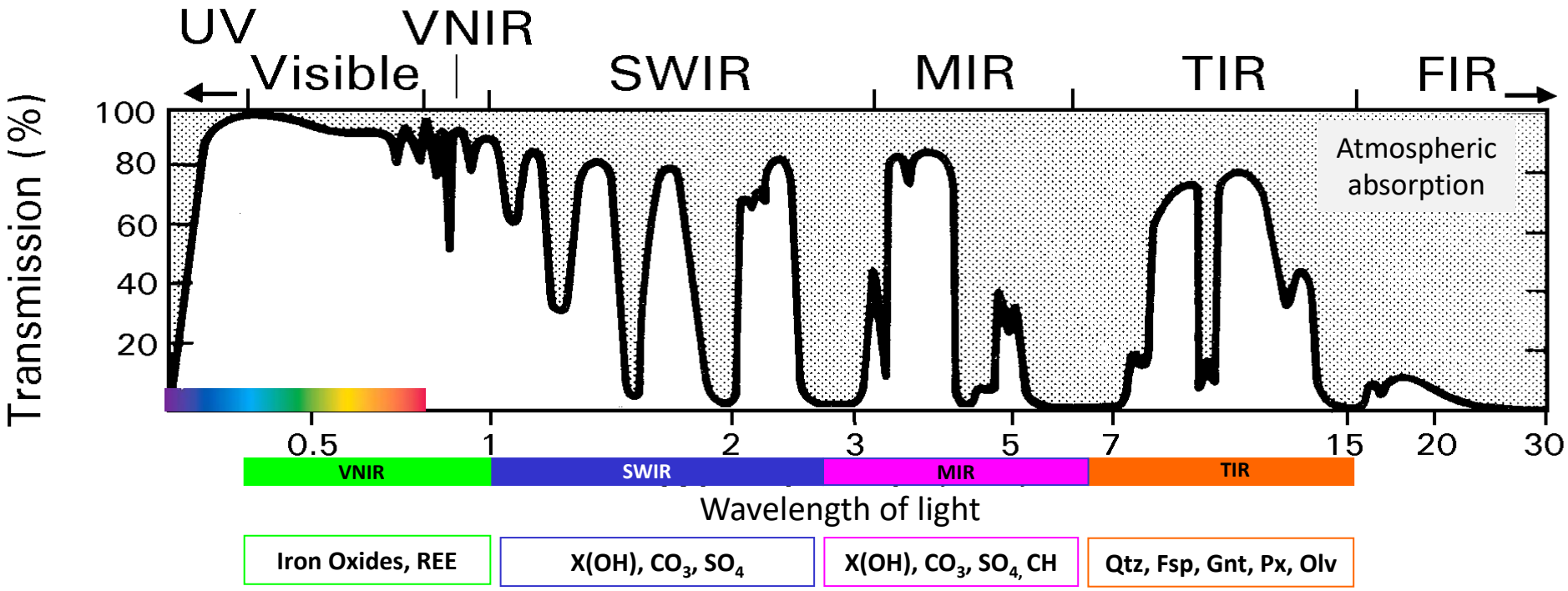
Advances in hyperspectral mineralogy at GS NSW

The new HyLogger 4 and the potential of mid-infrared mineralogy

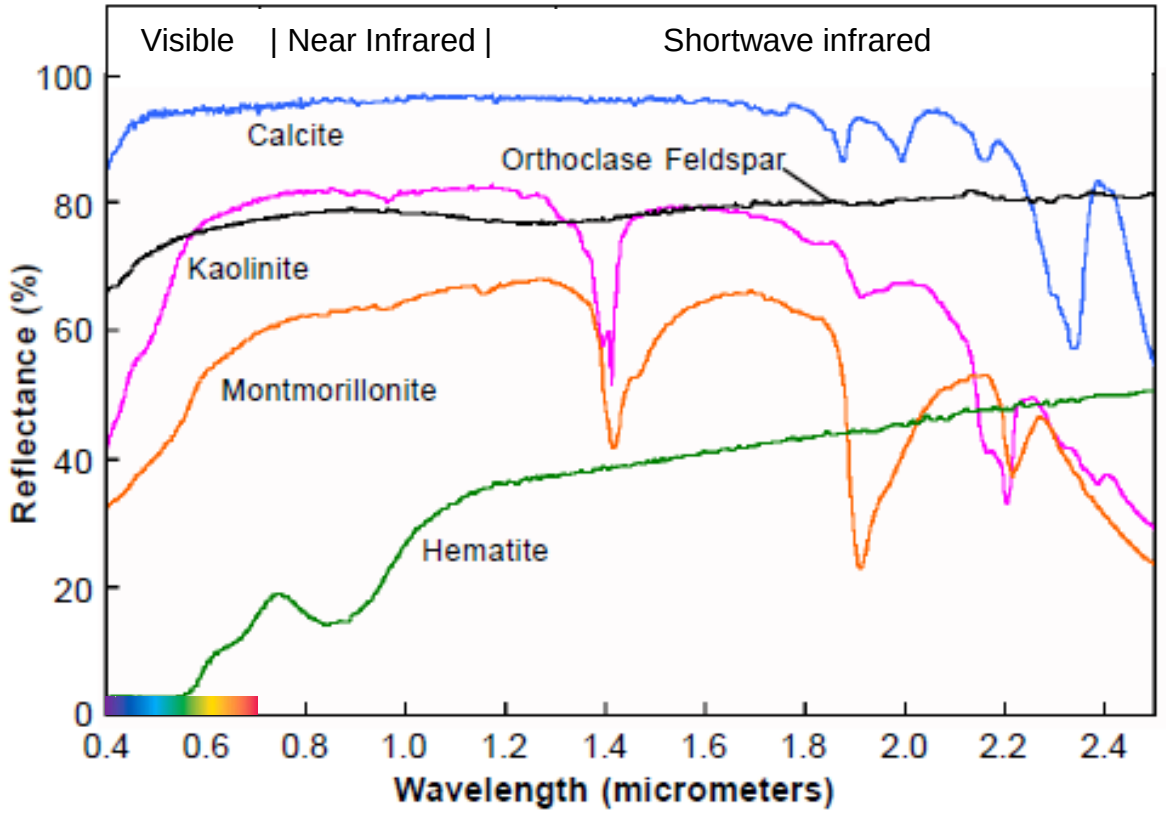
Exploration in the House - May 2025
Dr Jon Huntington, CSIRO Hon. Fellow

Mineral Sensing Wavelengths



What is hyperspectral HyLogging?

