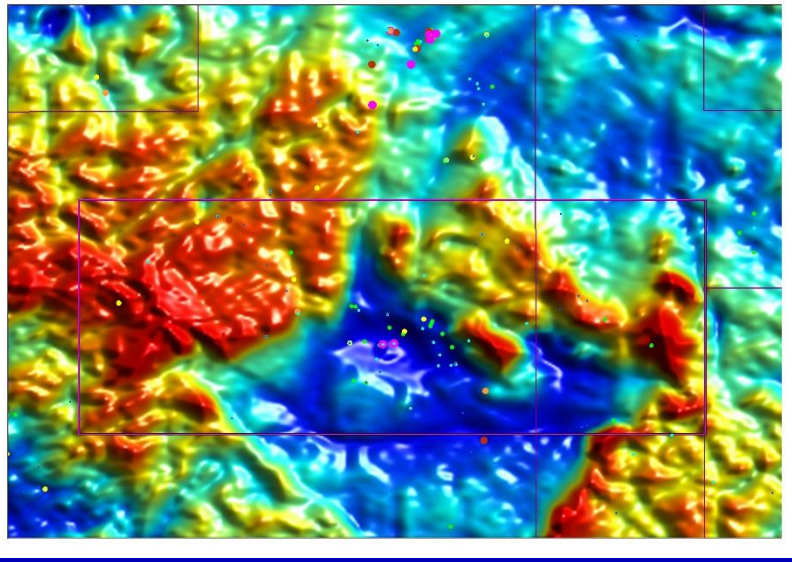
Nick Tate (2018) Conclusions

- **Copper Mineralisation appears to be associated with the most fractionated phases of the intrusive complex (plug of microgranite)te.**

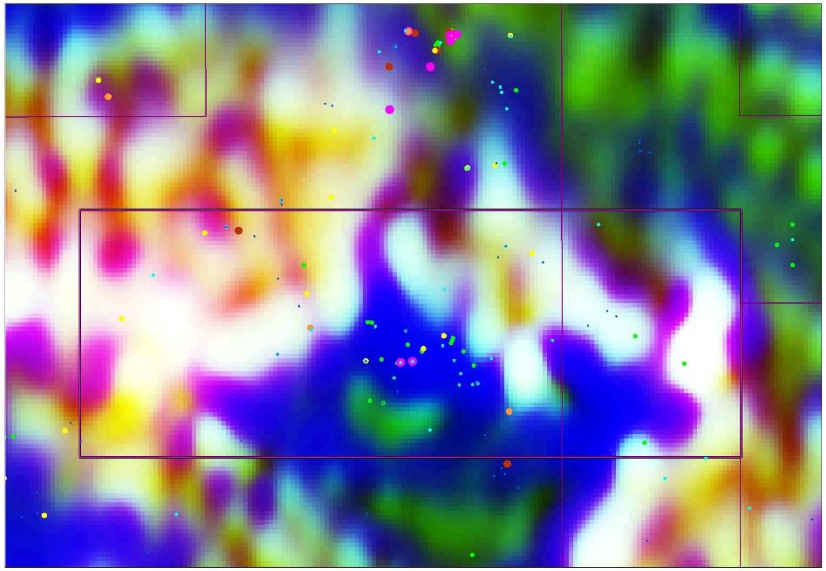
- **The styles of copper mineralisation and alteration are consistent with a porphyry type system, but the texture of the intrusives and greisen alteration suggest a plutonic rather than subvolcanic environment.**

- **The disseminated styles of mineralisation may have some analogues in the Goonumbla porphyry Cu-Au system where mineralisation occurs as a combination of stockwork and disseminated sulphides in tall finger-like plugs of highly fractionated porphyry.**

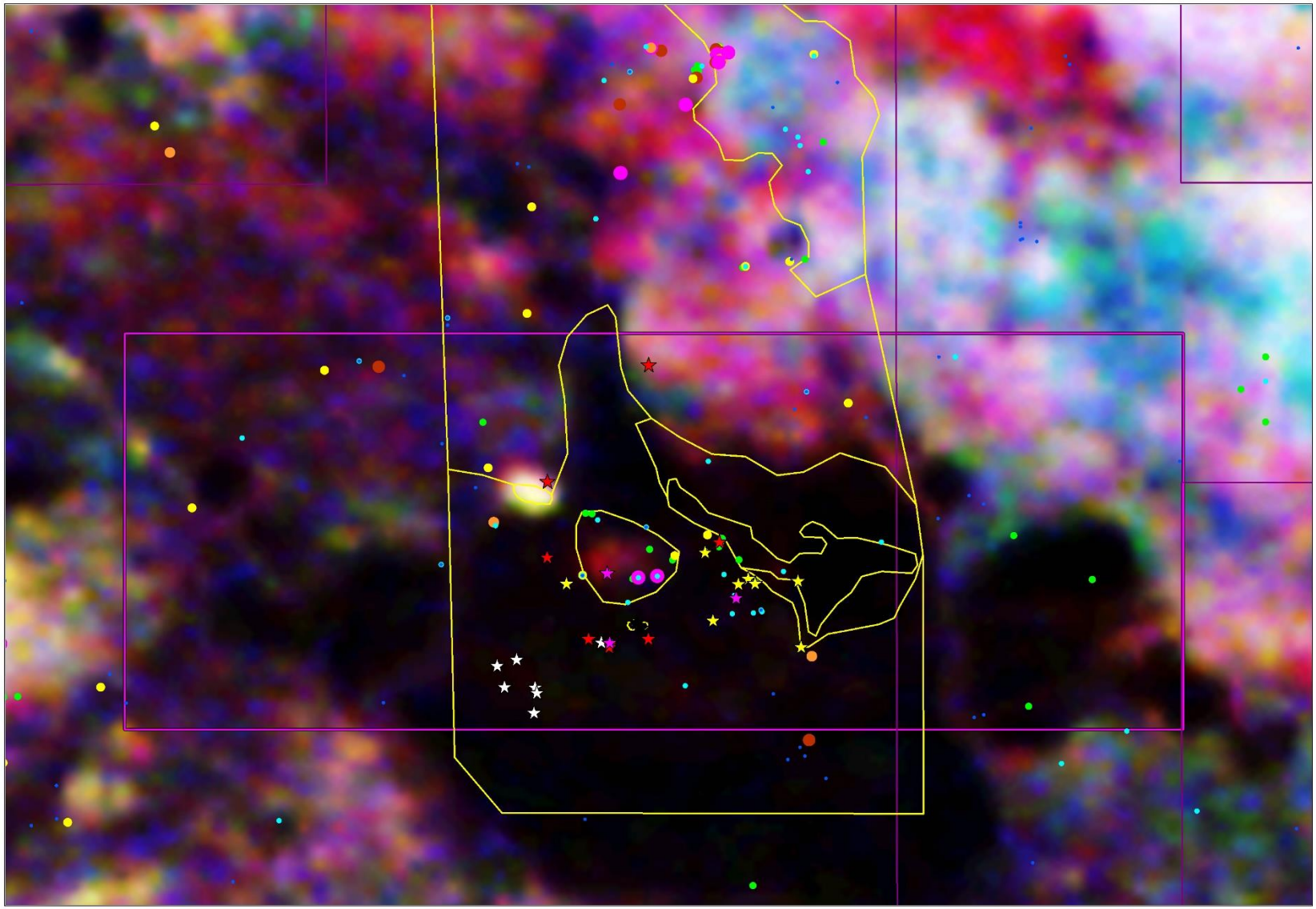




Aeromag RTP

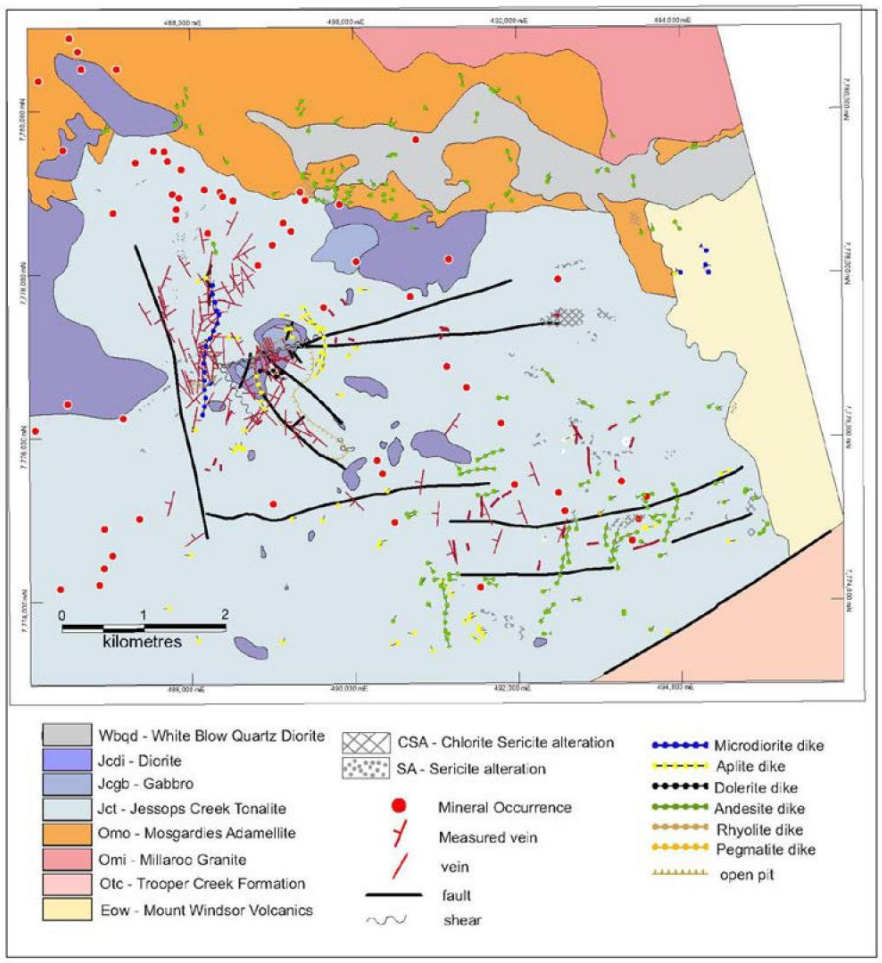


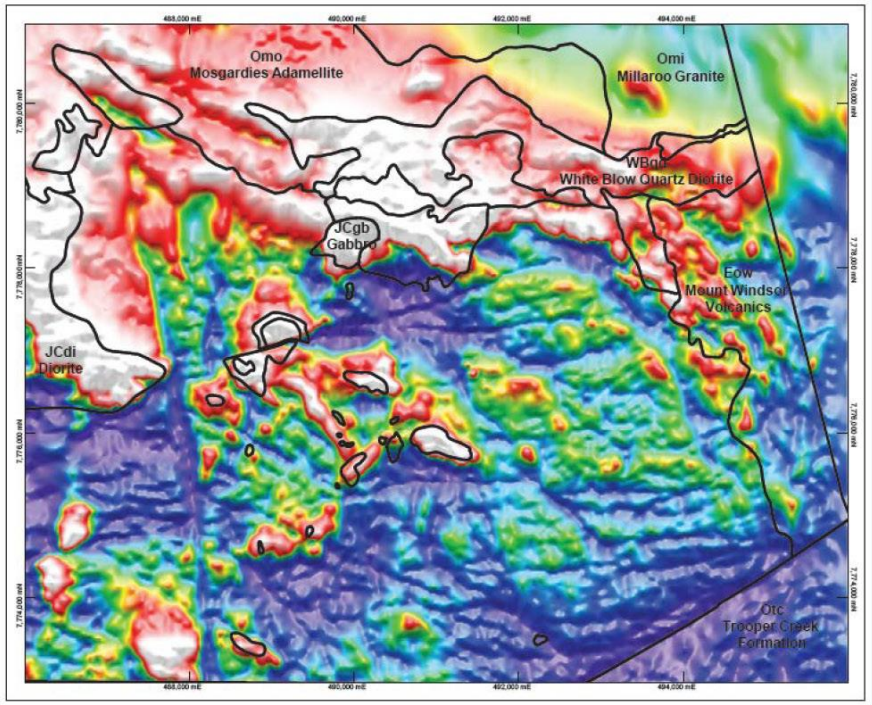
Aeromag 3 component RGB



Halo Prospect RGB Radiometrics (K –Th-U) Geology linework Tate (2018) . Greisen with high potassium in centre of tonalite / gabbro body with low radiometrics.

Ravenswood District: *Ravenswood Town Geology & RTP mag*

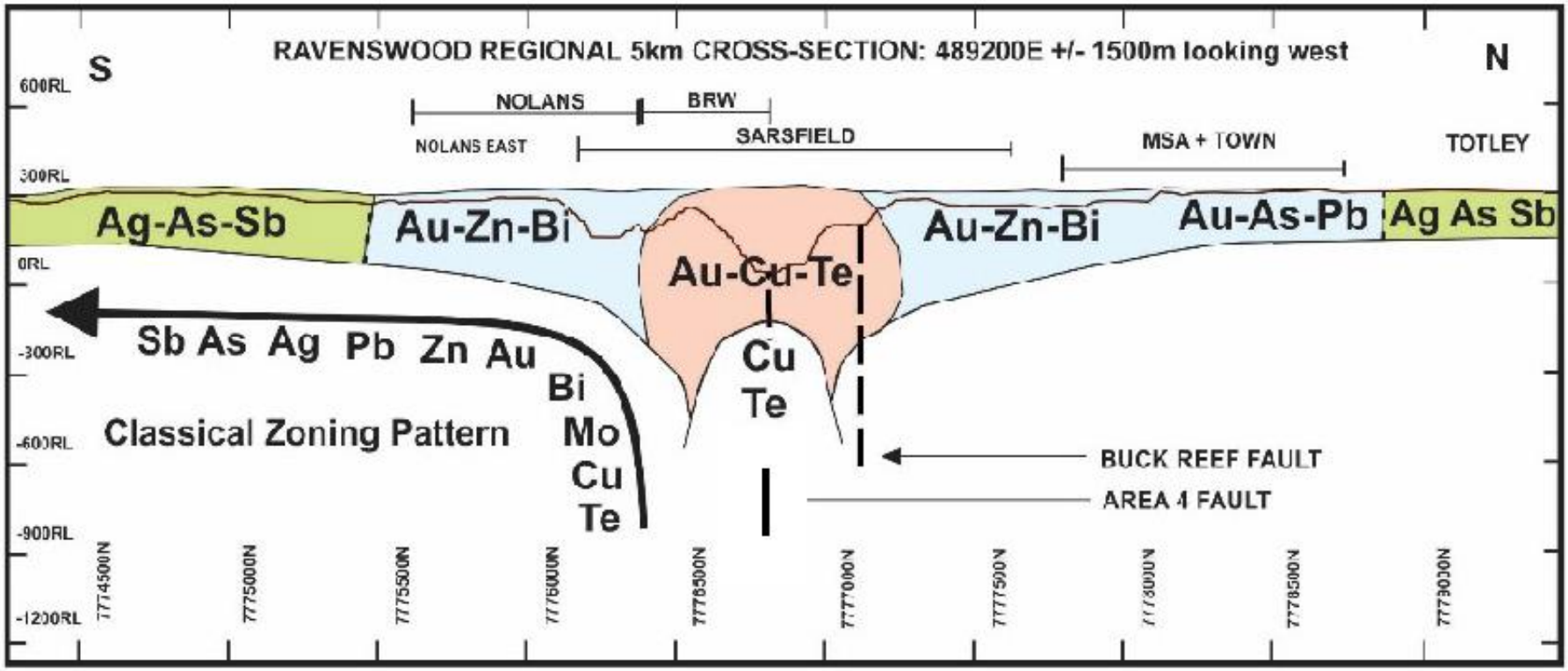




7Moz field

Morrison, 2014 IRGS

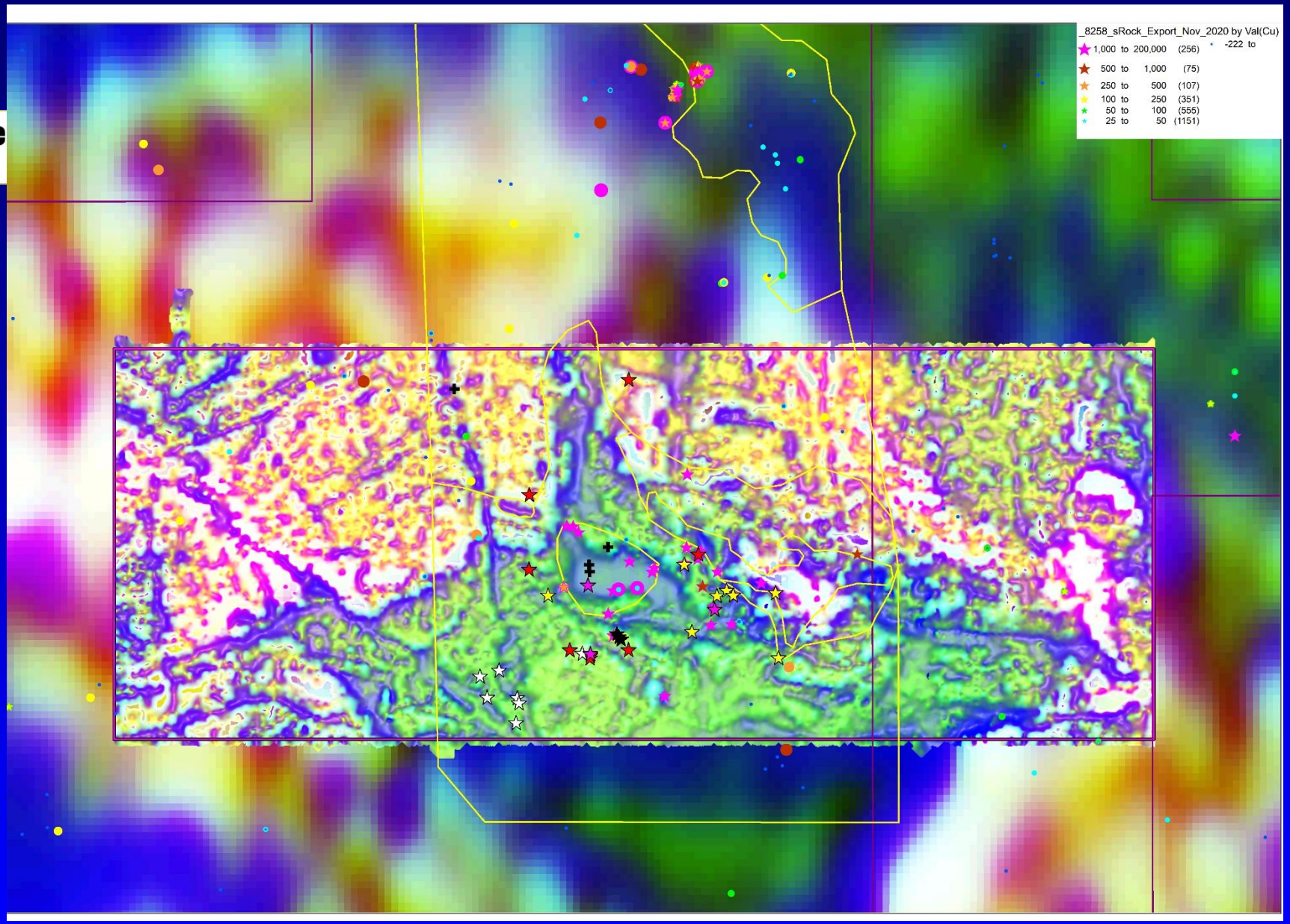
Ravenswood District: *Ravenswood Town metal zoning*



