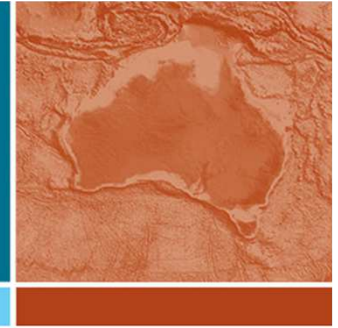




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Uncovering porphyry potential in the Stavely region through pre-competitive stratigraphic drilling

Anthony Schofield, Ross Cayley, David Taylor, Tim Barton, Evgeniy Bastrakov, David Huston, Chris Lewis and Matilda Thomas



Presentation outline

Part one

- Stavely Project background
- Regional geology
- Stratigraphic drilling program in the Stavely region

Part two

- New data acquisition
- New geochronological and geochemical constraints on the Stavely area
- Conclusions

The Stavely Project

Geoscience Australia-Geological Survey of Victoria collaborative project



Part of the UNCOVER initiative



Reduce exploration risk and increase mineral discovery through pre-competitive geoscience information



Test regional geological models developed by the Geological Survey of Victoria



Regional setting

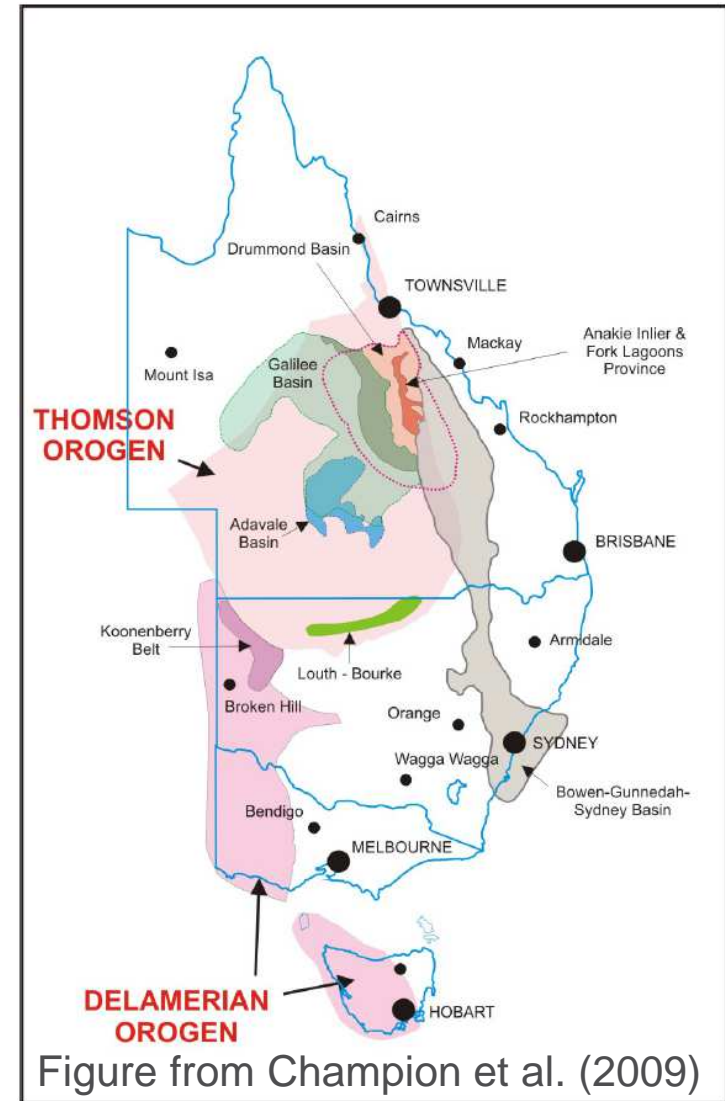
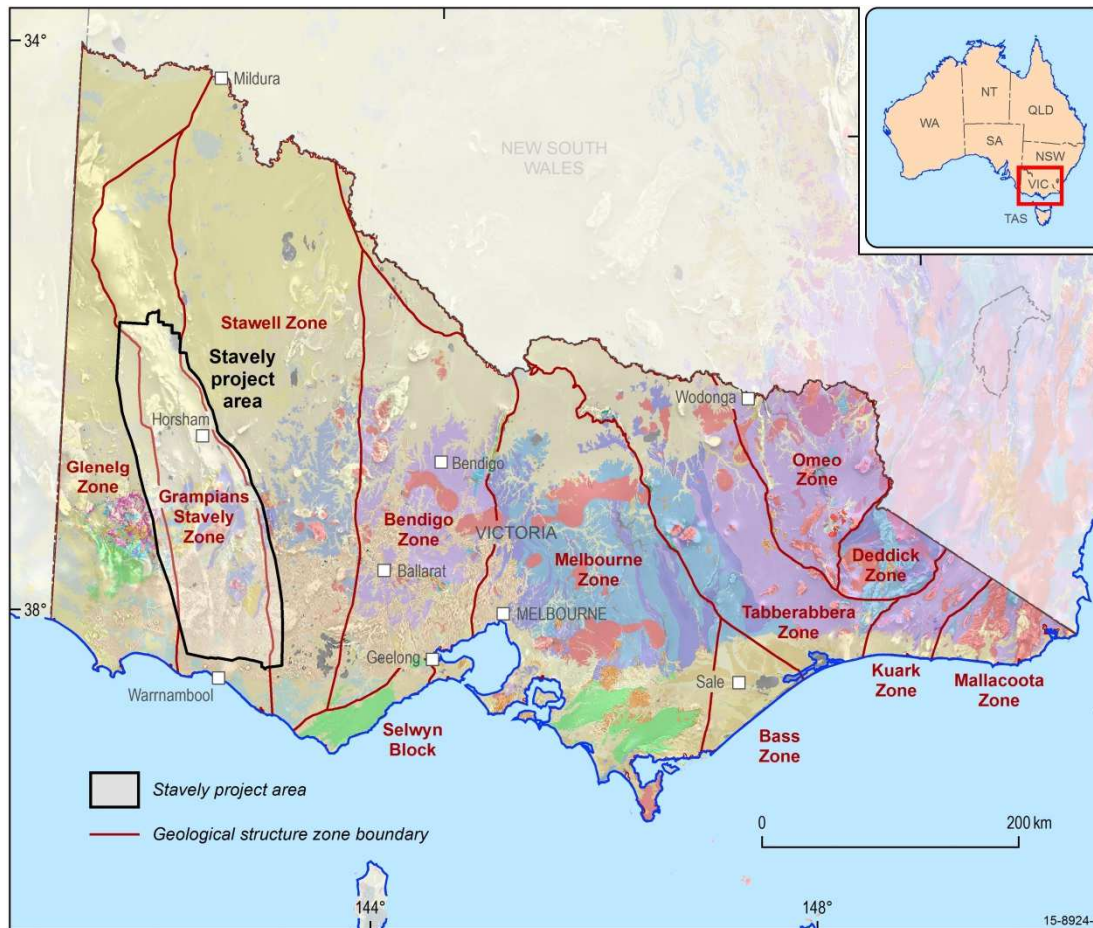


Figure from Champion et al. (2009)