- Slicing up the vibrational spectra of rocks and minerals into hundreds of spectral response bands, way beyond what the human eye can see.
- Allows their identification
- HyLogging is a now commercialised CSIRO technology for robotically scanning drill cores in their boxes at continuous centimetre scales



History

- HyLogging in NSW has been value-adding and distributing the State's huge legacy drill core assets to assist future resource developments since 2006

- Londonderry-based facility has scanned and published over 1085 drill holes since 2010.
  - Scanned 272,400m. 7,500m with HL4

2000 - CSIRO core logging vision

2002 - CSIRO-AMIRA industry research

2005 - AuScope/NCRIS Infrastructure idea

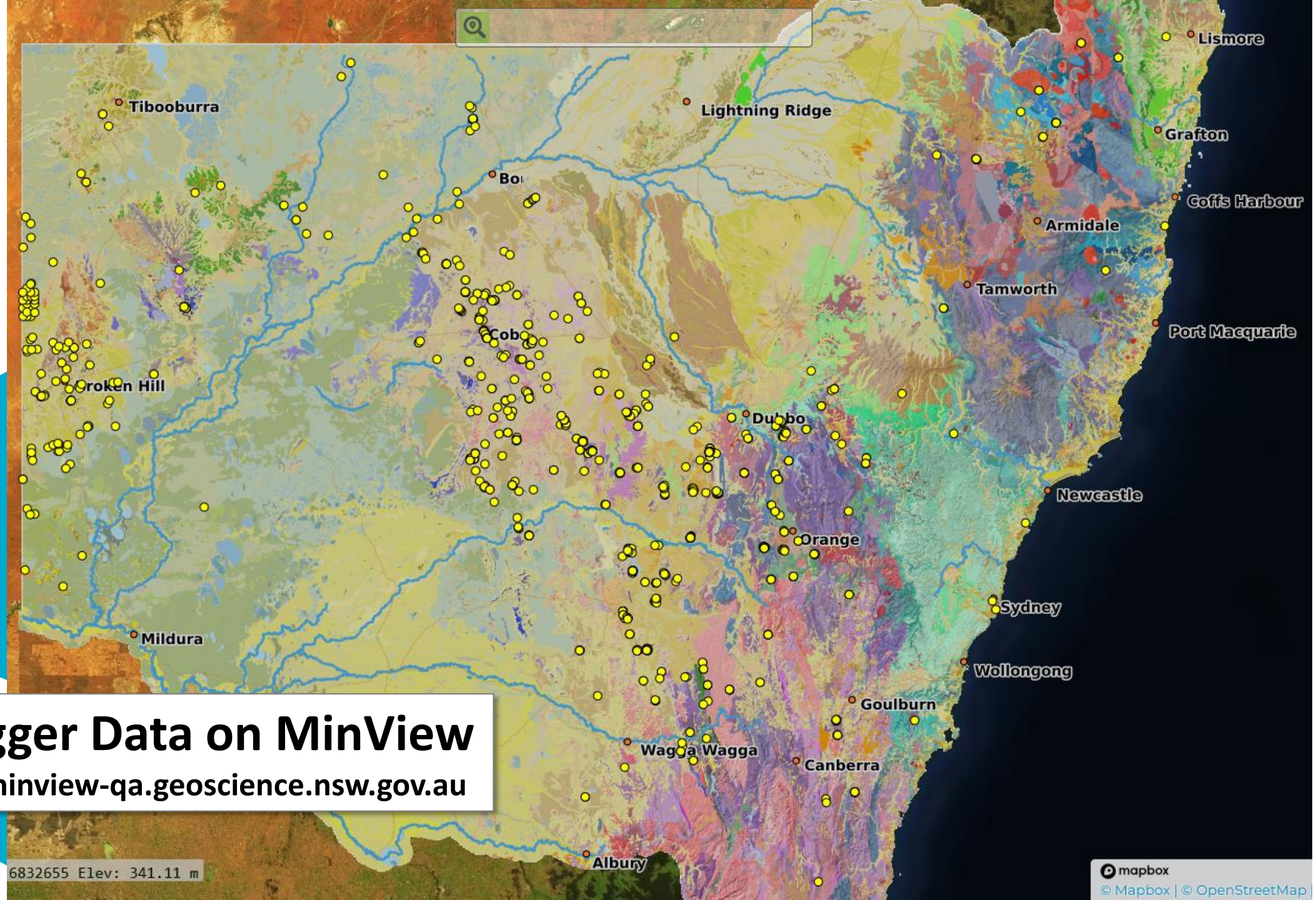
2006 - GS NSW joins AuScope/NCRIS NVCL project with 6 other Surveys & CSIRO

2009 - GS NSW first HyLogger-2

2010 - GS NSW HyLogger-3 upgrade

2017 - Corescan commercialisation

2025 - HyLogger-4 operational at GS NSW for the next 20 years



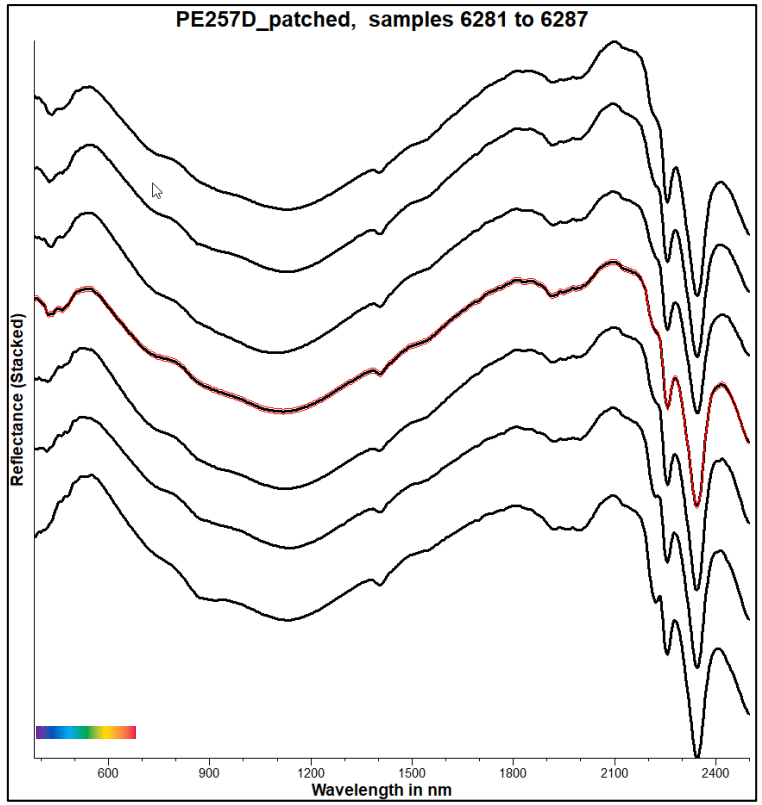
HyLogger Data on MinView

https://minview-qa.geoscience.nsw.gov.au

HyLogger-4 Benefits

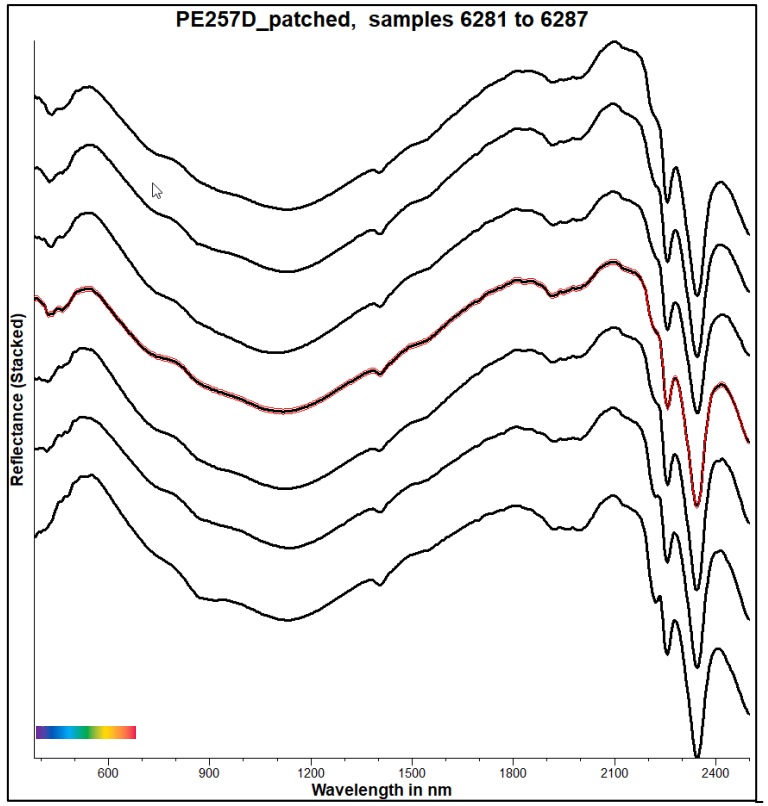
1. Sustainability secured
   - Now commercially manufactured as opposed to a CSIRO research project
2. New Mid-Infrared wavelengths means new minerals
3. Duplication of wavelengths means increased confidence
4. Overcoming “blindness” at other wavelengths
5. More detailed core imaging