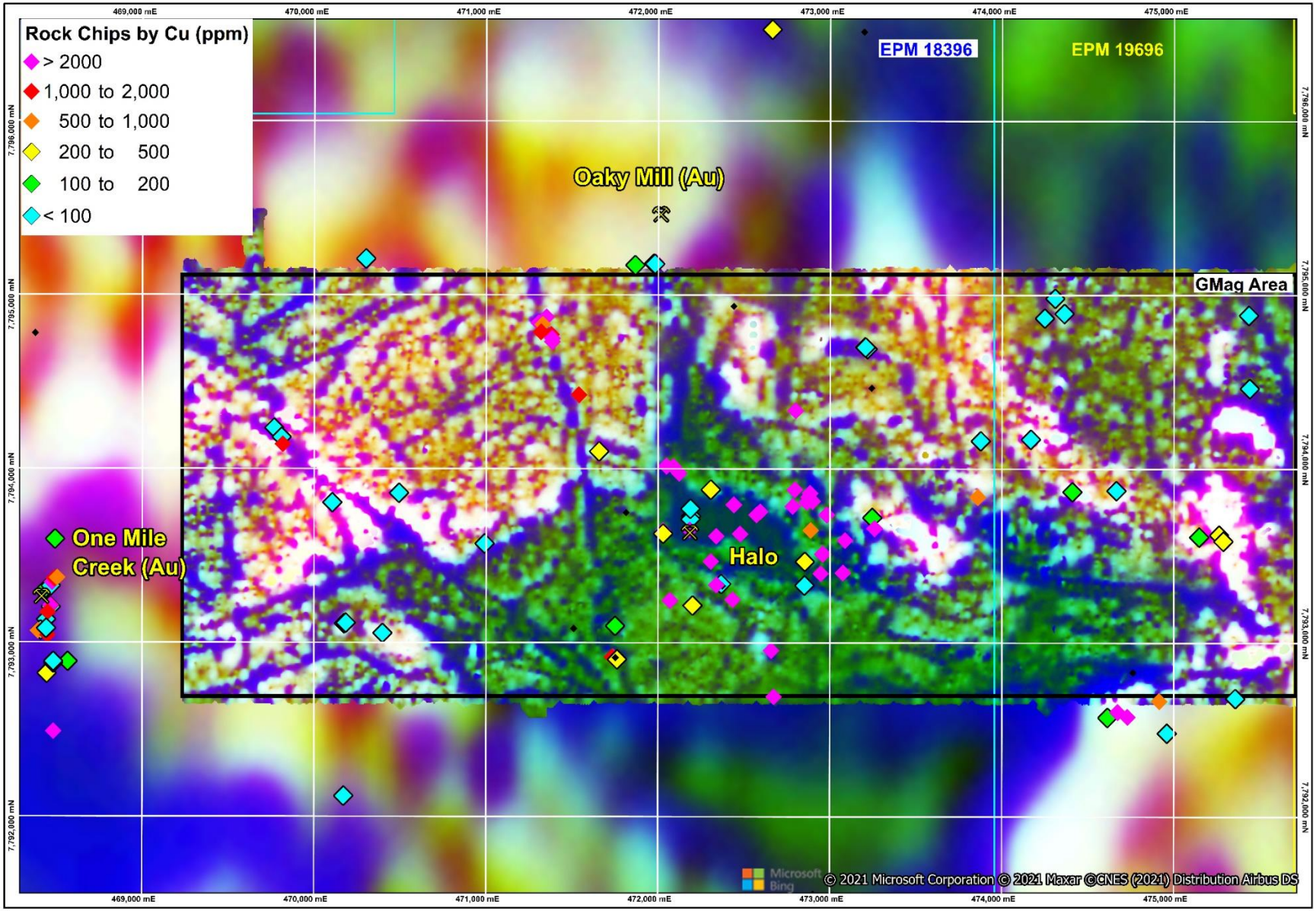
Zoning of key metals up & out
Mushroom shape from to central feeder and dispersion in re-activated structures

Zoning reflects declining temperature
Consistent with alteration zones

•Morrison, 2014 IRGS



Halo RGB Ground Magnetics (RTP-1VD-AS)

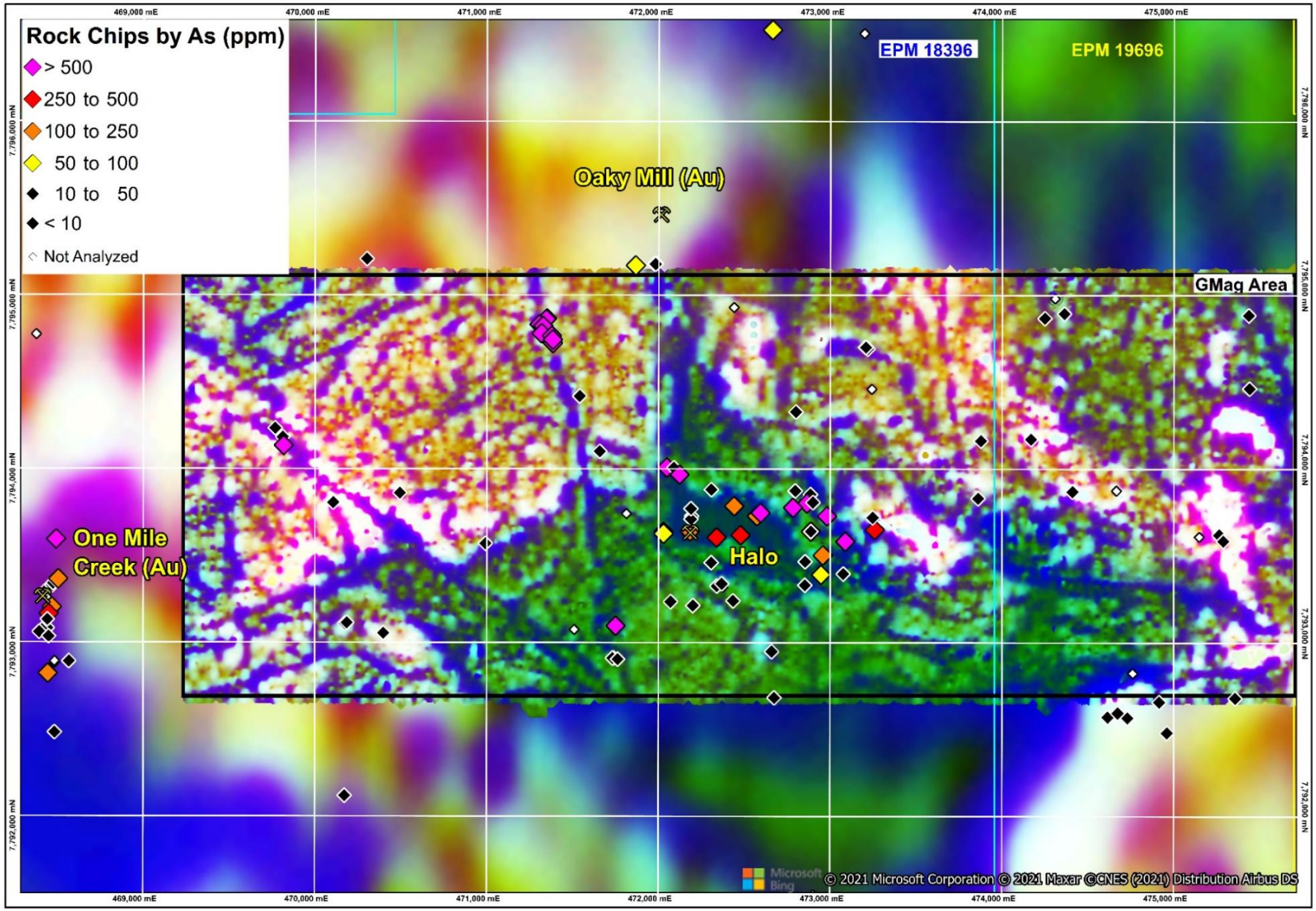


Cu in rock chips Halo relation to magnetic images

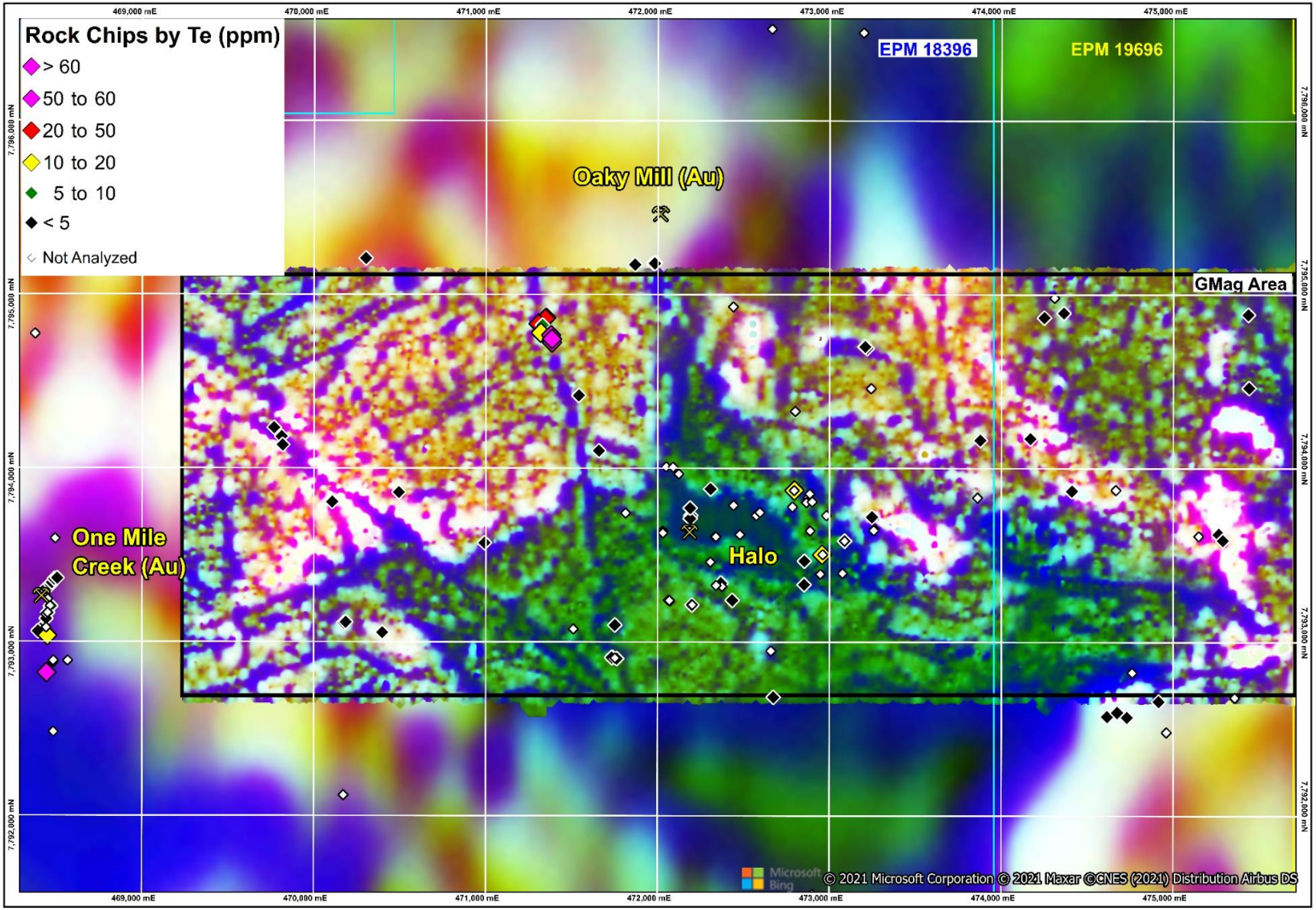
Outcrop metre wide gossanous quartz (Big Vein) SE Wishbone II

Outcrop gossanous quartz NE Halo Wishbone II- high Te,Bi,As,anomalous Au , Cu,Zn,Pb : “the Ravenswood signature”

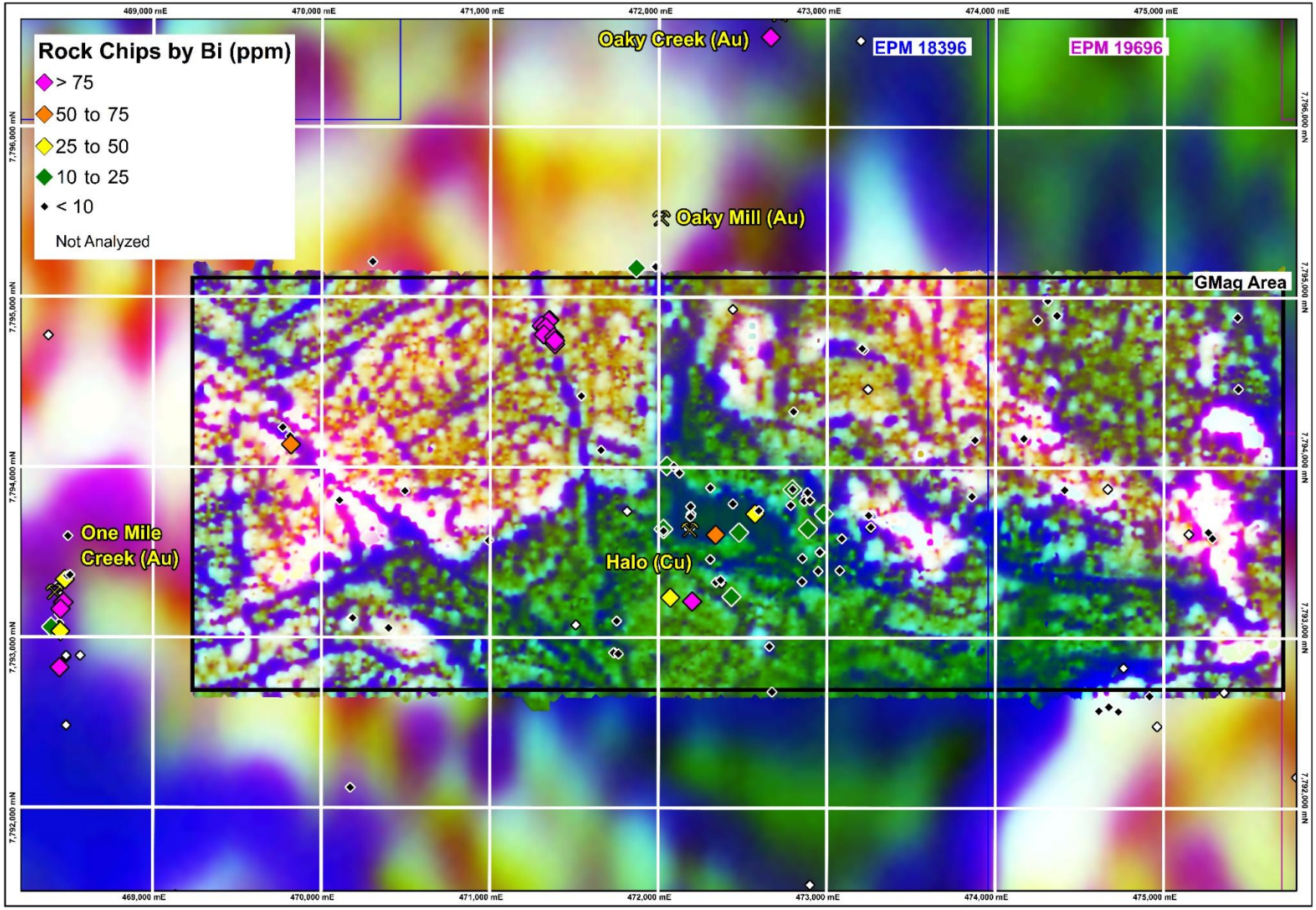
Outcrop gossanous quartz NE Halo Wishbone II- high Te,Bi,As,anomalous Au , Cu,Zn,Pb : “the Ravenswood signature”