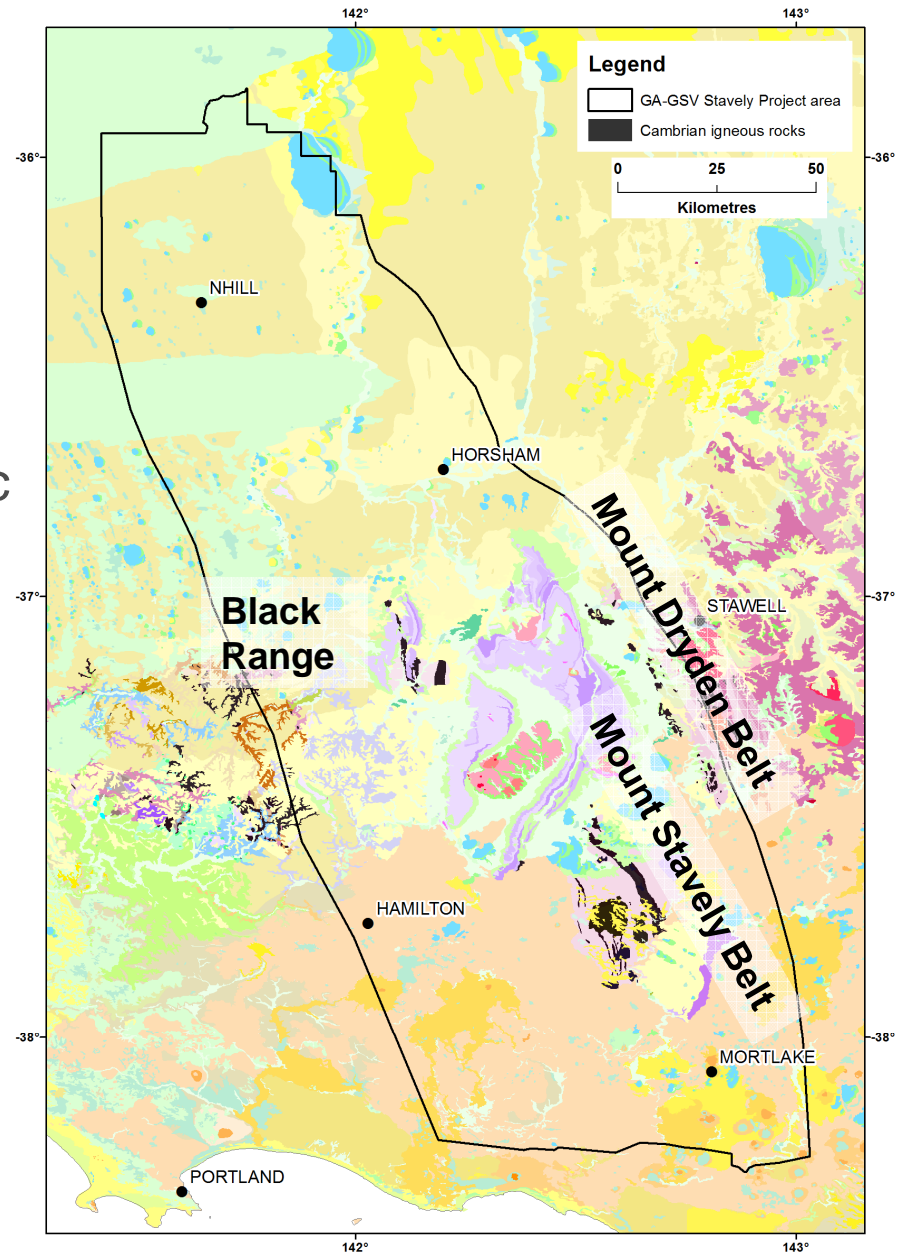
Geology

Exposed belts of Cambrian igneous rocks

- Arc-like geochemical signature
- Part of largely buried Cambrian arc package (Stavelly Arc)
- Interpreted west-dipping subduction regime