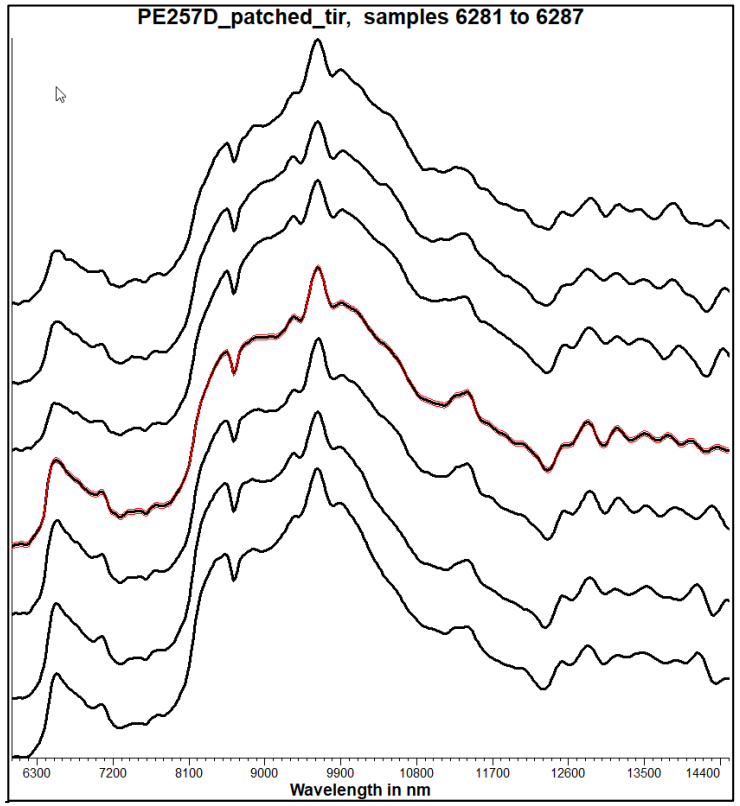
HyLogger-2 2010 - 531 wavelengths



Visible & Shortwave Infrared

HyLogger-3 2012 - 881 wavelengths



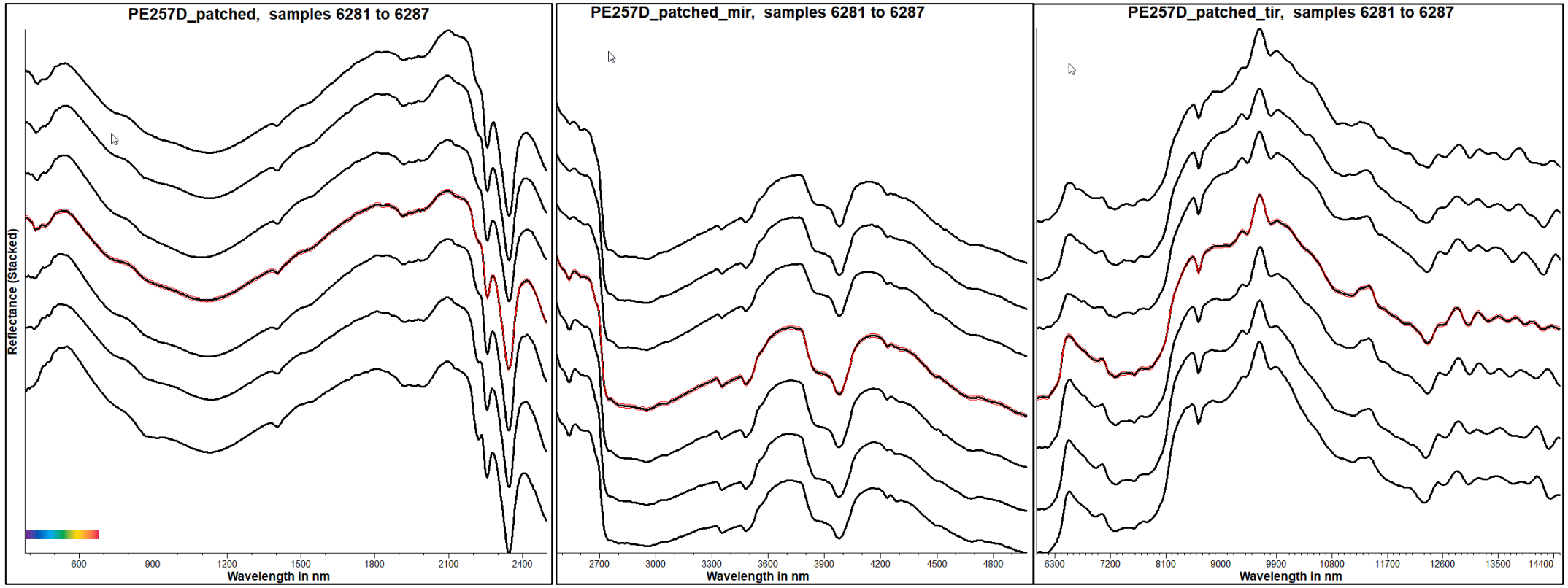


Visible & Shortwave Infrared

Thermal Infrared

HyLogger-4 2024 – 1222 wavelengths

The only fully-registered continuous-wavelength instrument of its kind in the world



Visible & Shortwave Infrared **Mid Infrared** **Thermal Infrared**

HyLogger-4 scanning

Testing Phase

- Tomingley Au PE257D. (159.7m)
- Hera HRUD165 Pb-Zn. (356.98m)
- Temora Au TD021. (296.08m)
- Bowdens Ag BD23003. (375.5m)