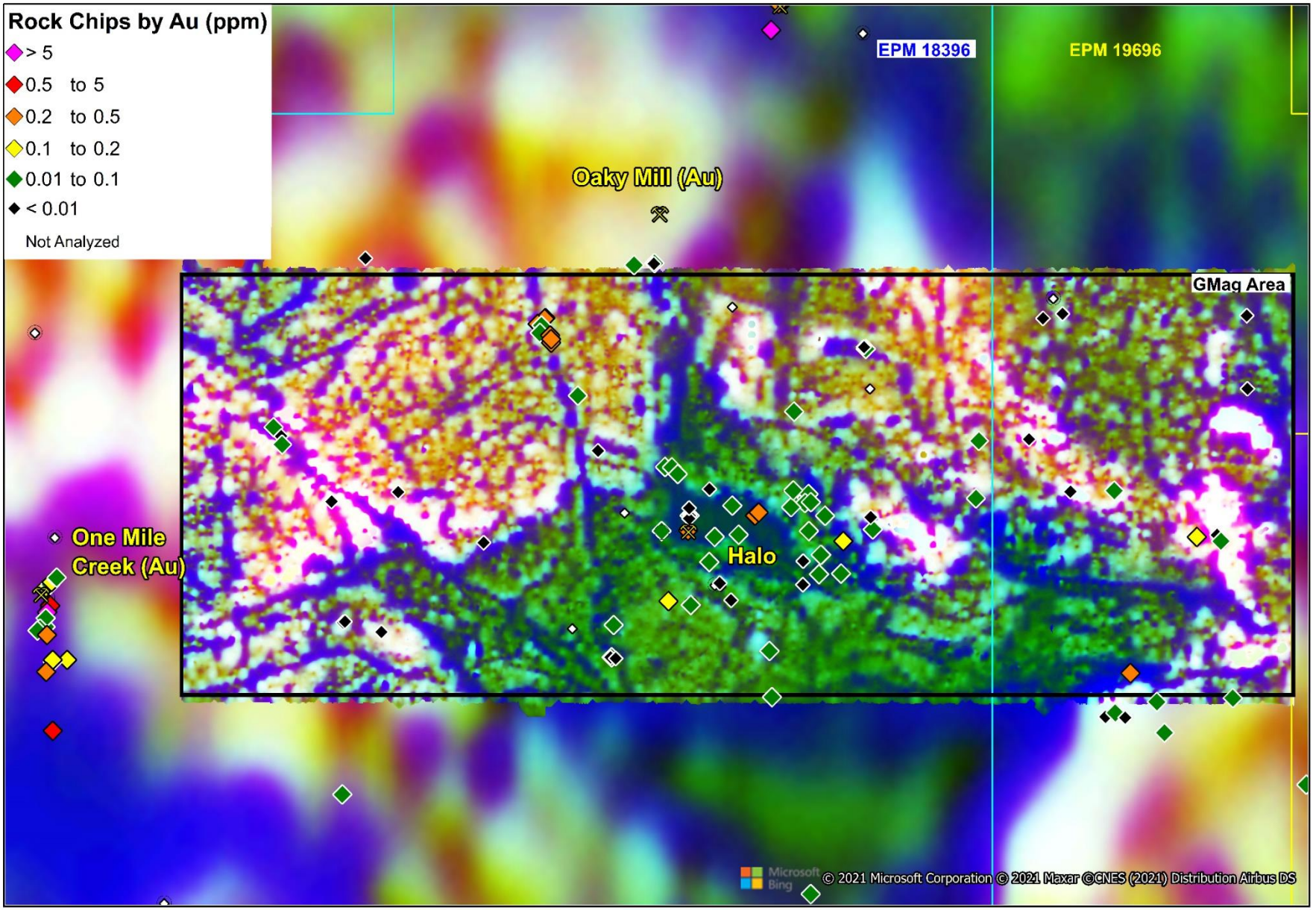
As in rock chips Halo 2021 geological prospecting



Te in rock chips Halo 2021 geological prospecting

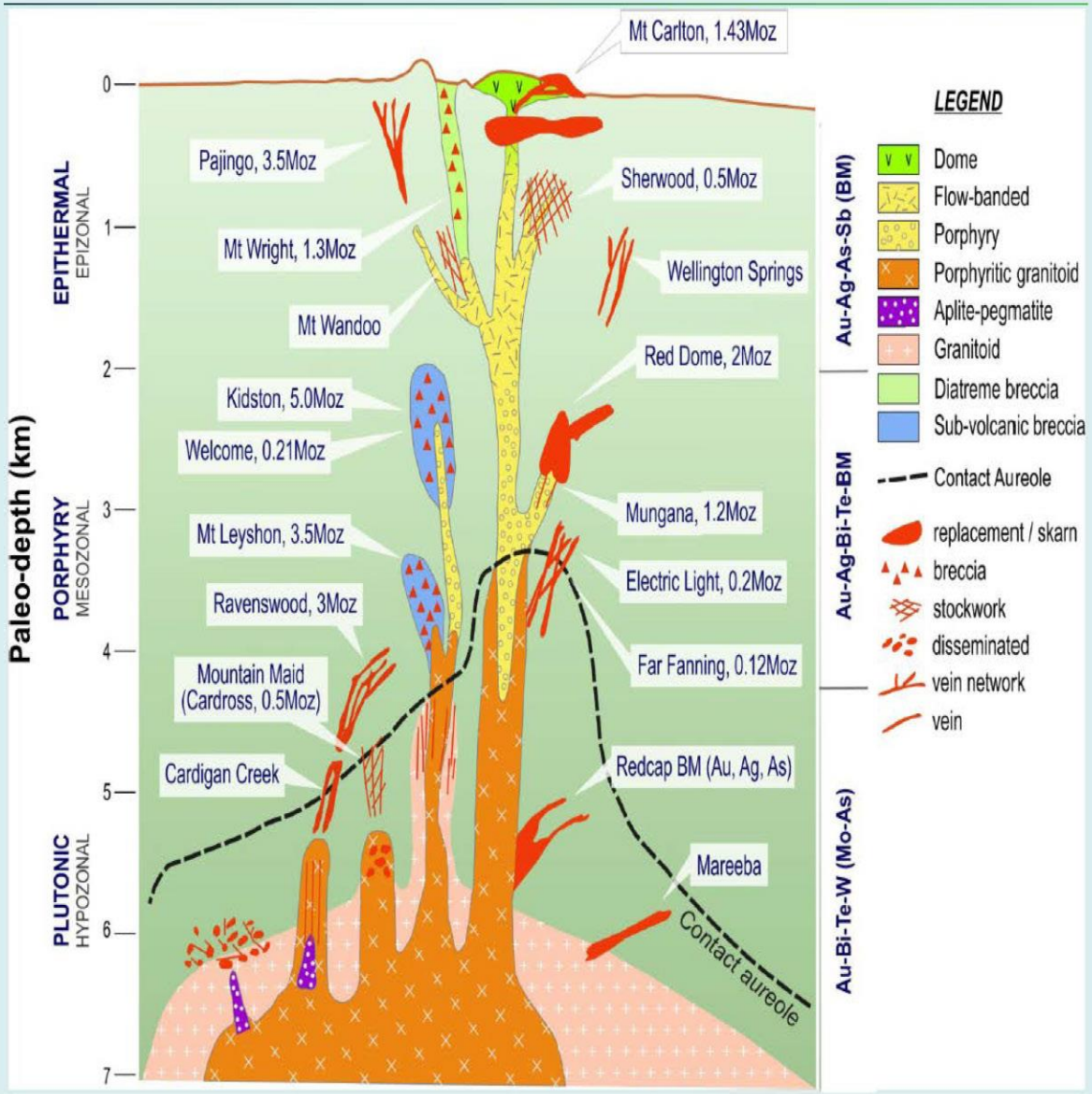


Bi in rock chips Halo 2021 geological prospecting



Au in rock chips Halo 2021 geological prospecting

NQ IRGS model in Charters Towers



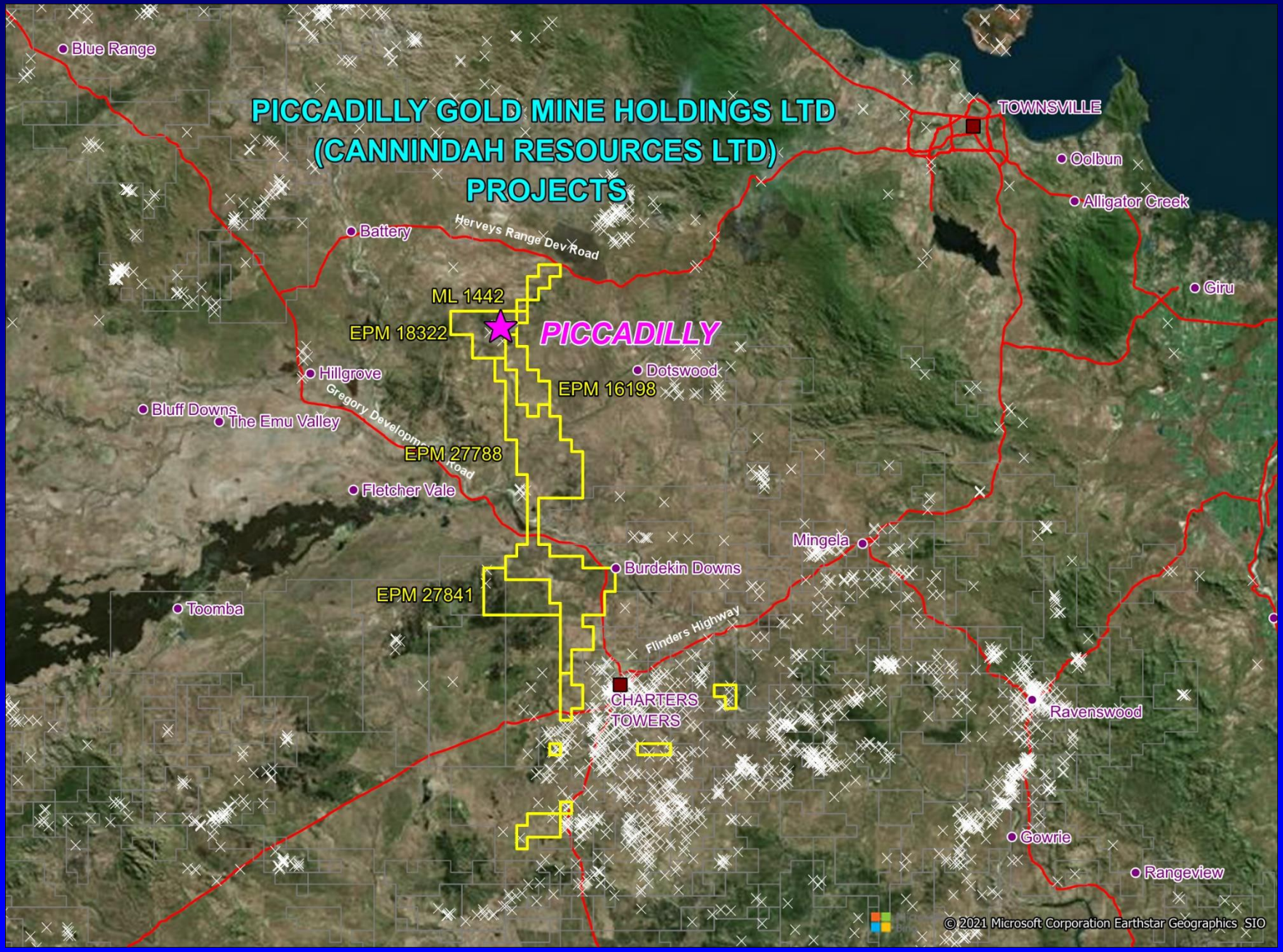
NQ IRGS Morrison 2014

Works fine

vein & breccia styles prominent

mesozonal and epizonal

rhyolite, rhyodacite
& andesite related


PICCADILLY GOLD MINE HOLDINGS LTD
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PICCADILLY
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EPM 16198
Bluff Downs
The Emu Valley
Gregory Development Road
EPM 27788
Fletcher Vale
Mingela
Burdekin Downs
EPM 27841
Toomba
Flinders Highway
CHARTERS TOWERS
Ravenswood
Gowrie
Rangeview
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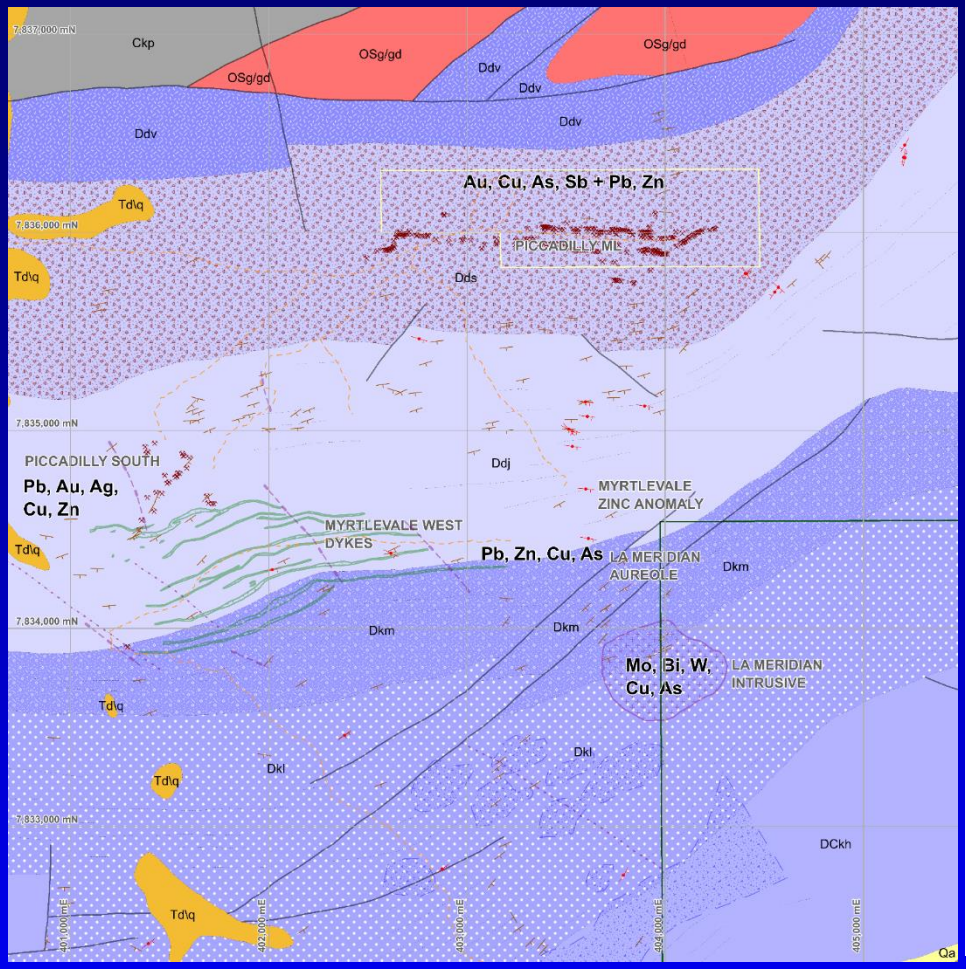
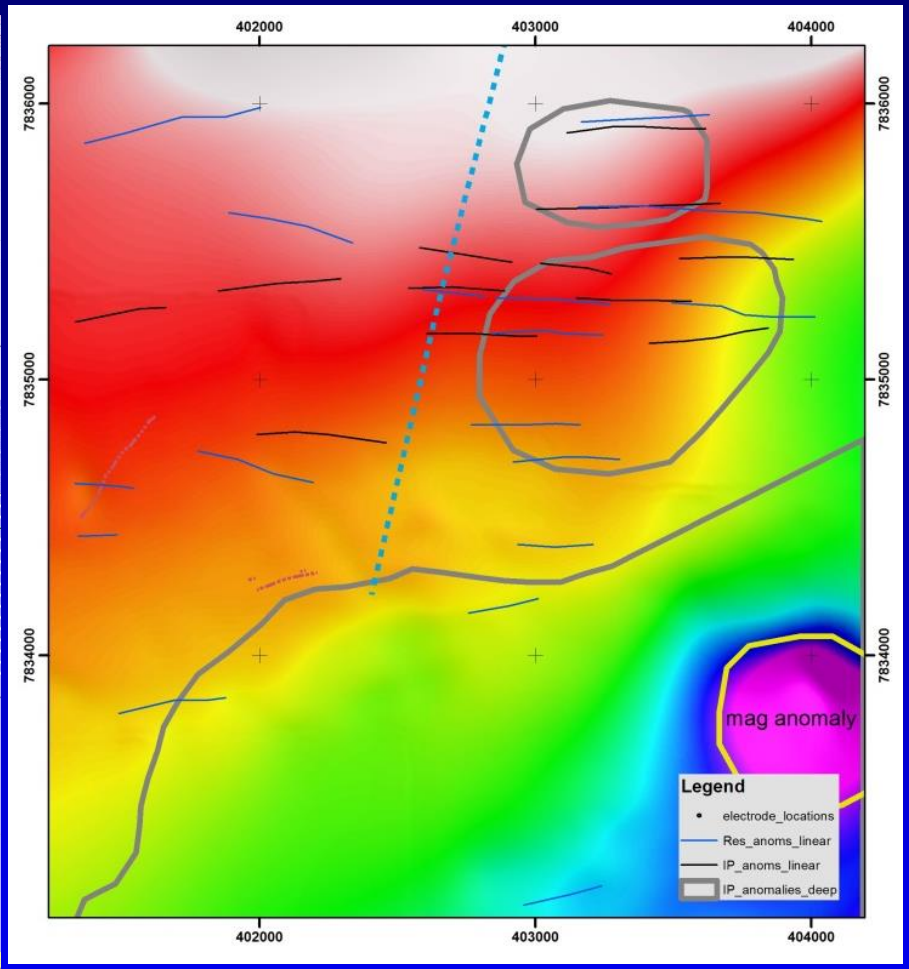
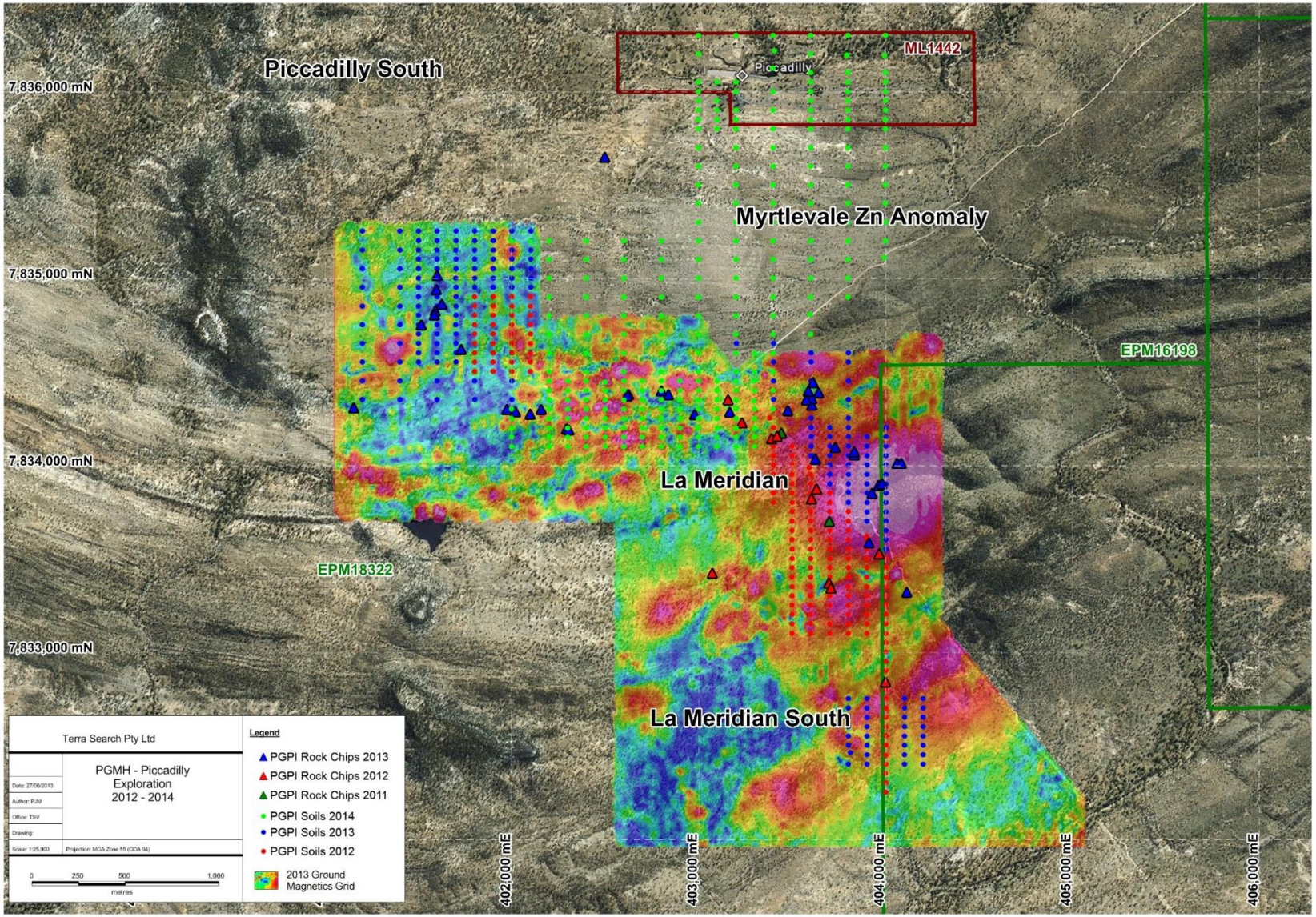