Diverse 'cover' types

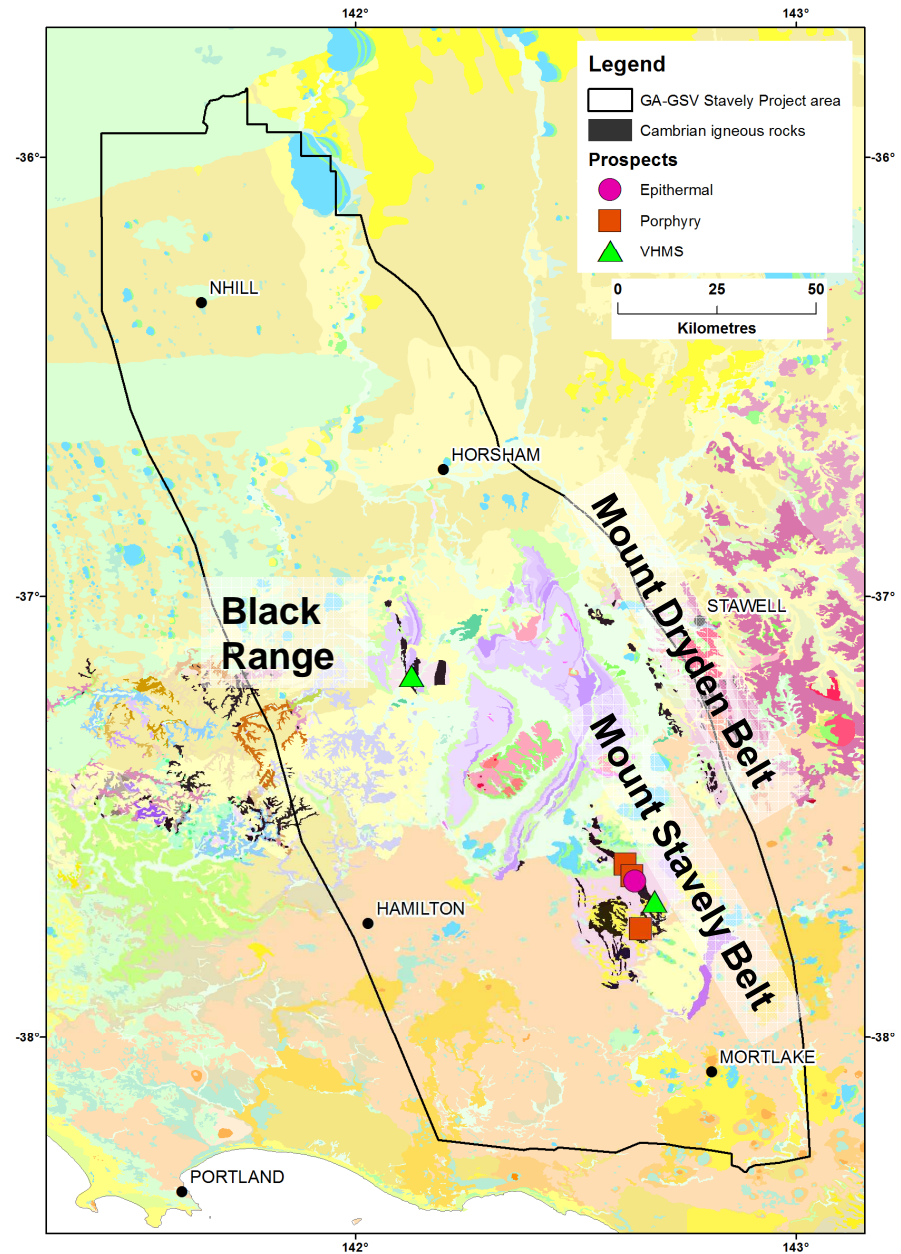
- Recent sediments and volcanics
- Silurian Grampians Group sediments
- Devonian felsic magmatism