Production Phase

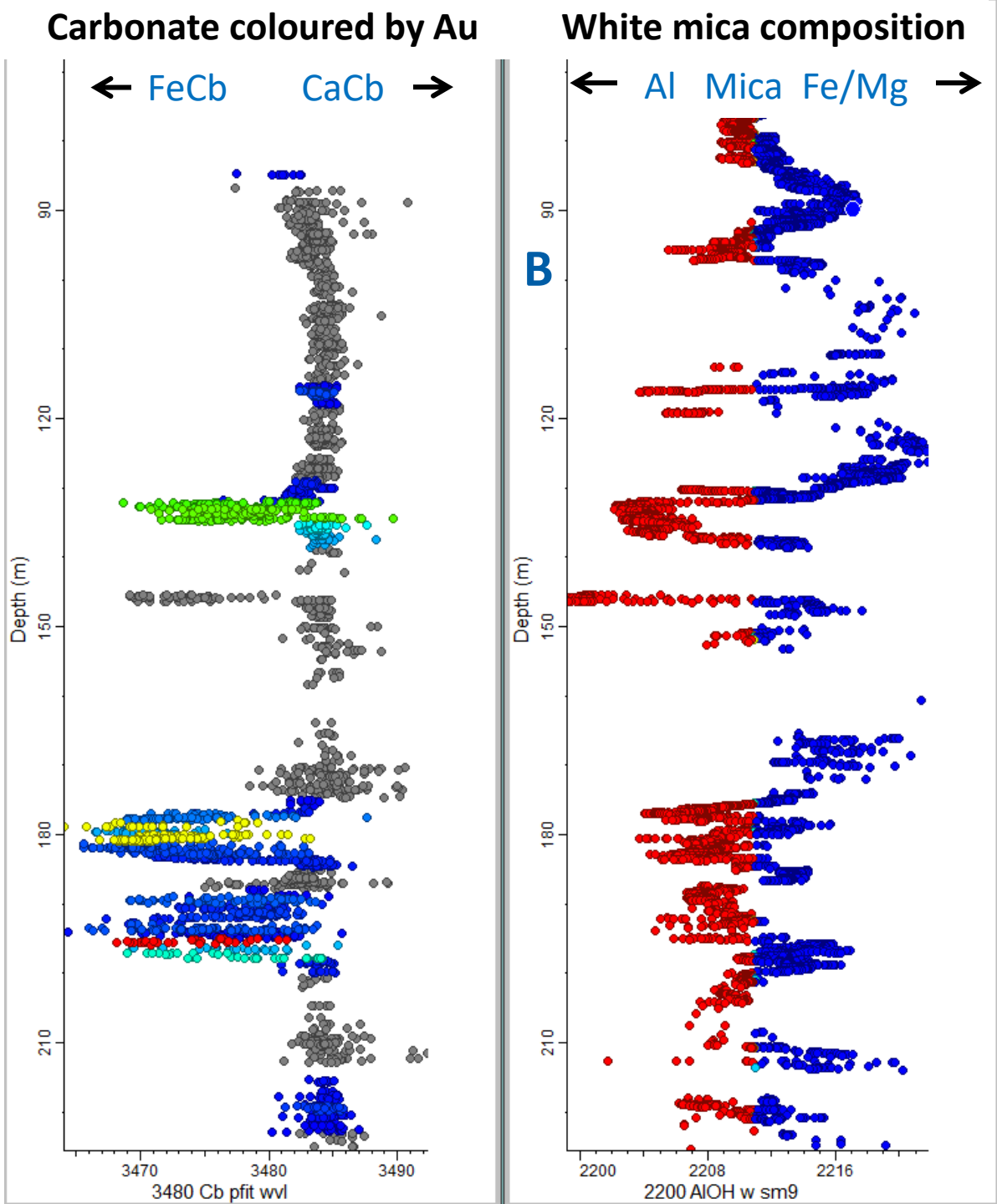
- Bowdens Ag
- Broken Hill line-of-load holes (current)

Carbonate, W-mica alteration

New HyLogger-4 mid-infrared is supremely sensitive to carbonates and carbonate composition

Tomingley Au has abundant iron-rich carbonate (ankerite) in the mineralised zones [A]. Not seen as clearly before

Paralleled by Al-rich muscovite mica, not Fe/Mg phengitic mica [B]



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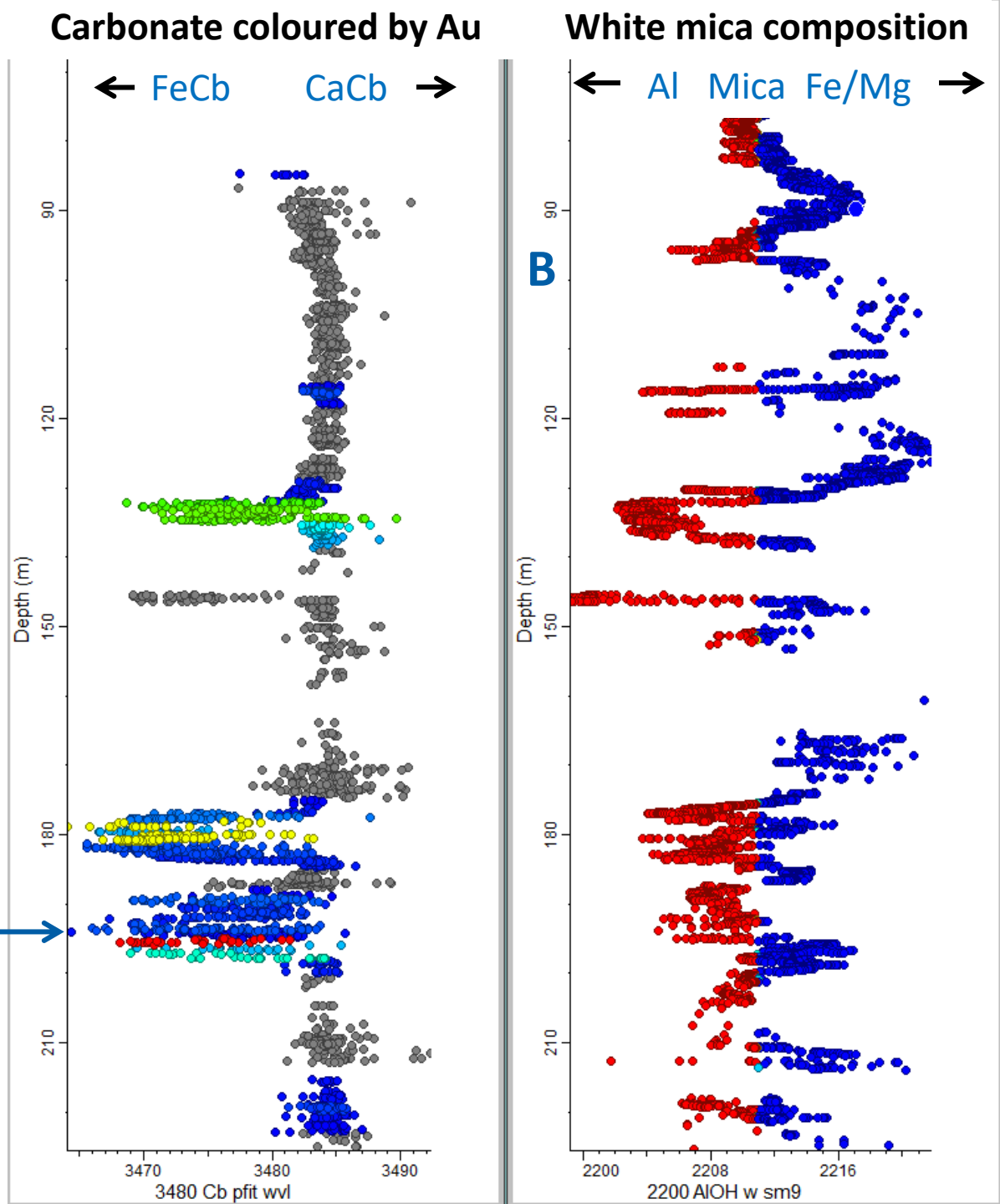
Paralleled by Al-rich muscovite mica, not Fe/Mg phengitic mica [B]