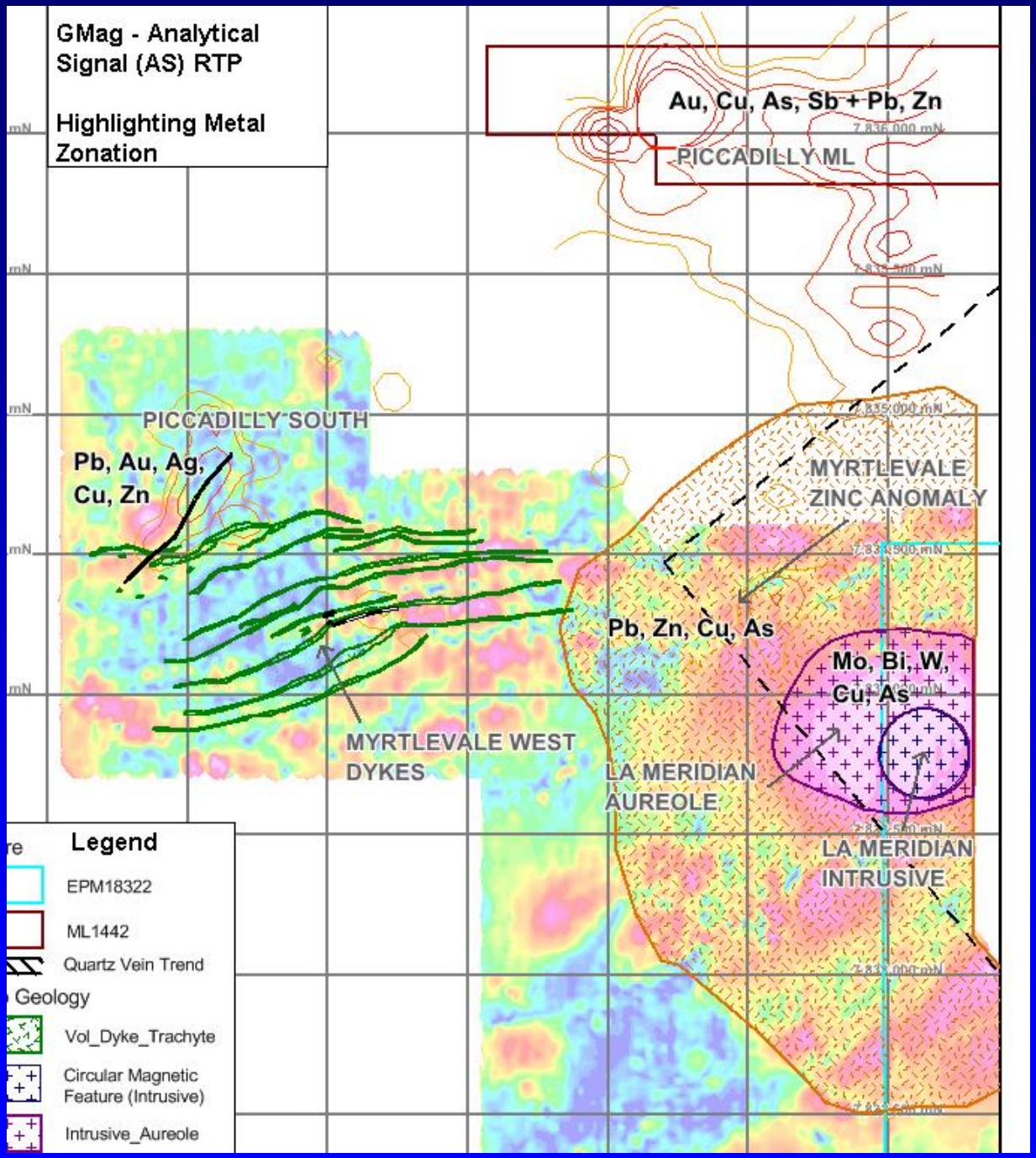


Piccadilly Geology Devonian Sedimentary Sequence
Historic Gold field
Piccadilly Aero Magnetics – mag low