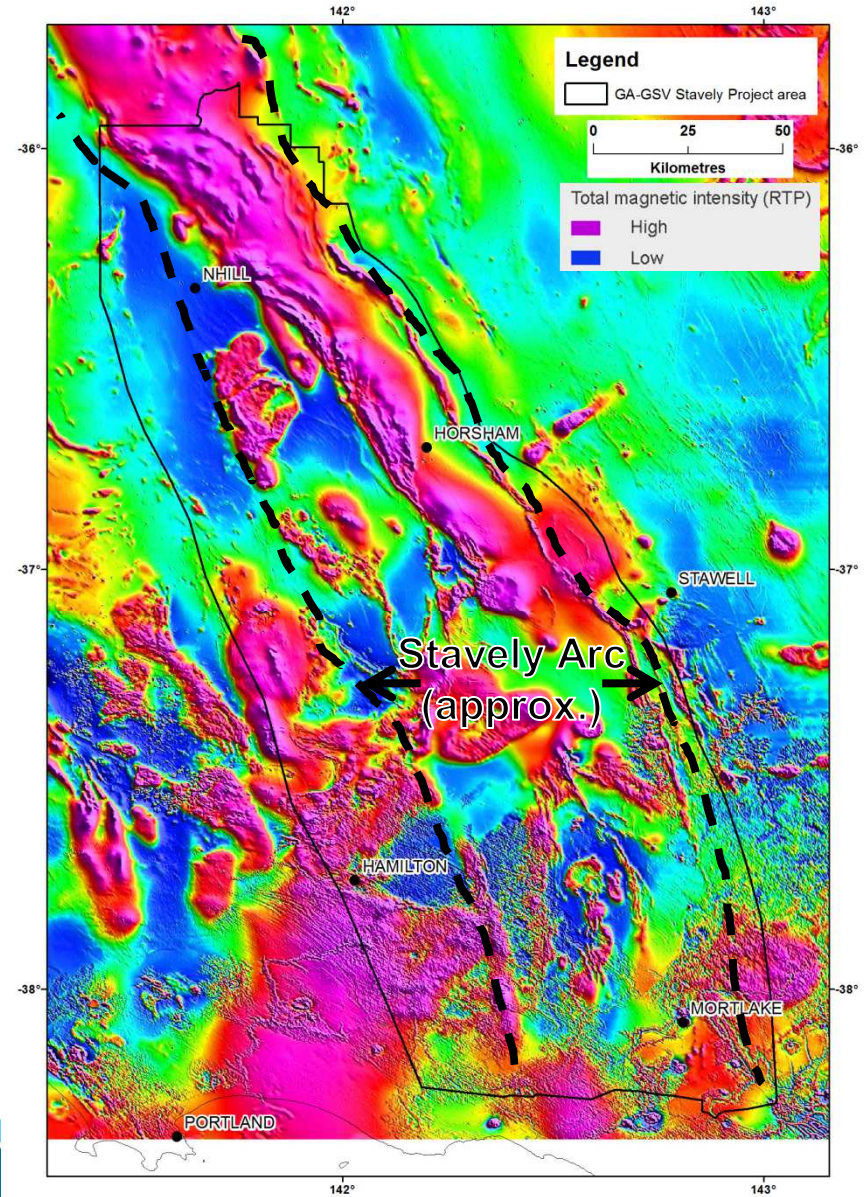