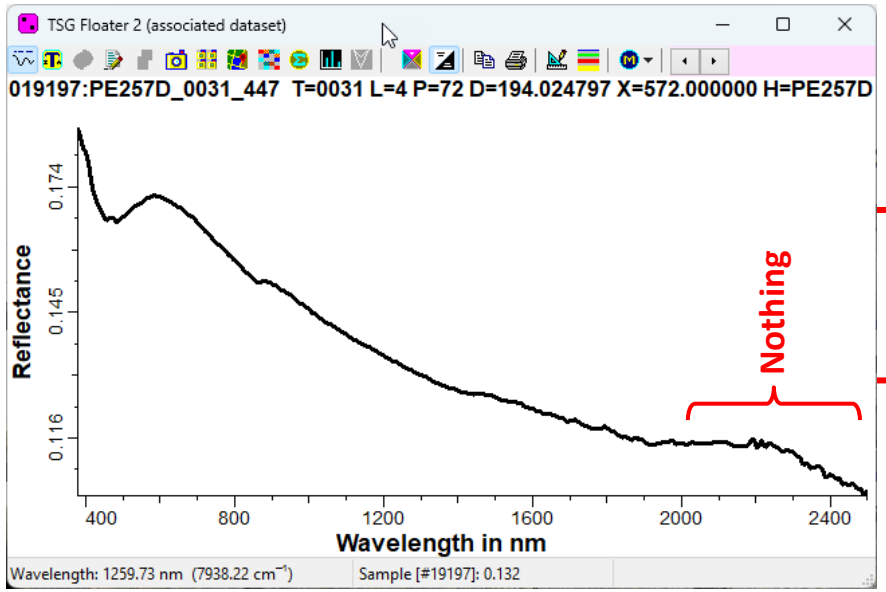
Table 1. *Point counted modal mineralogy sandstone of sample T094468*

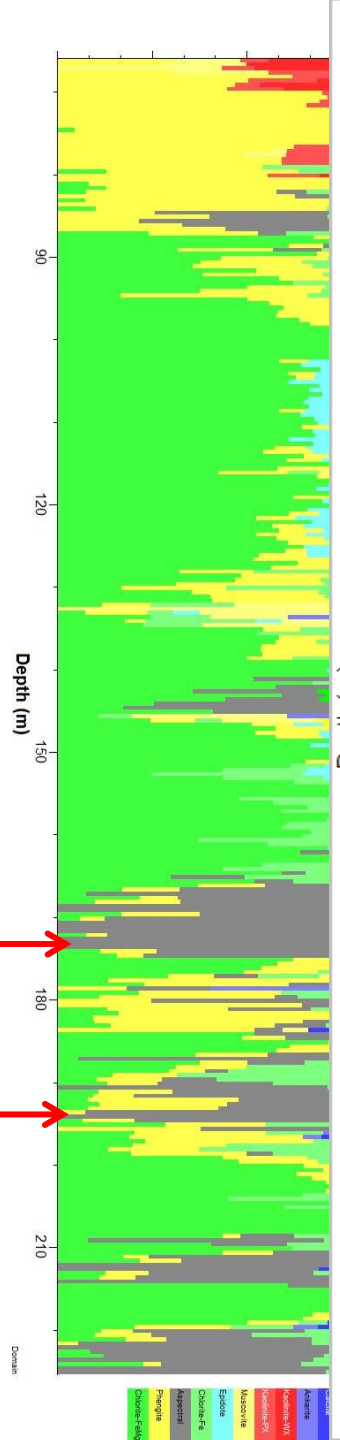
Mineral(s)	Count	%
Quartz matrix (and vein)	85	26.56%
Carbonate matrix (and vein)	119	37.19%
White mica matrix (and vein)	86	26.88%
Feldspar (plagioclase)	13	4.06%
Pyrrhotite	5	1.56%
Pyrite	8	2.50%
Dark graphitic material	4	1.25%
Total Count	**320**	**100.00%**