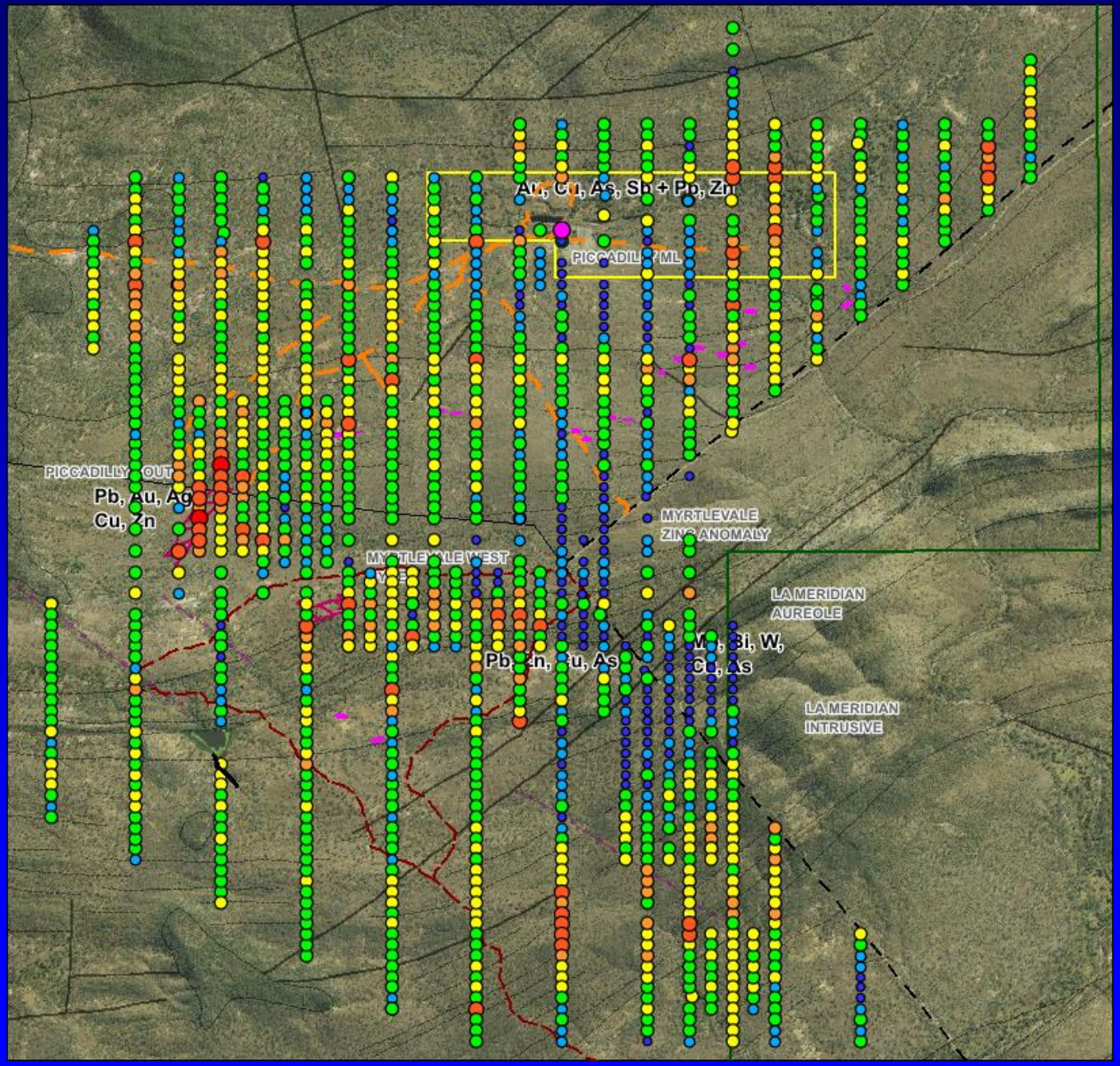


Piccadilly Ground Magnetics Analytical Signal

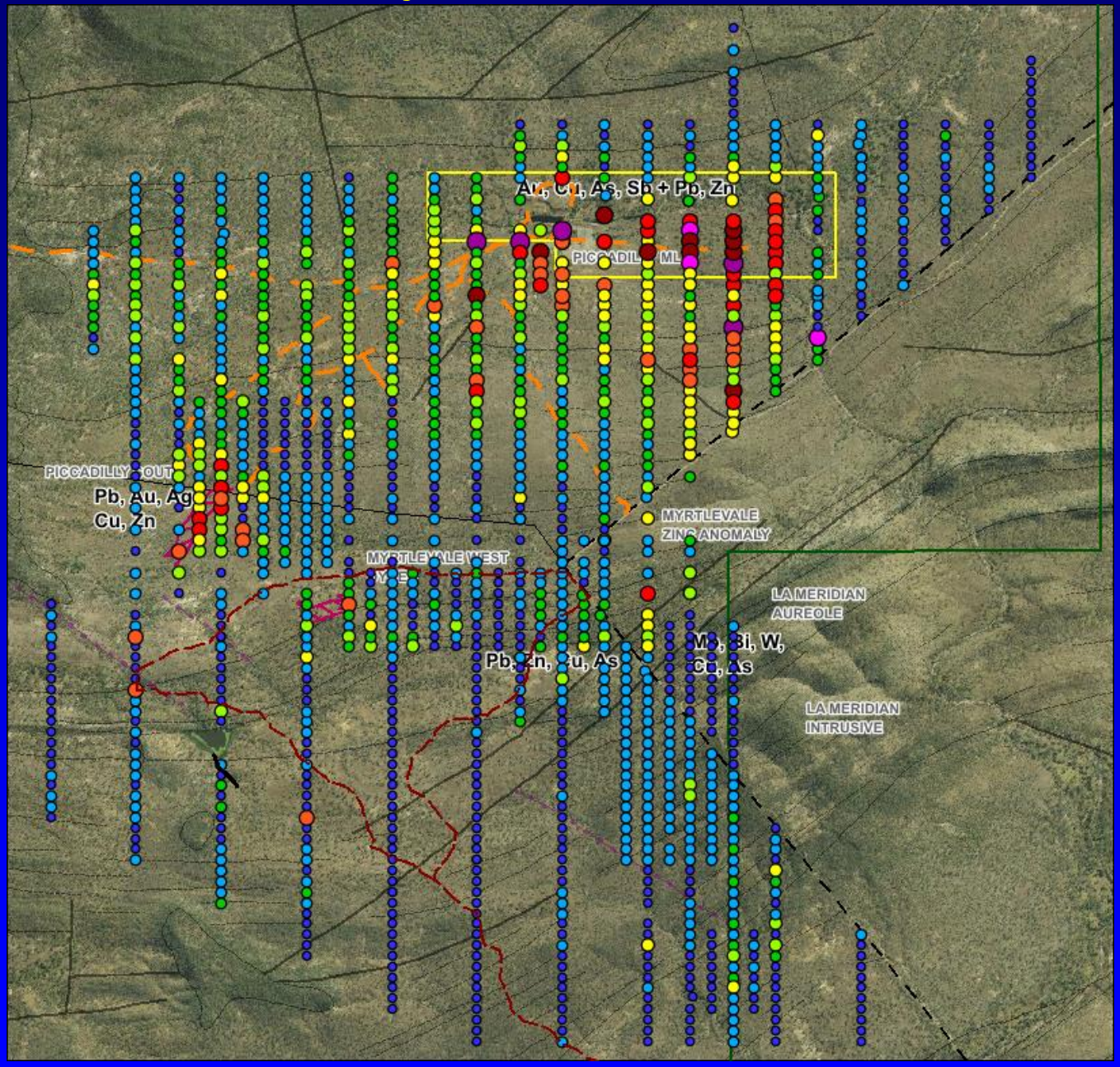
Piccadilly Zoning

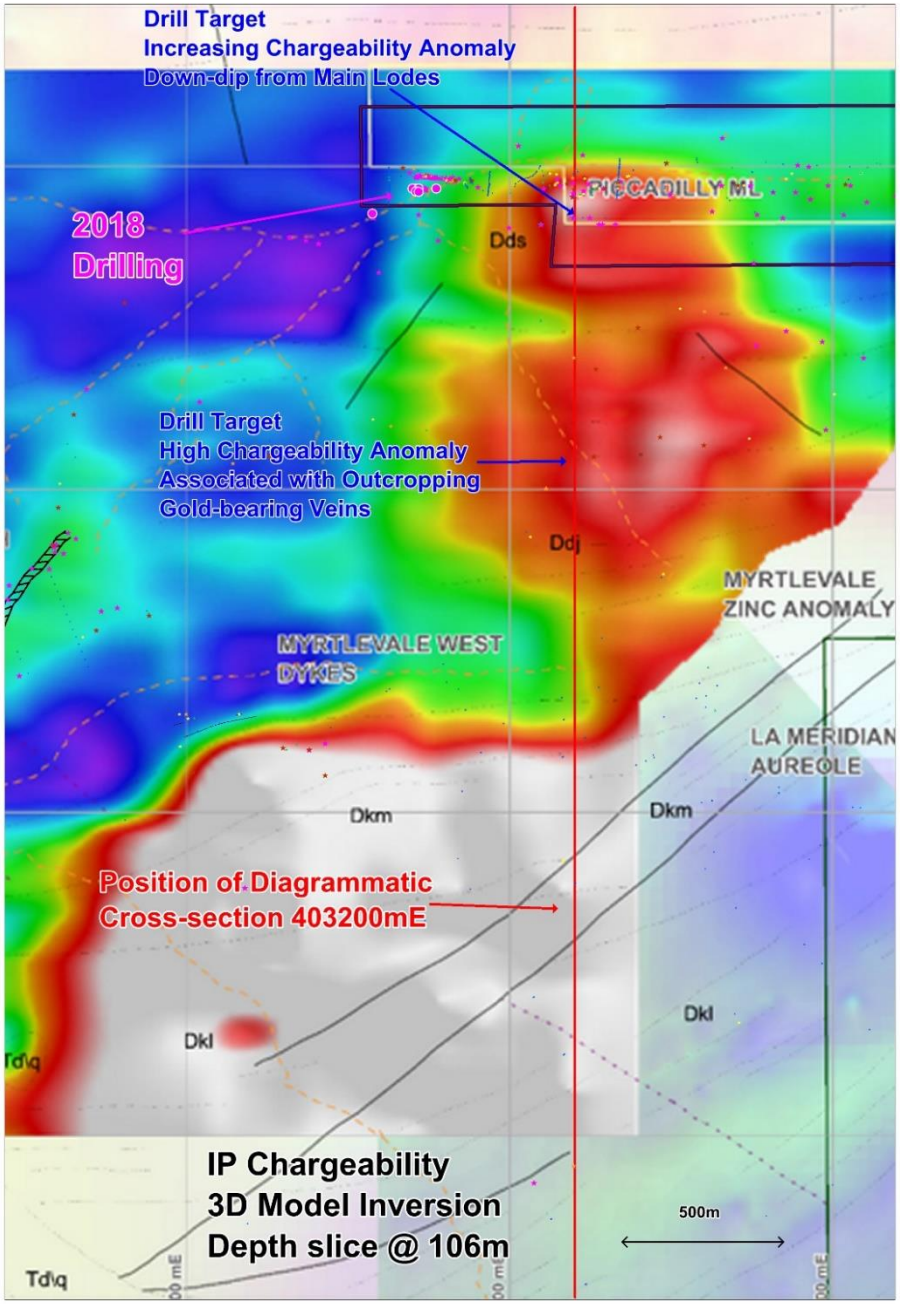


Piccadilly Pb Geochem

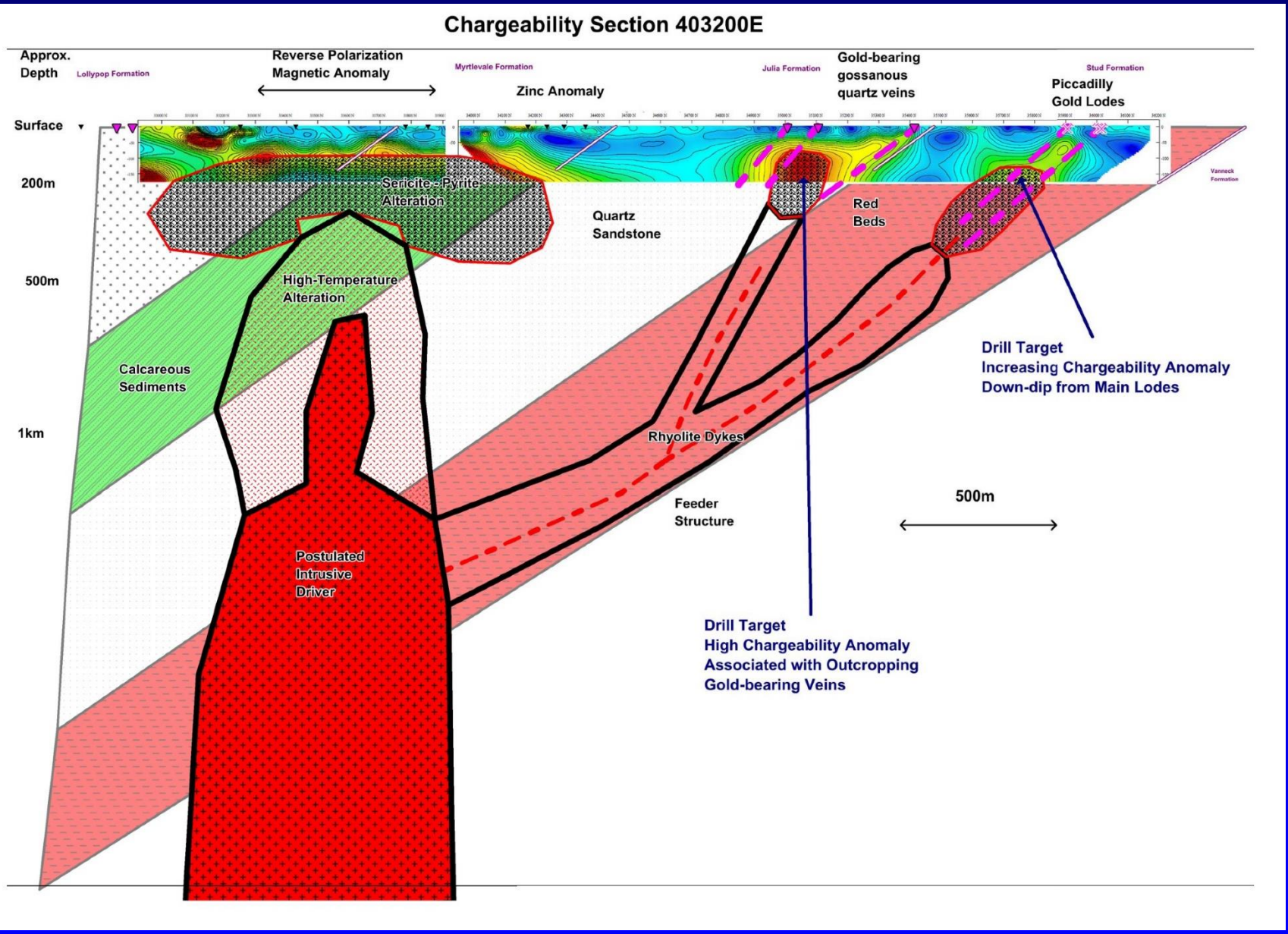


Piccadilly Au Geochem

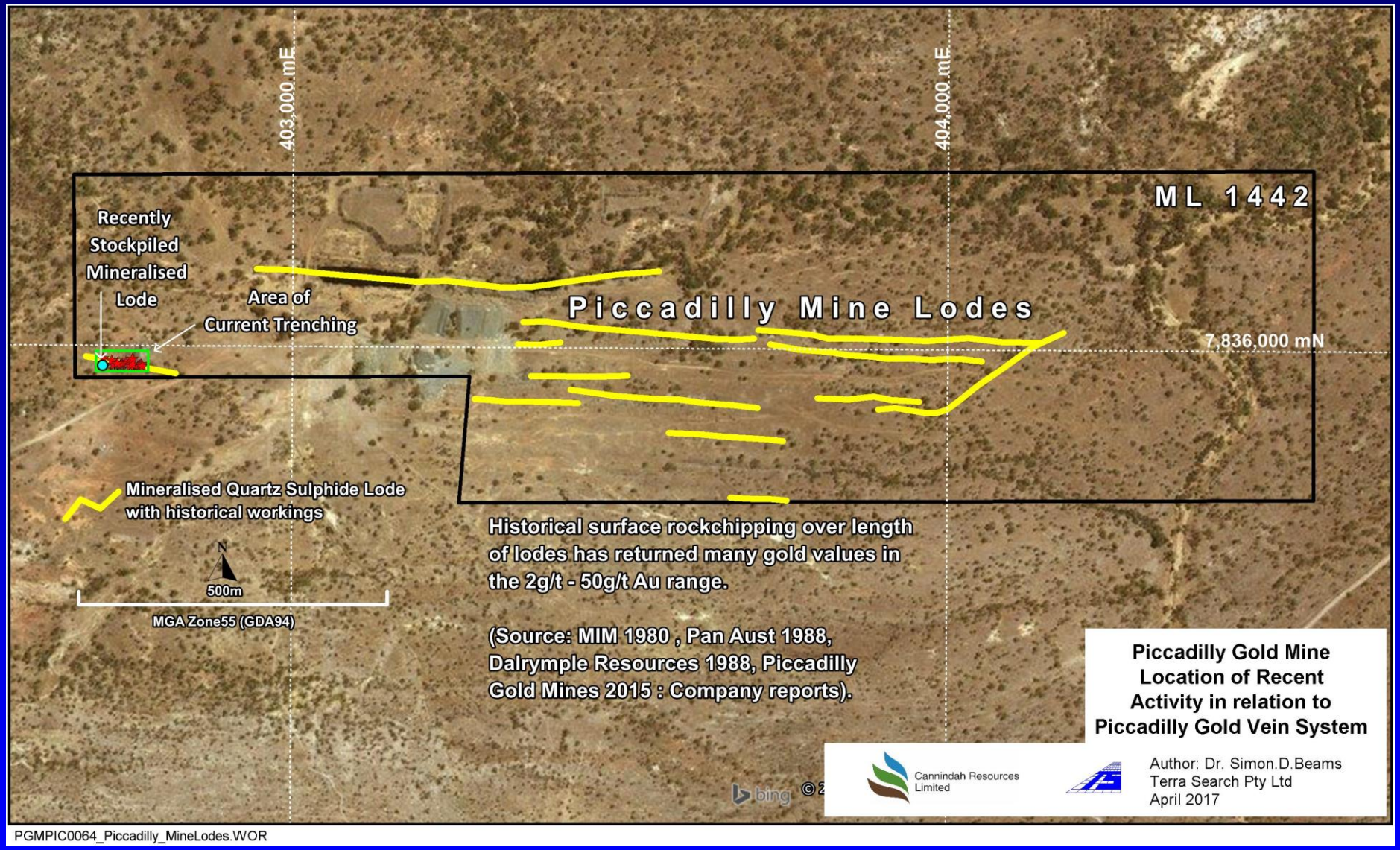




Piccadilly IP Chargeabilty Model 106m depth



Piccadilly Mineral System Targets



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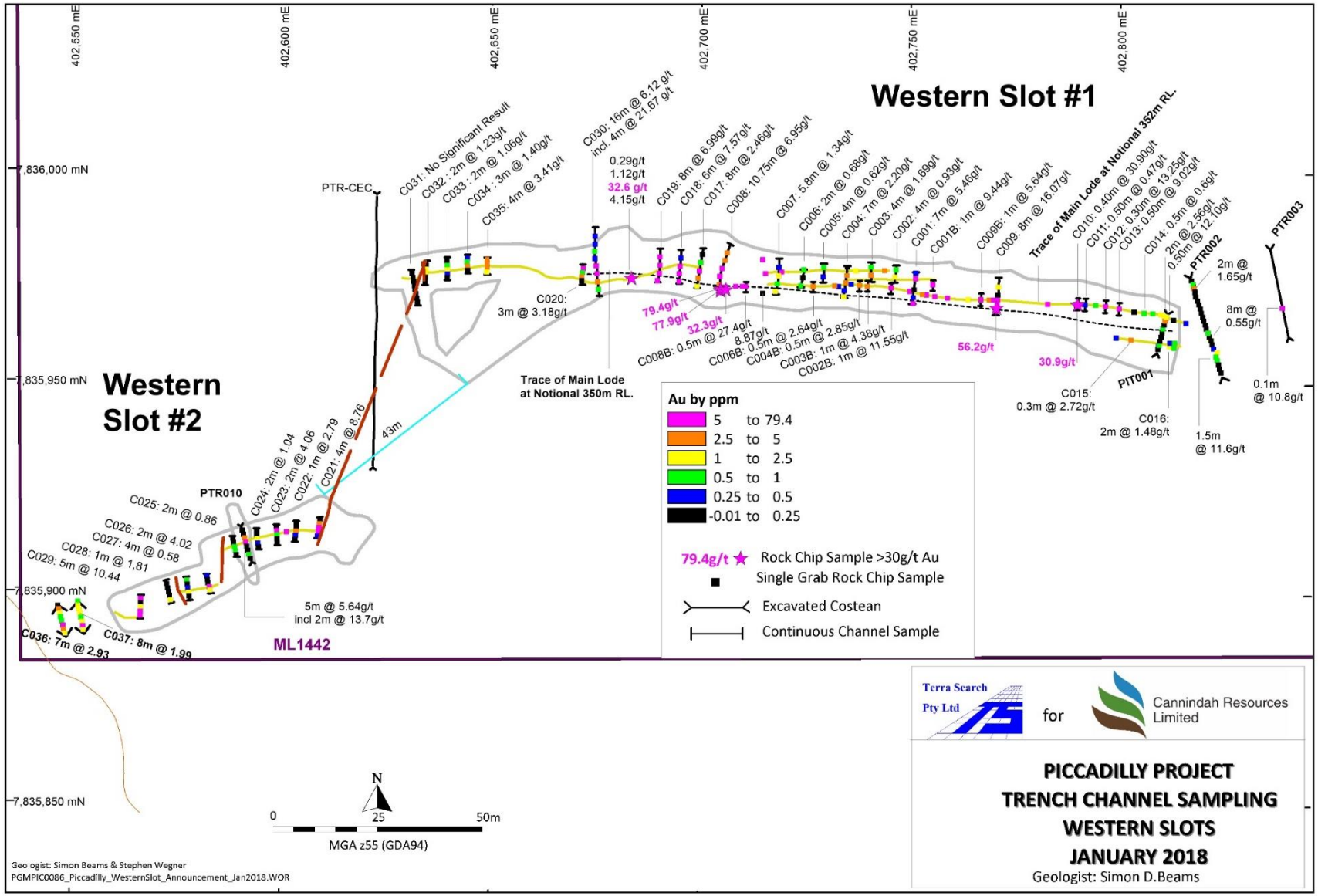
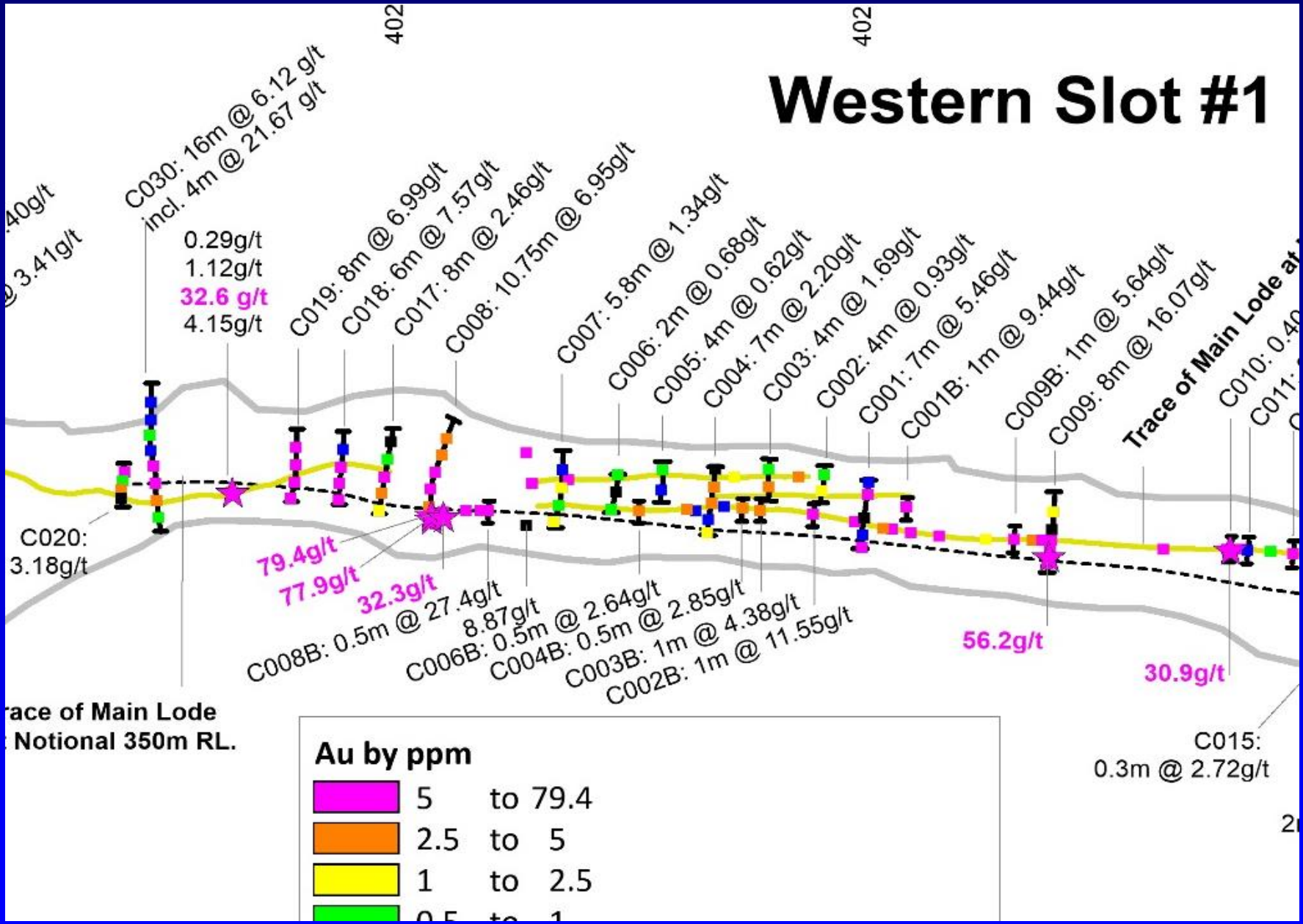
Piccadilly Historical Workings