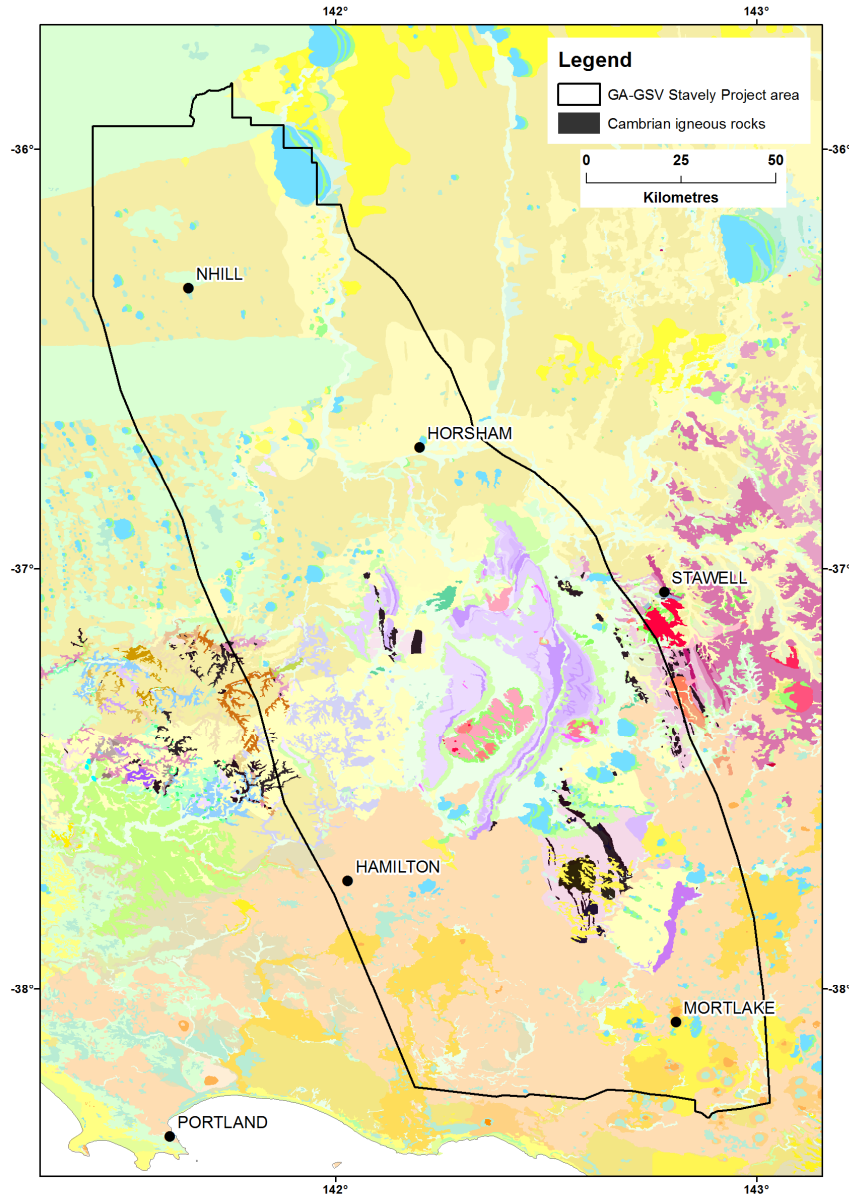
Mineralisation