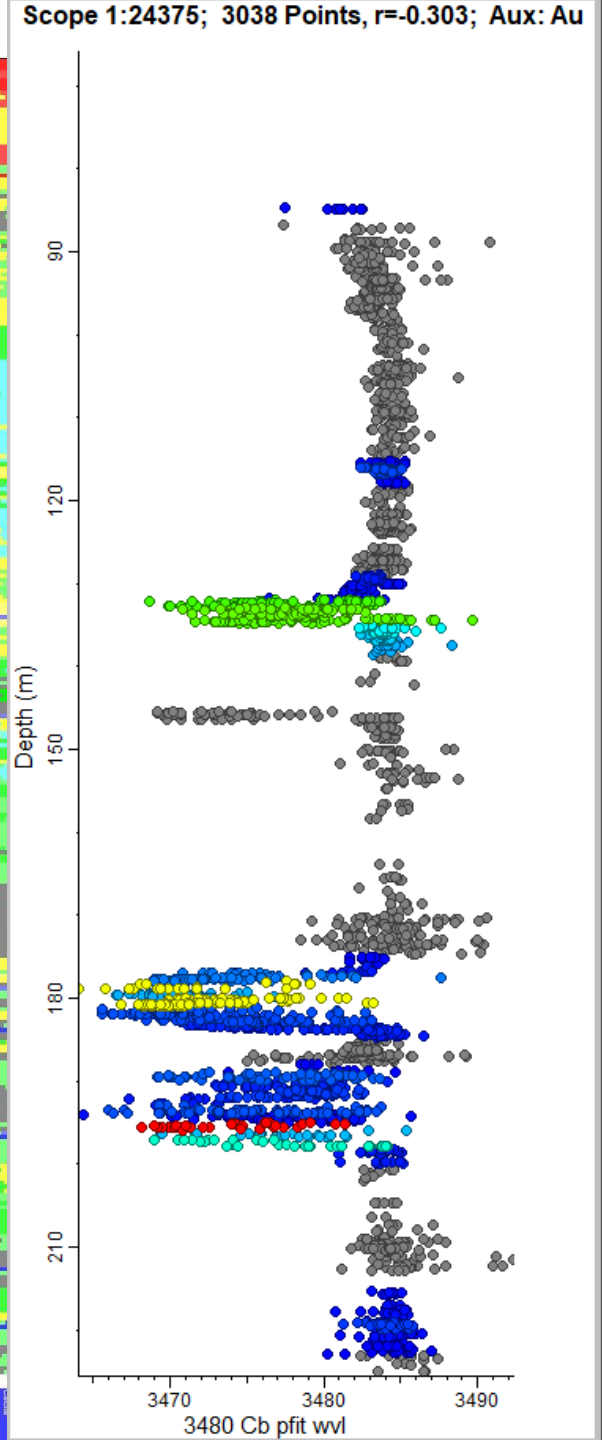


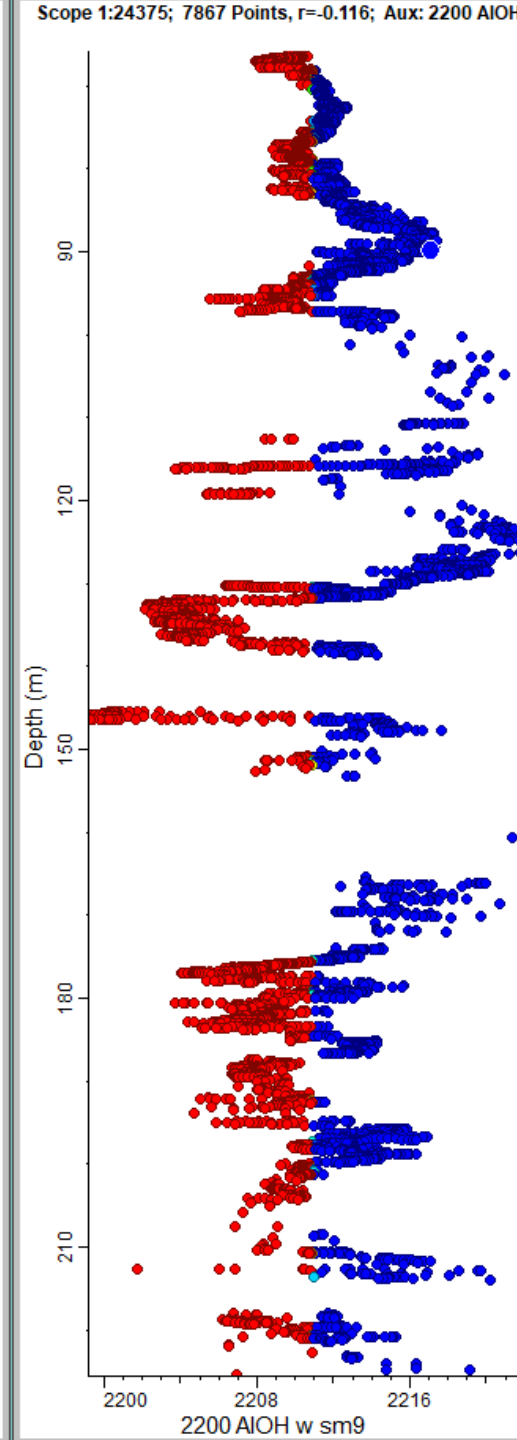
Aspectral responses

Some rocks are just not spectrally active, or ‘aspectral’- grey, in the SWIR.









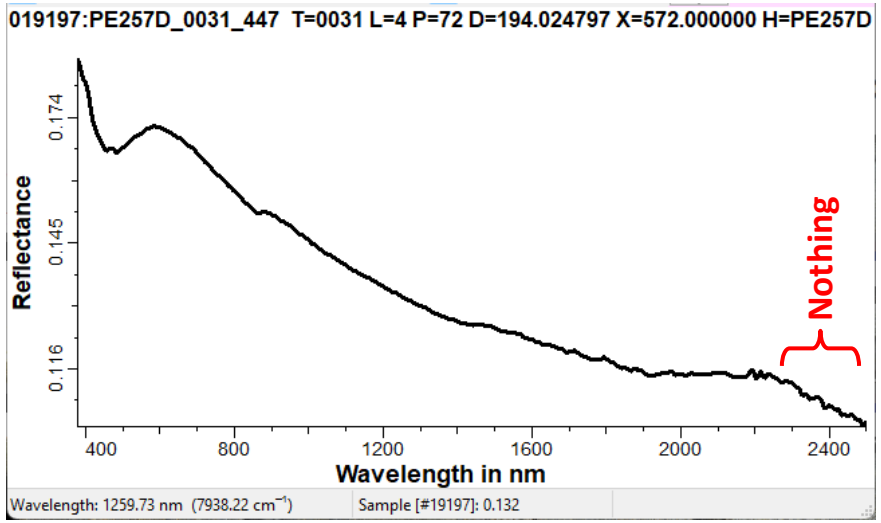
SWIR blindness / Aspectral isn't aspectral

But not so in the MIR where there is plenty of action

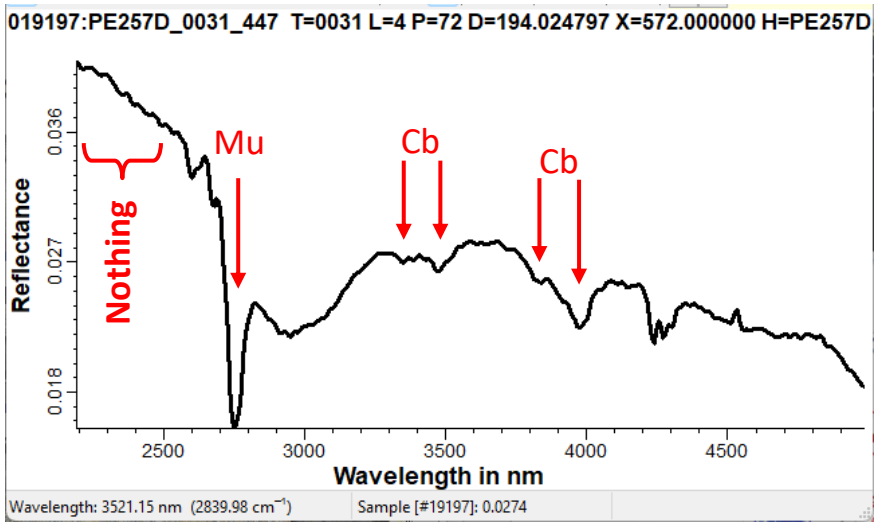
The HL-4 has truly given us something valuable we weren't expecting

Why is this so? Opaque minerals?

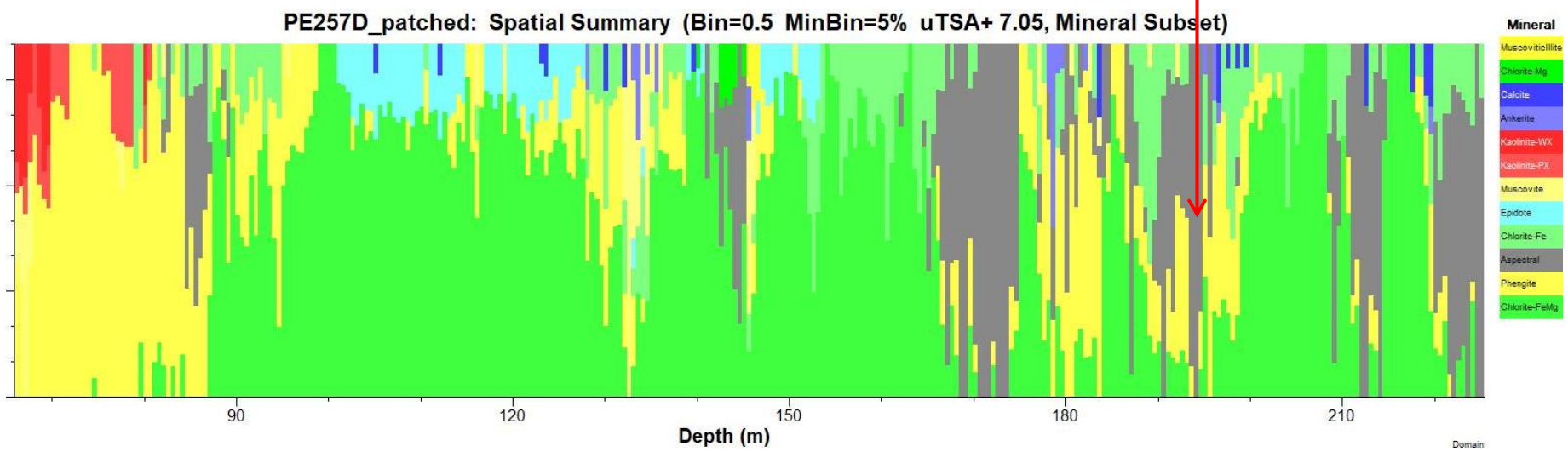
Under investigation in collaboration with Joel Fitzherbert