Piccadilly Western Slot

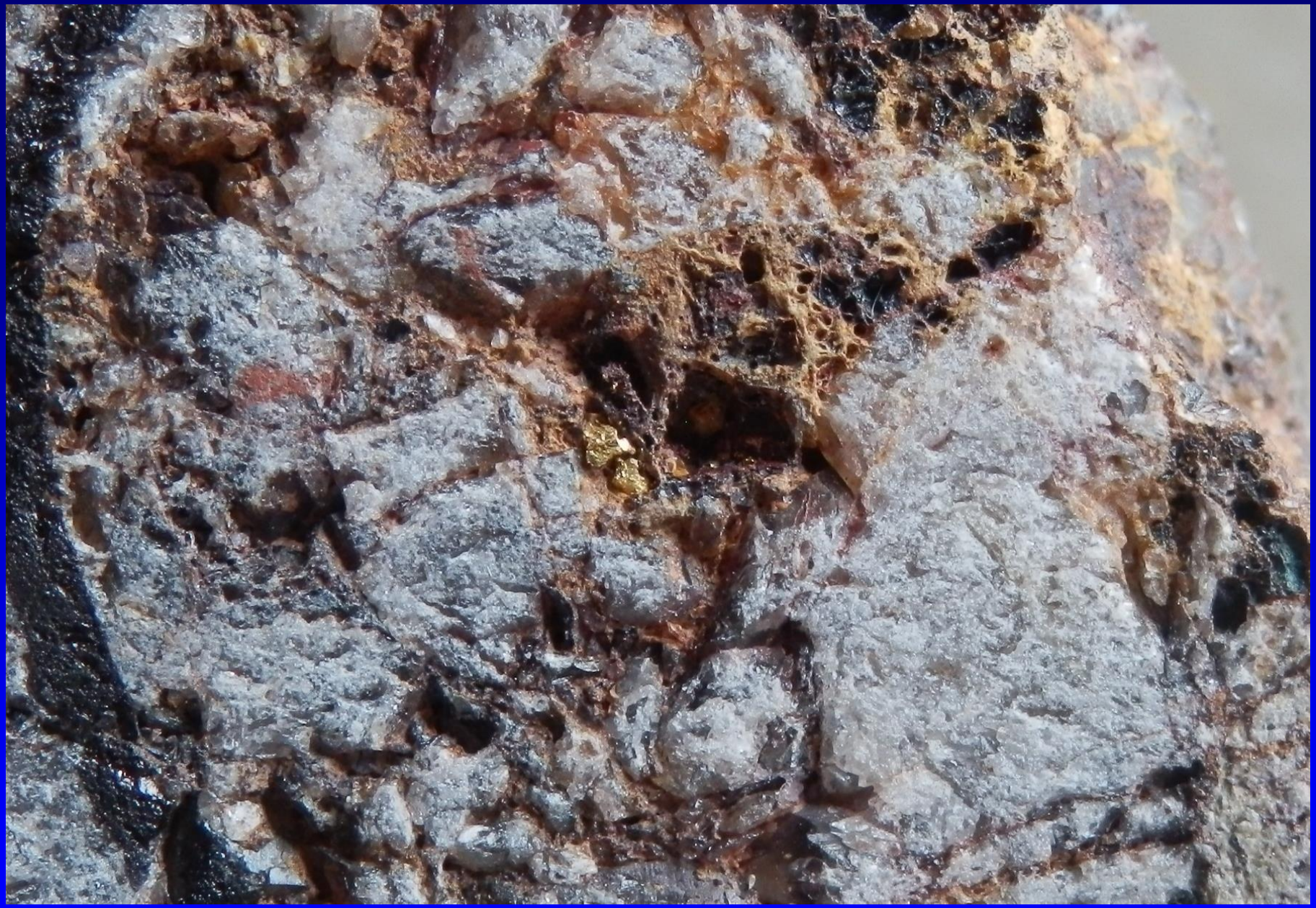
Piccadilly Western Slot



Piccadilly Western Slot

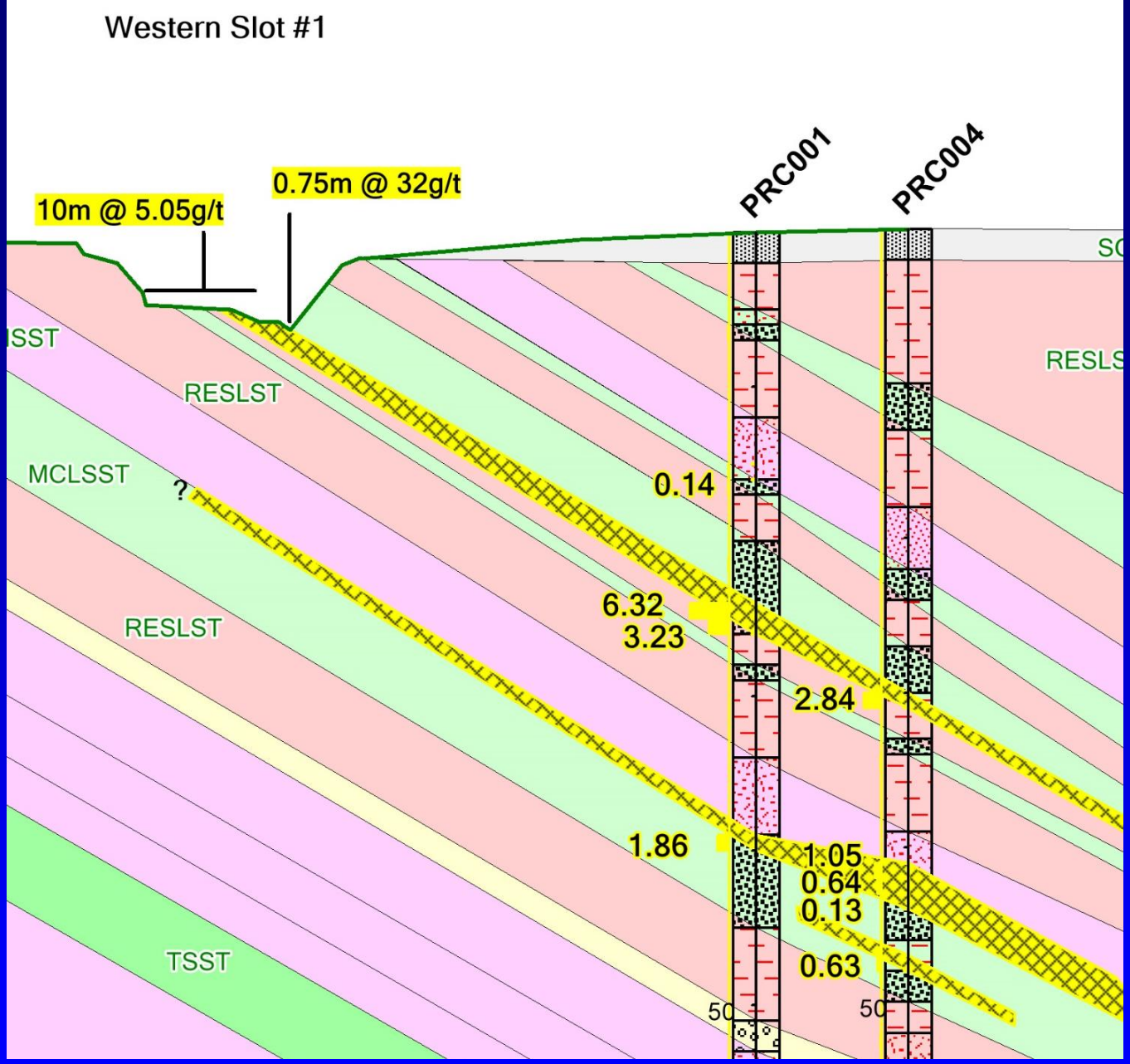


Piccadilly Western Slot

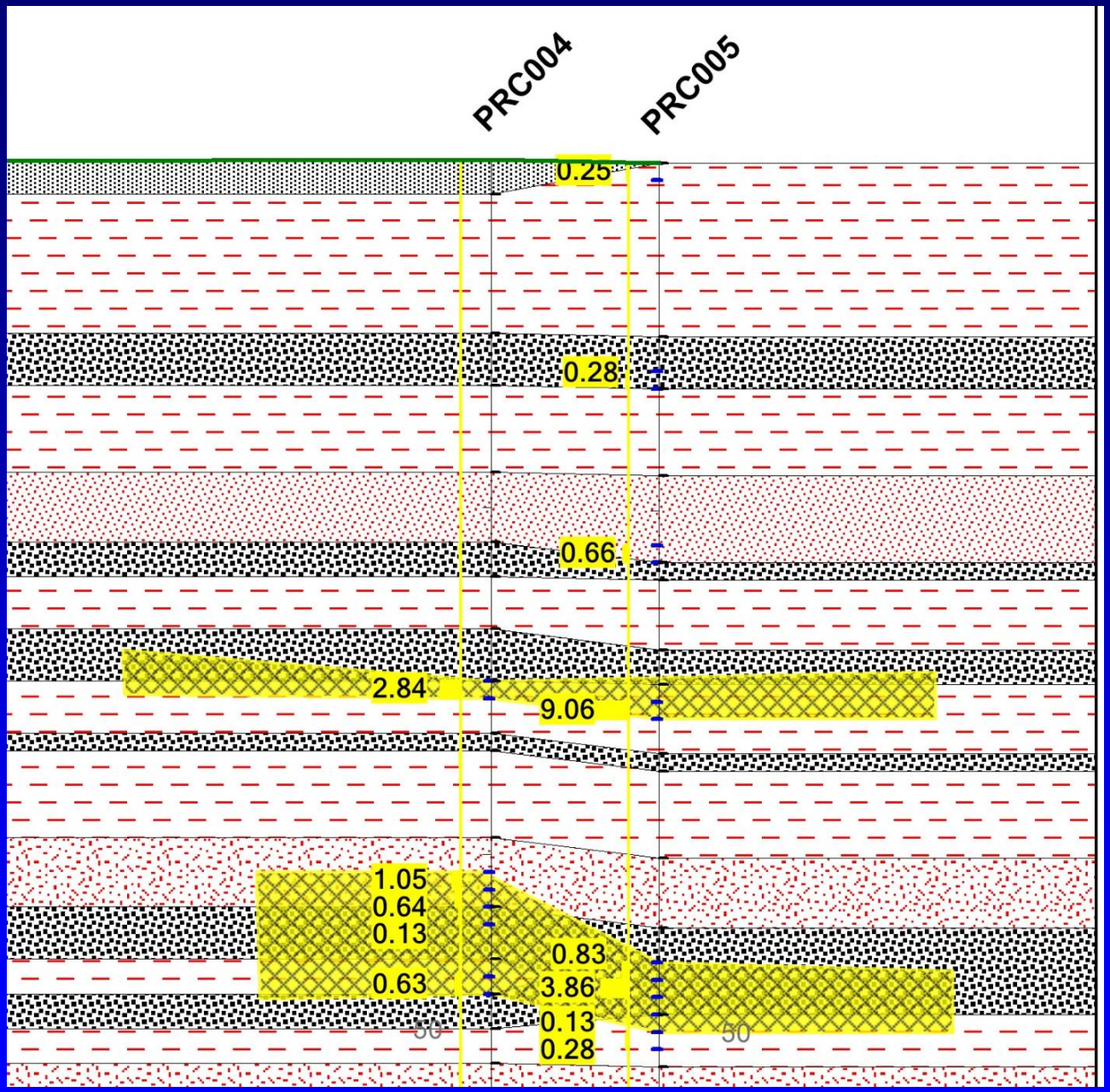


Piccadilly Western Slot

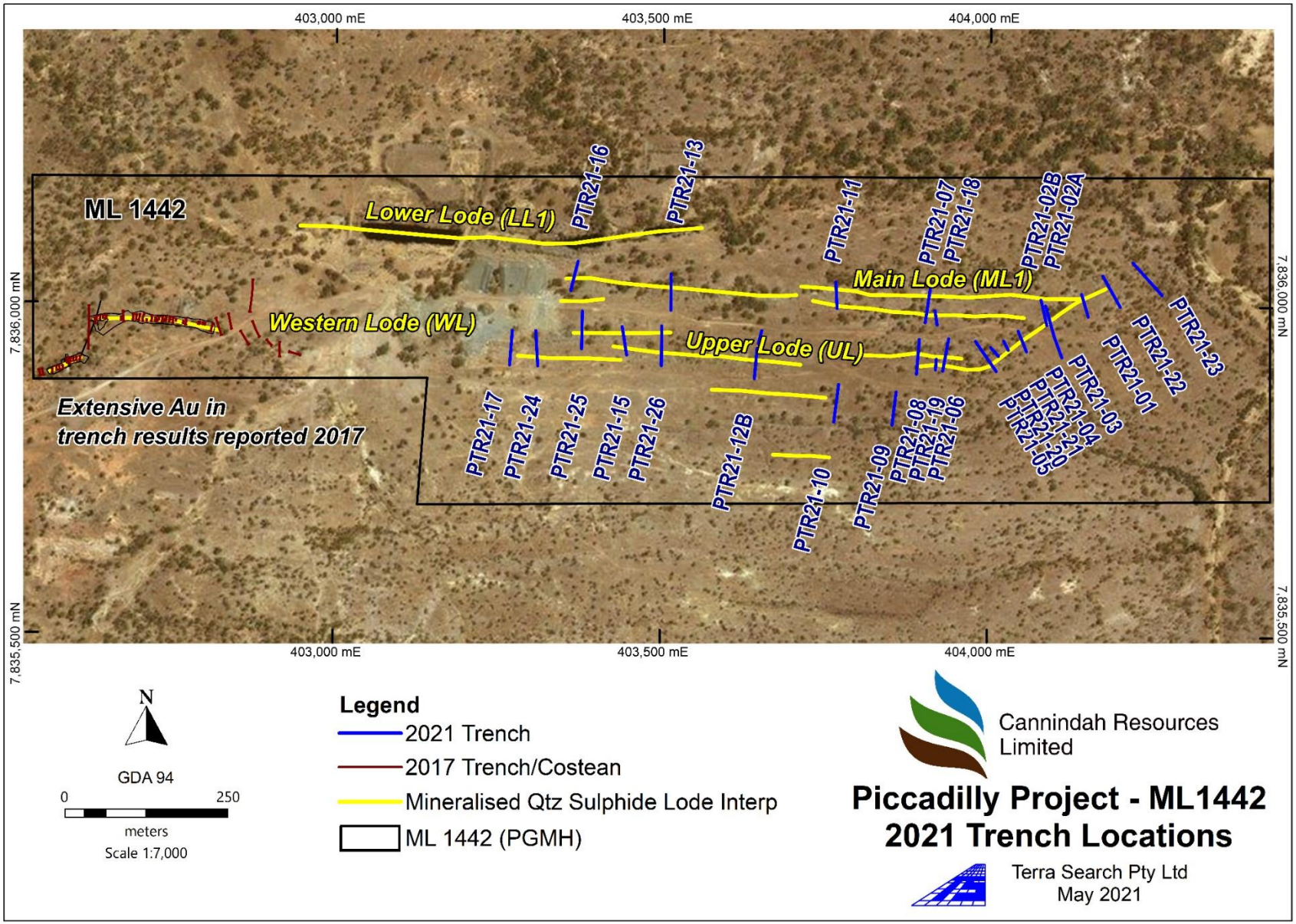
Piccadilly Western Slot Panned Gold



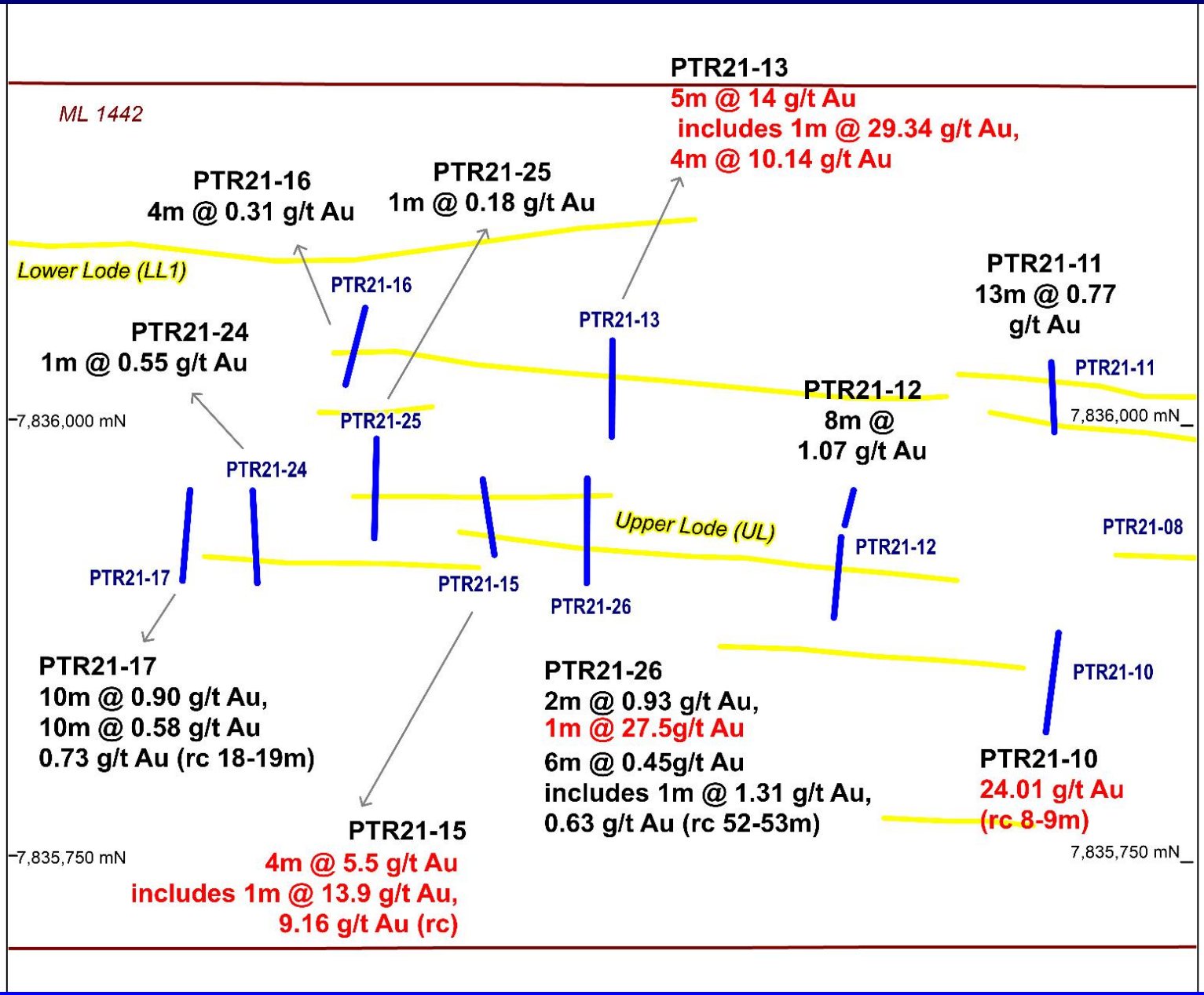
Piccadilly Western Slot 2018 Drilling Cross section