Known porphyry, epithermal and VHMS prospects

- Spatially associated with outcropping Stavely Arc rocks



The Stavelly Arc: fairway for porphyry exploration



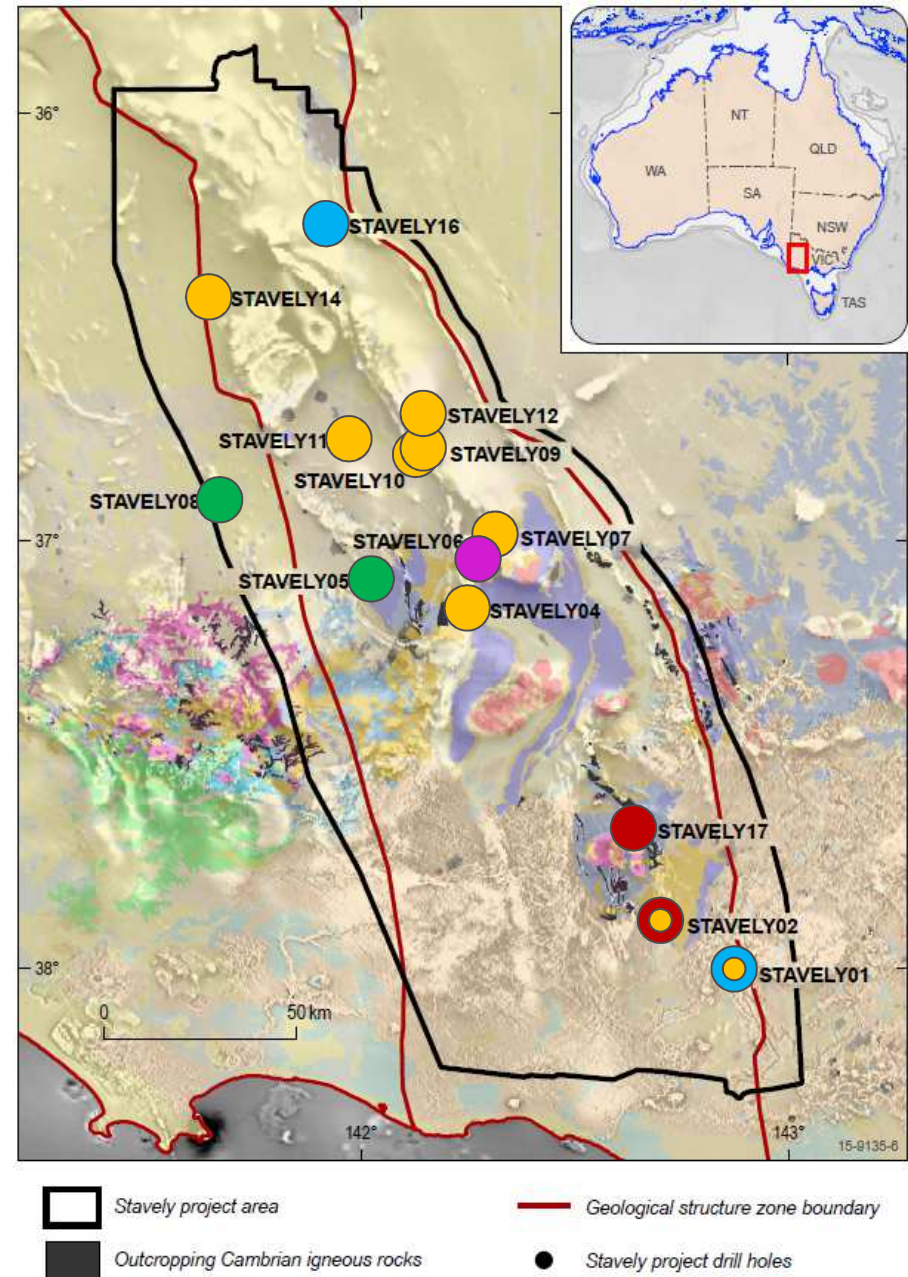
Testing the fairway

- Pre-competitive stratigraphic drilling to test the extent of Stavelly Arc rocks under cover
- New geochemistry and geochronology data to characterise rock packages
- Non-destructive testing to determine rock petrophysical and spectral properties
- Determine depth to prospective basement



Drill hole aims

1. Test under cover extension to Mount Stavely Belt
2. Test for arc-related rocks to define the eastern margin of the Stavely Arc
3. Test regional structural interpretations to define the western margin of the Stavely Arc
4. Intersect and characterise belts imaged in magnetic data
5. Characterise geophysical responses to test for alteration



Drilling methods

14 fully-cored stratigraphic drill holes

- April-September 2014
- Sonic and diamond drilling techniques used
- 2708 m total (1152 m sonic, 1556 m diamond including ~400 m by UoM)
- Included deepest sonic hole drilled in Australia (212 m)
- Cover depths relatively shallow (typically <150 m)



Deploying new drilling technologies



DET CRC technologies deployed during drilling

- Lab-at-Rig[®] (geochemistry)
- AutoSonde[™] (geophysics)