HyLogger-3 VNIR/SWIR



HyLogger-4 MIR



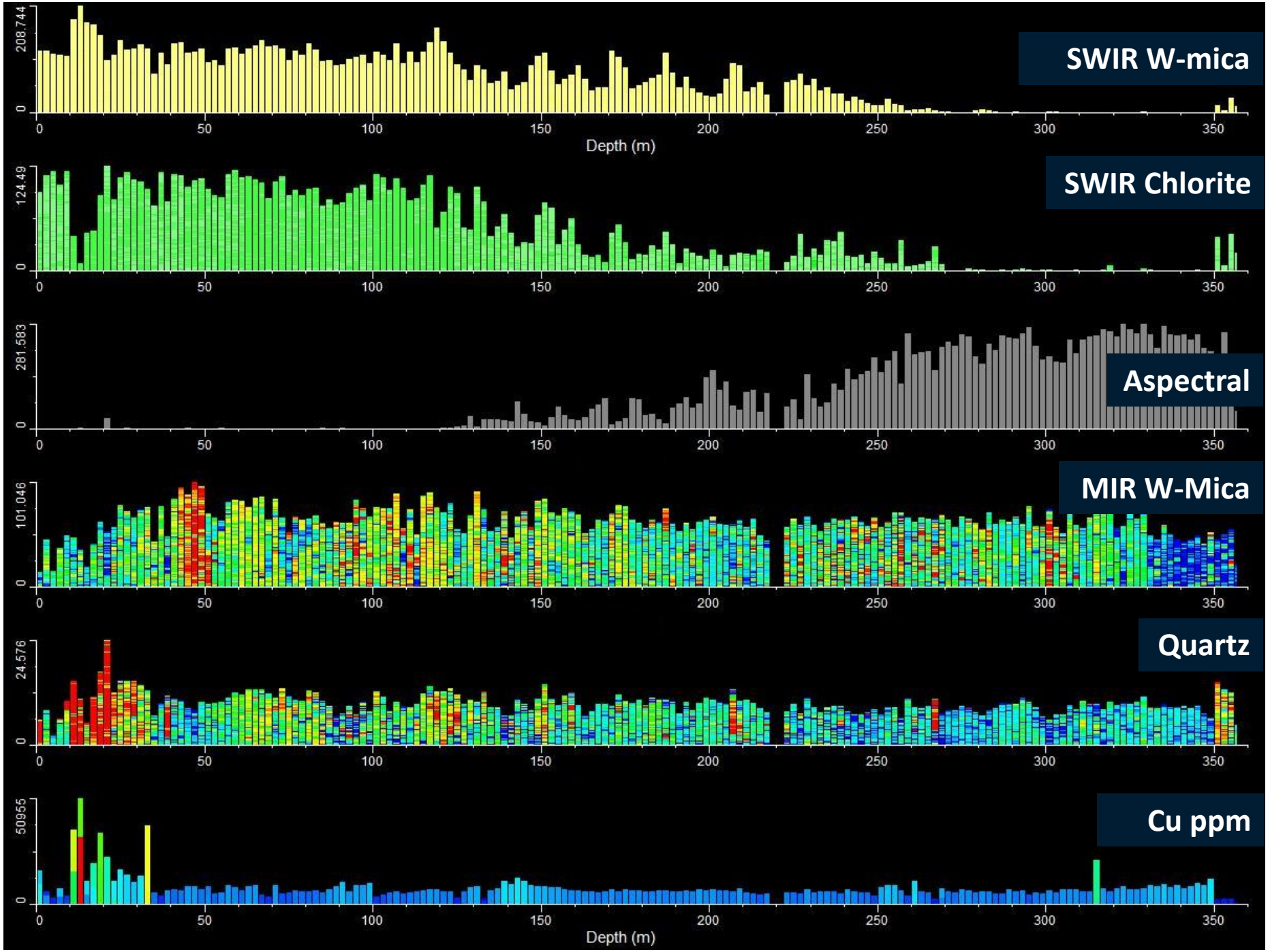
Hera

HRUD165

HL4 confirms there's more W-mica than the SWIR sees

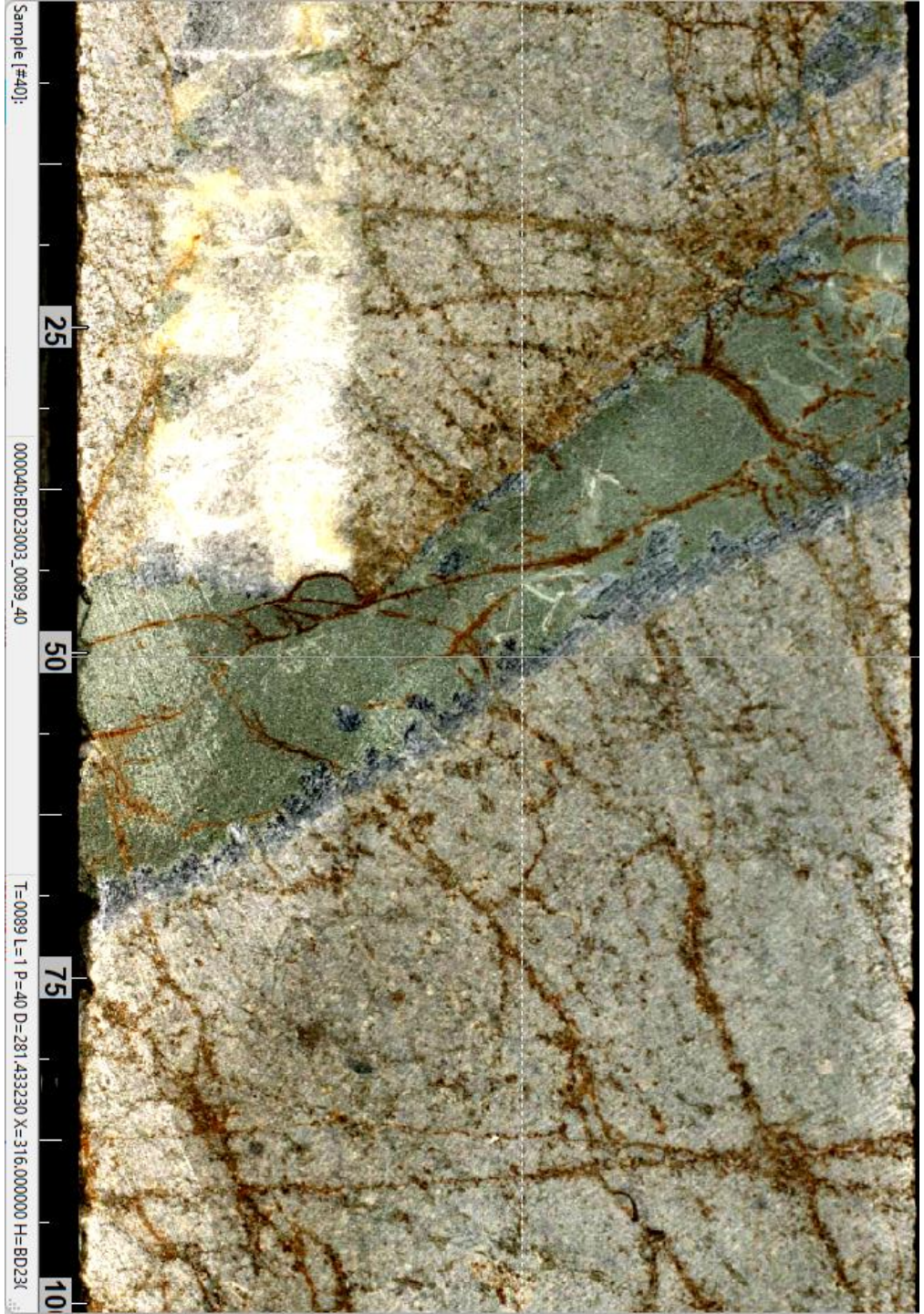
What mineralogy renders the SWIR partially blind?

Opaques?