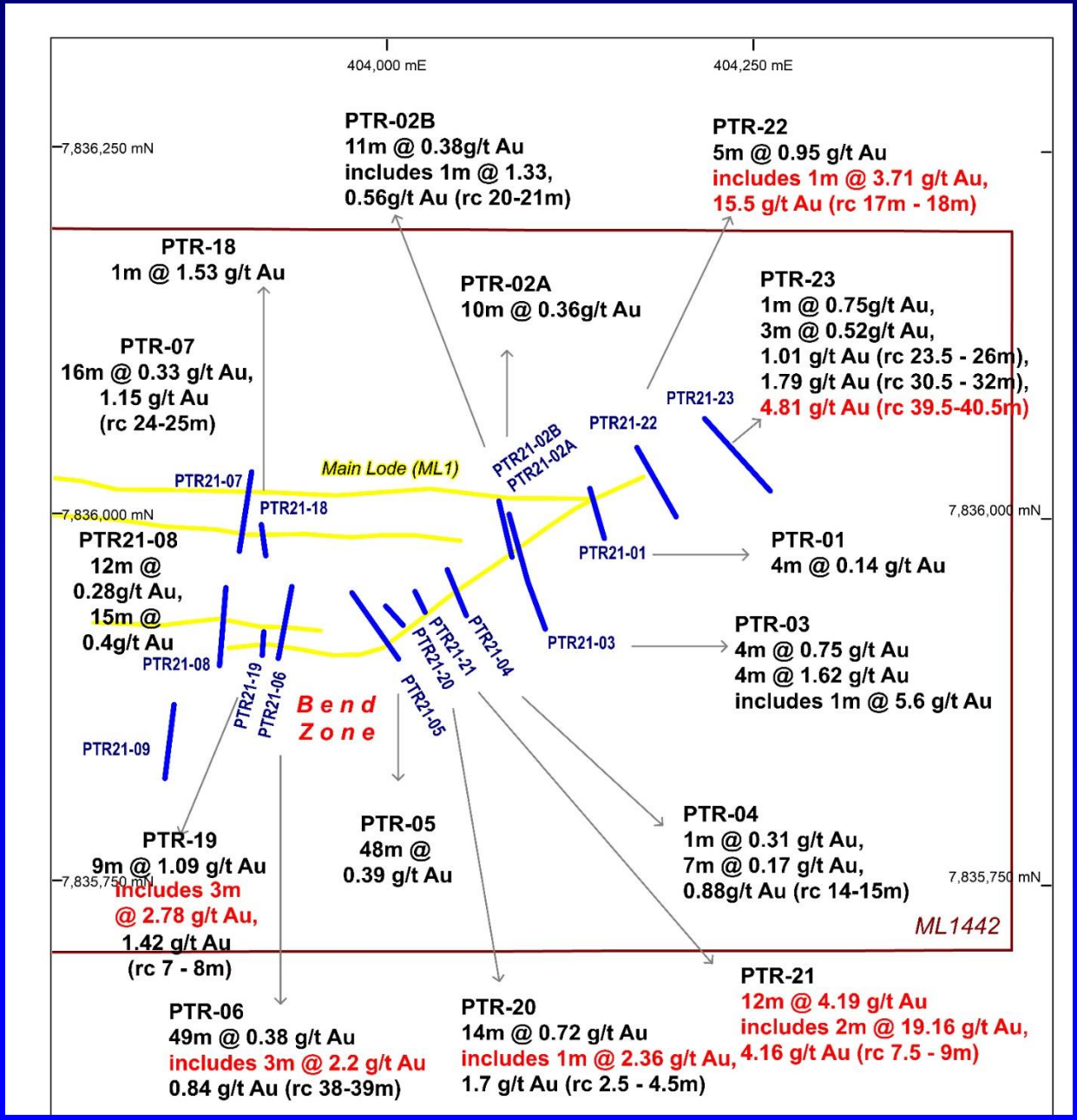
Piccadilly Western Slot 2018 Drilling Long section



Piccadilly 2021 Trenching

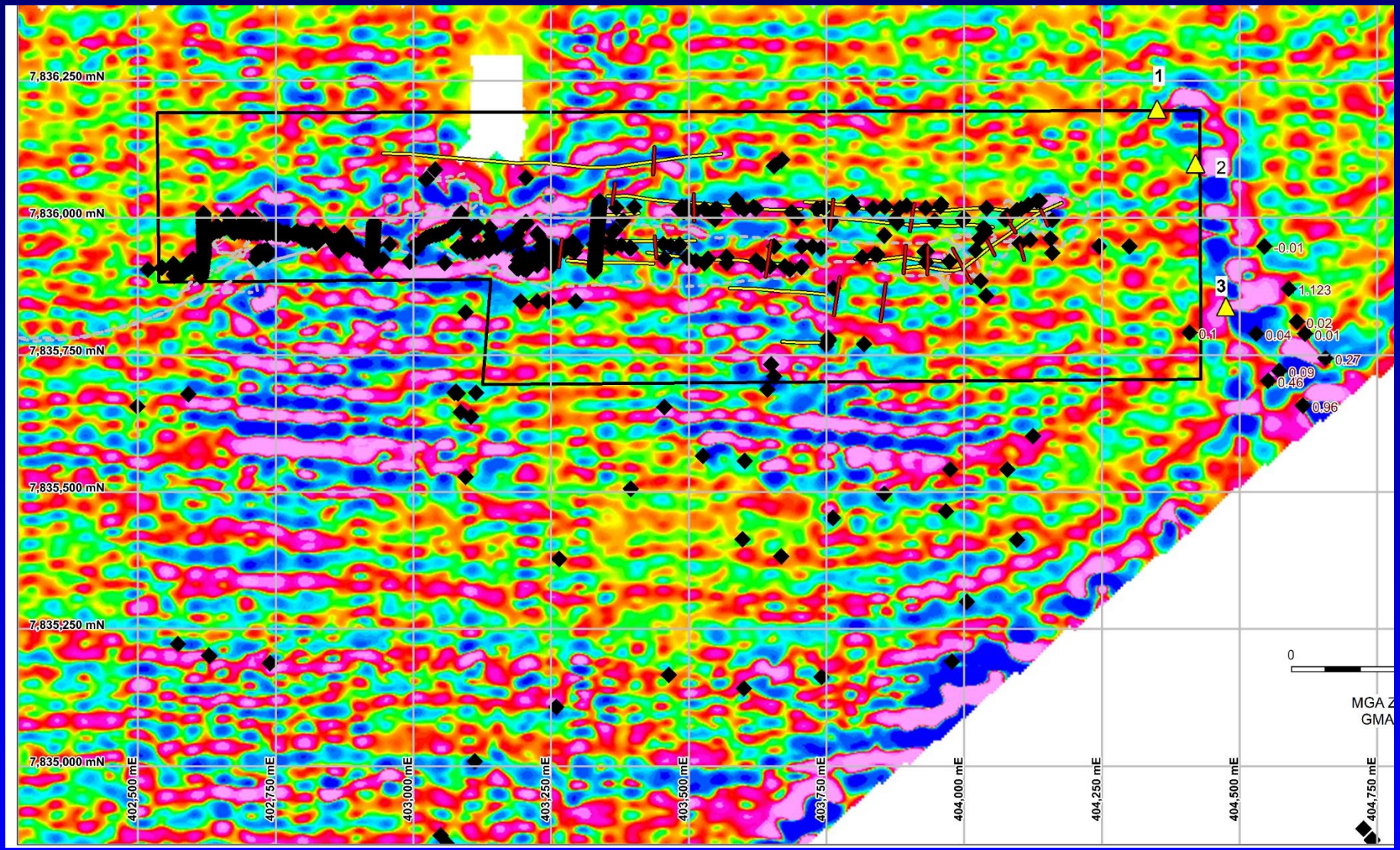


Piccadilly 2021 Trenching



Piccadilly 2021 Trenching

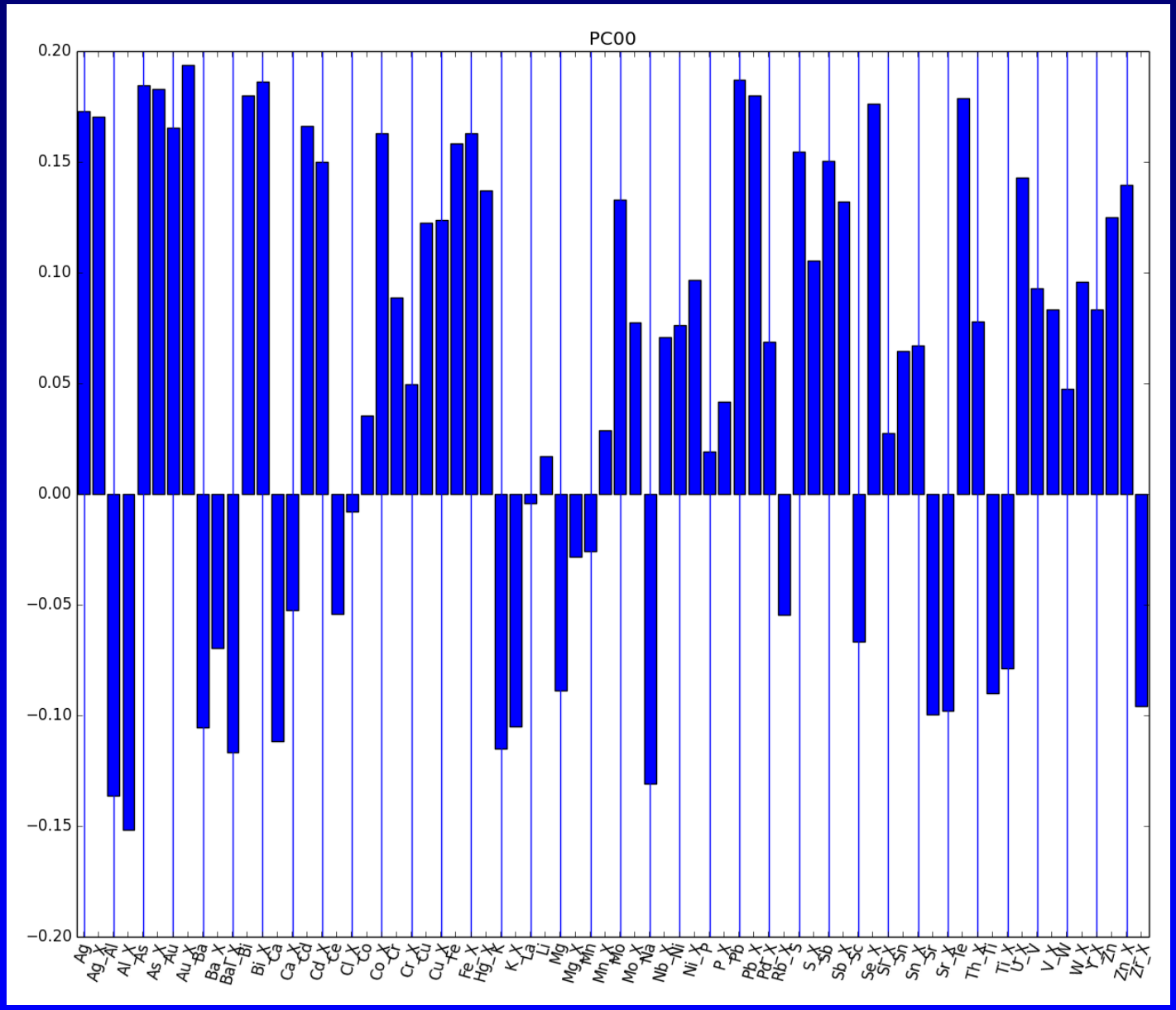
Piccadilly 2021 Trench 21 2m @ 19 g/tAu thin, ferruginous zones, little quartz veining evident



Piccadilly Ground Mag 2VD

Conclusions

- Presentation of a snapshot of Drill Ready Targets
- Demonstration that even historical mineral fields can be under-explored.
- Demonstration of the many powerful tools that enable modern scientific exploration to enhance exploration outcomes with the goal of increasing the chances of commercial success.
- Exploration is a journey from 100's of kms regional scale – being in the right area for right reasons - to an ore-block , maybe only 10s of metres of high value.

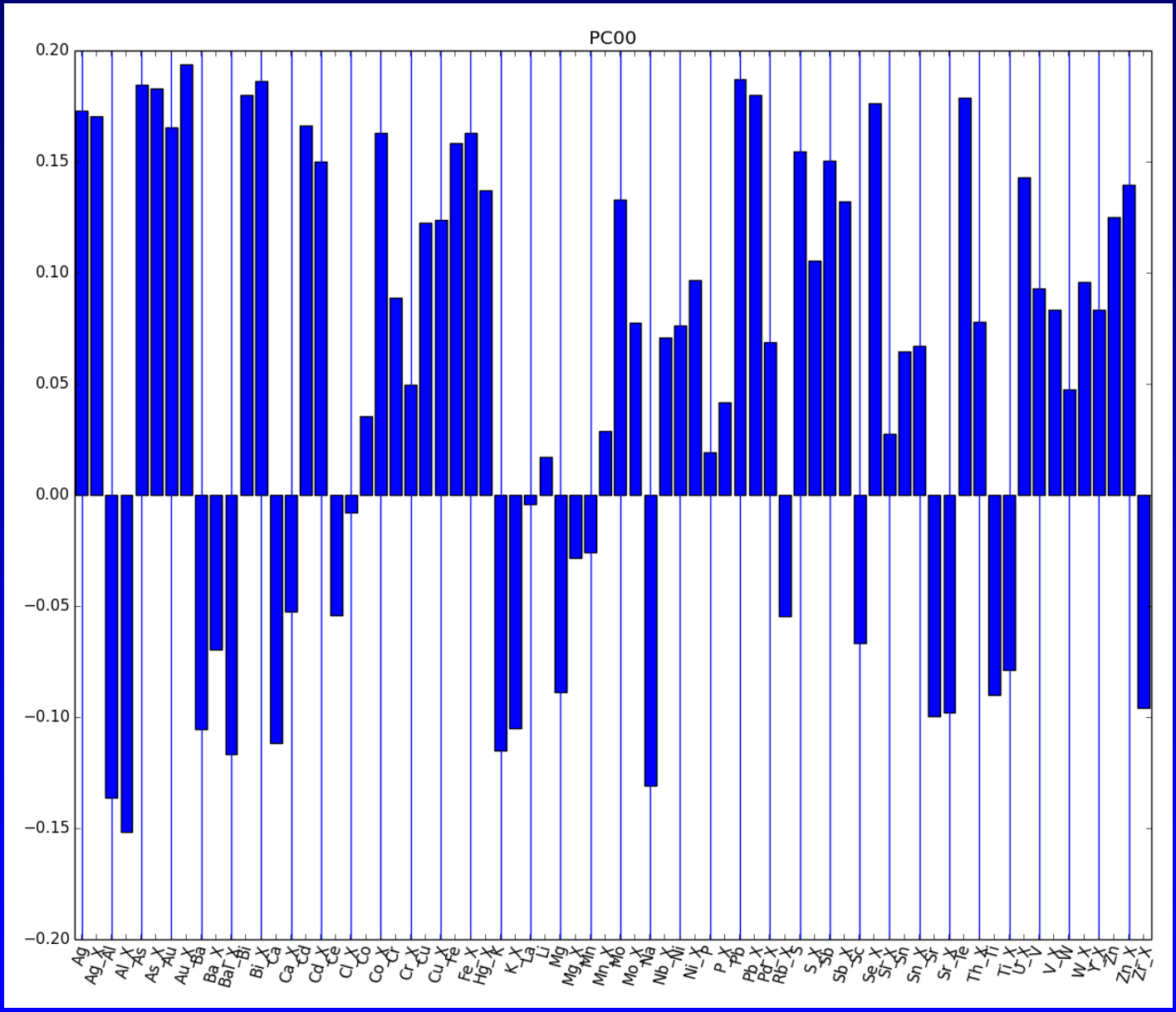


Positive PC0 Ag,As,Au,Bi ,Cu,Fe,Pb,Te, Zn mineralized veins & greisen

73 plus elements lab 4 acid digest/ICP and PXRF

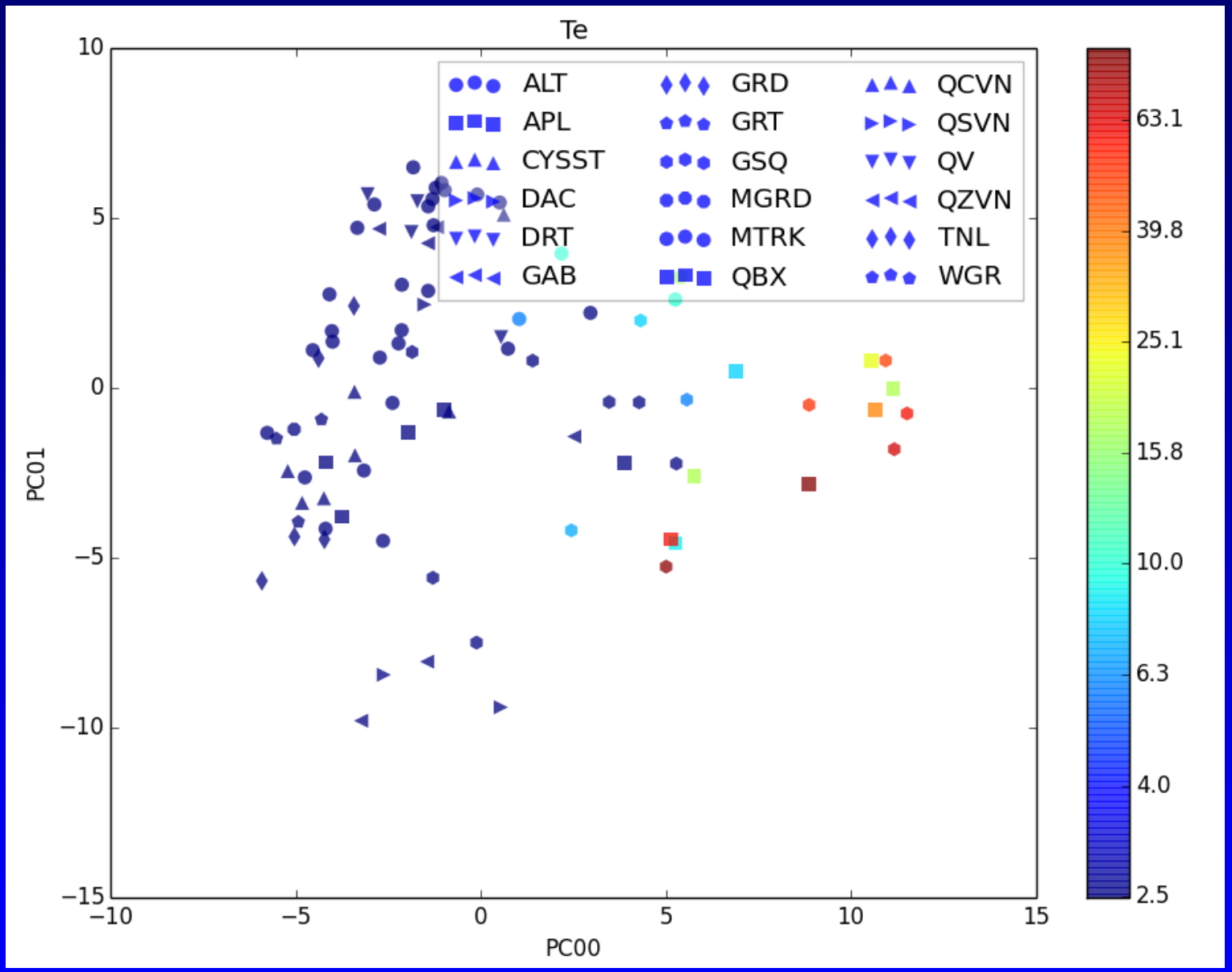
Halo Prospect Principal Component Analysis (PCA) . Halo Rockchip

Wishbone Gold

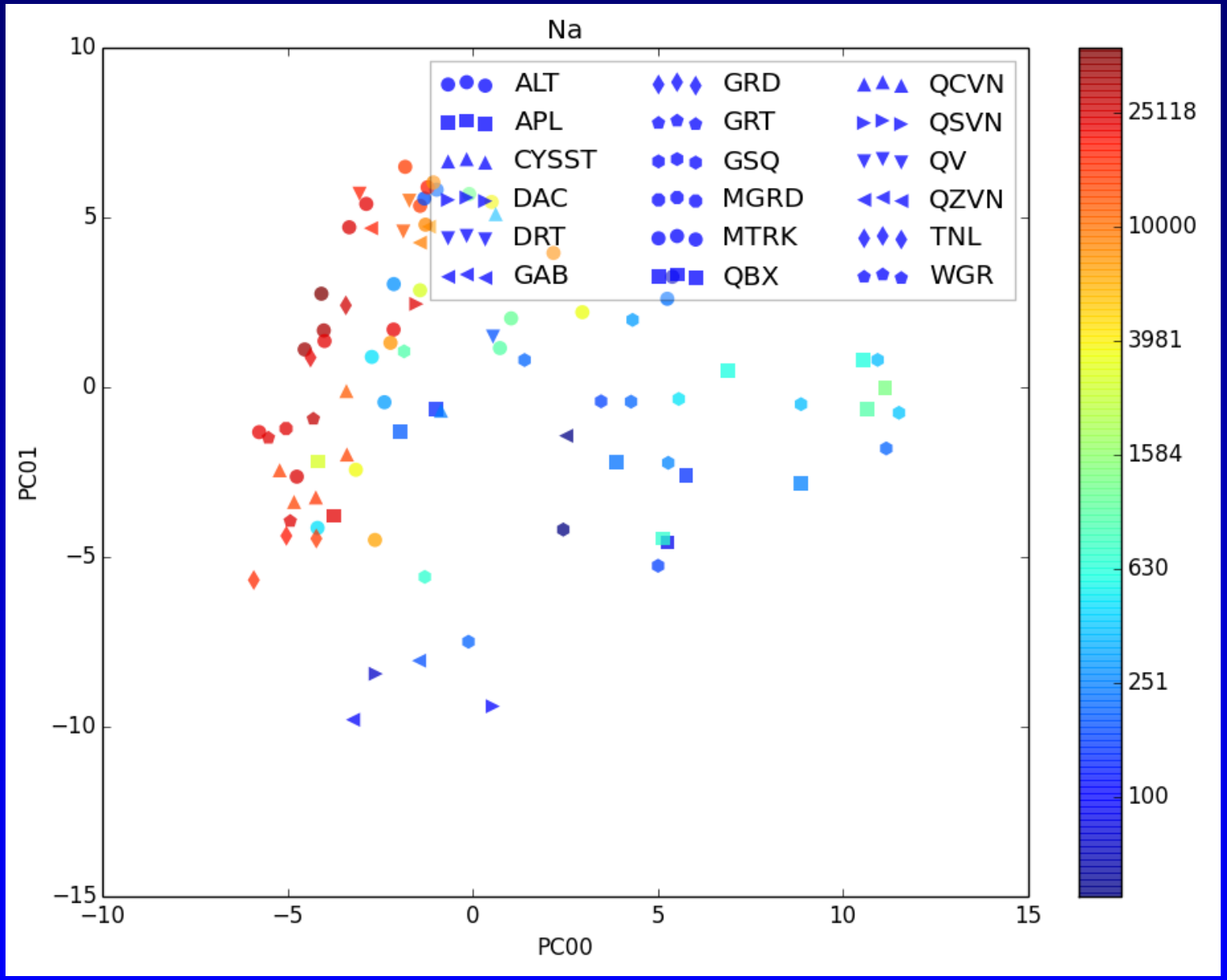


Negative PC0 Al,Ba,Ca,K,Mg,Na,Rb,Sr,Ti, Zr Unaltered gabbro,diorite, tonalite granite.

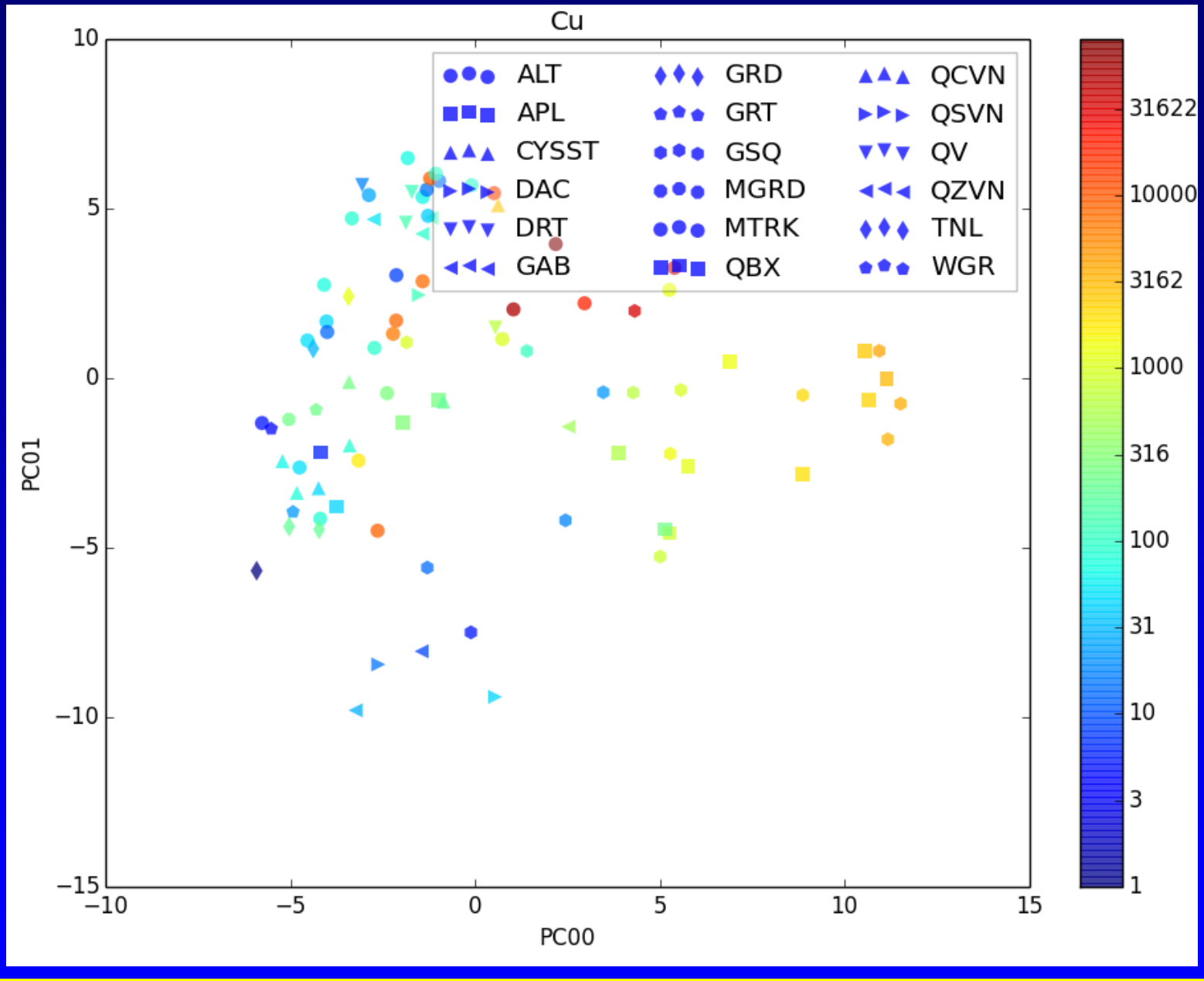
Halo Prospect Principal Component Analysis (PCA) . Halo Rockchip



Halo Prospect Rock chips ,Principal Component example PC0 Vs PC1 : Te .
Discriminates gossanous vein breccia against unaltered rocks.



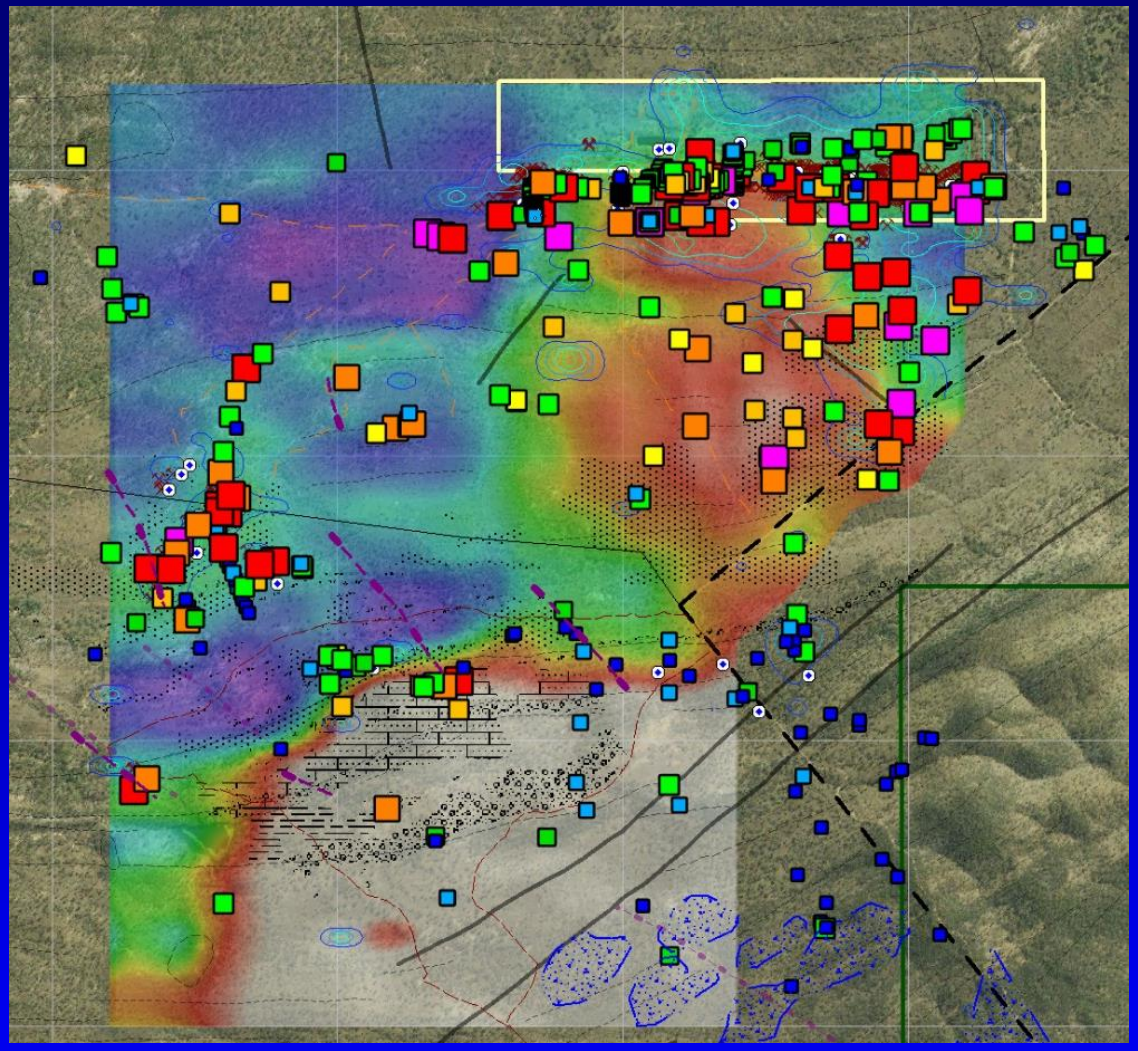
Halo Prospect Rock chips ,Principal Component example PC0 Vs PC1 : Na .
Discriminates unaltered rocks against mineralized ones .



Halo Prospect Rock chips ,Principal Component example PC0 Vs PC1 : Cu .

Wider scatter as Cu in veins, micaceous greisen and higher in mafic rocks..

Piccadilly IP & Gold in rock chips



EX3_RC Samples
MI by Au (g/t)

-0.05	to	0.02	1	to	2
0.02	to	0.05	2	to	5
0.05	to	0.1	5	to	20
0.1	to	0.5	20	to	125
0.5	to	1			

Chargeability
Pseudo-Section 3200 E