Hi Resolution imaging

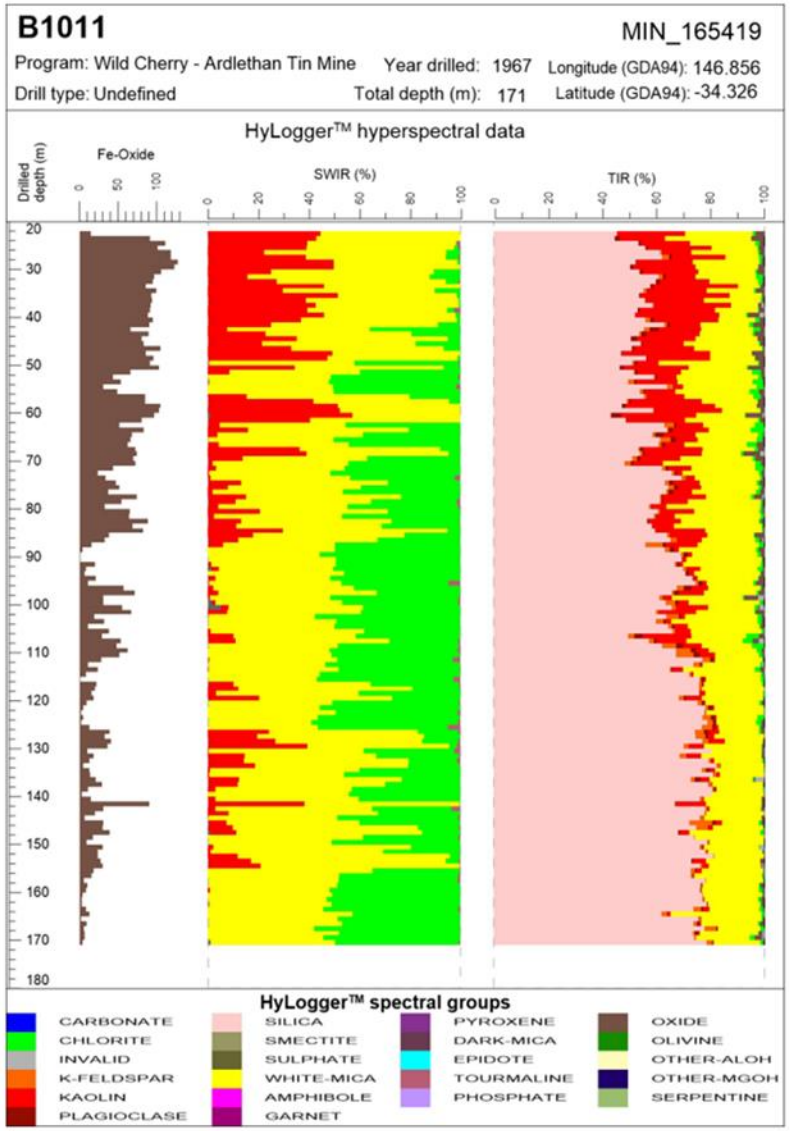
HyLogger-4 uses a 6.25 µm resolution camera for enhanced textures, vein and selvedge detail, compared to the HL3’s 25 micrometres

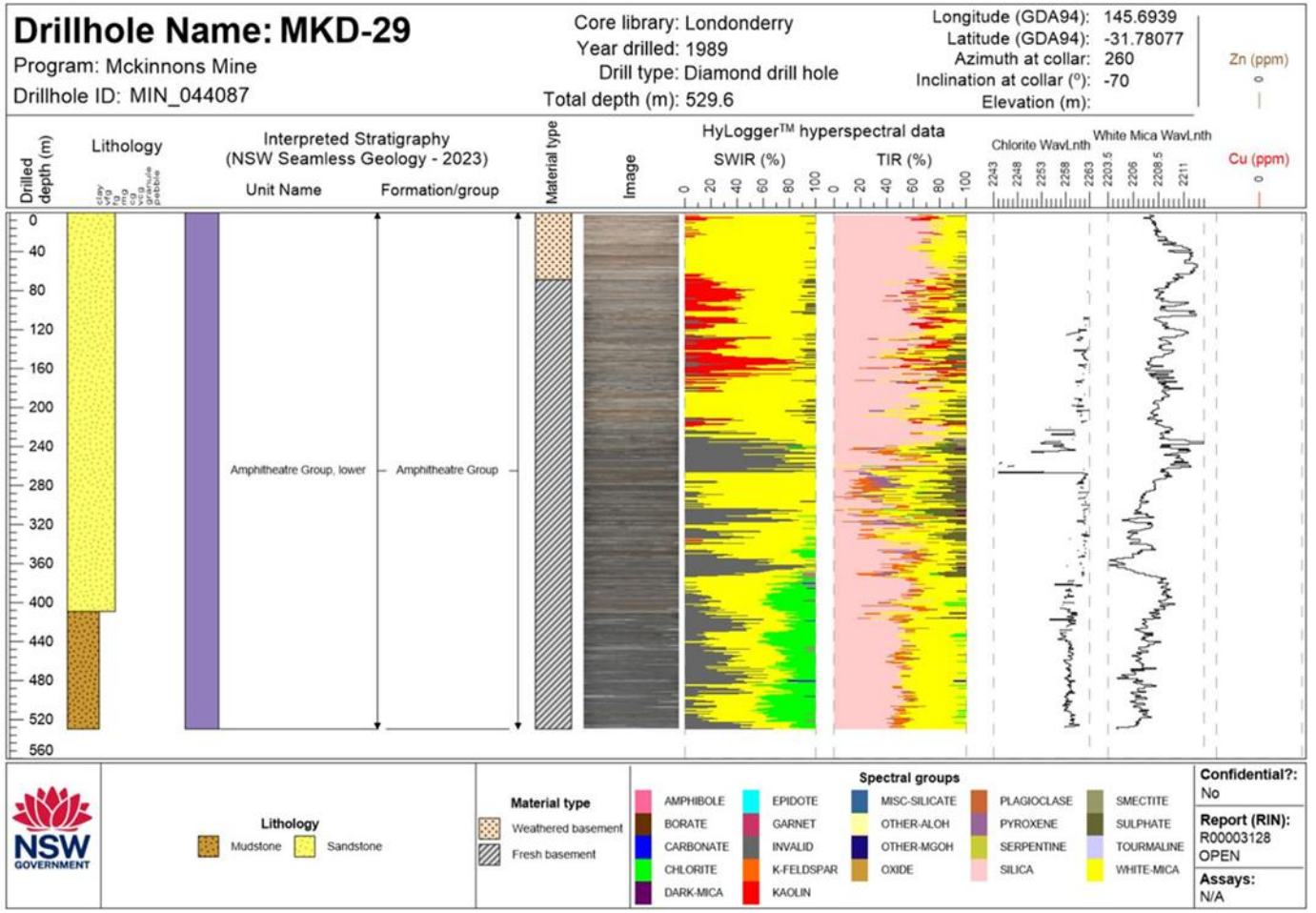


Benefits reminder

1. Sustainable future secured
   - Commercial manufacture & maintenance
   - NSW has one of the most advanced reconnaissance spectral logging systems in the world
2. New Mid-infrared wavelengths
3. Wavelength duplication means increased confidence
4. Overcoming “aspectral-ness” at other wavelengths, despite that property telling us something of the rocks.
5. More detailed core imaging.

MinView Drill Log Automation (Kyle Hughes)





Acknowledgements

- GS NSW, the Mineral Systems team & Core Library staff
- Corescan Powered by Epiroc team
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- CSIRO Mineral Resources team

Thank you

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