Help detect lithological changes and distal signatures of mineral systems



STAVELY01

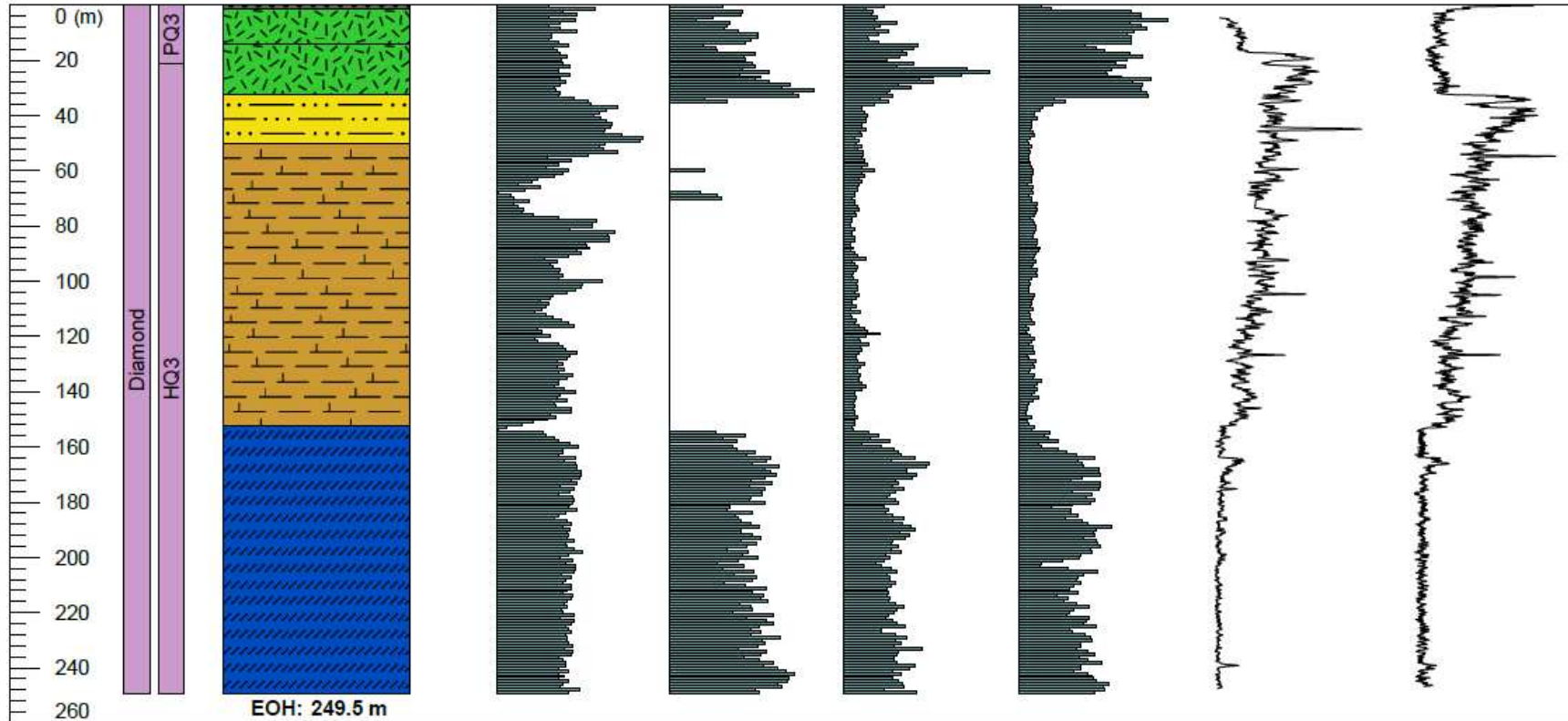
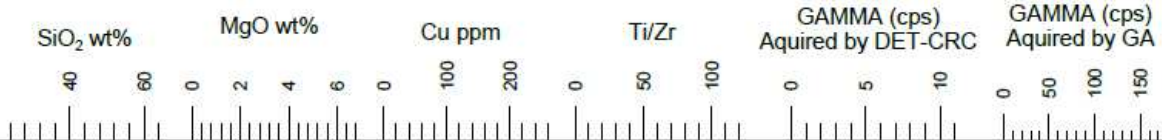
Drilling Dates: 27/06/2014 - 09/07/2014
 Azimuth: 250° Dip: -80°
 Collar Height: 150.16m
 Datum: GDA94Zone 54
 Easting 664884 Northing 5790574



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DEEP EXPLORATION
 TECHNOLOGIES CRC
 Uncovering the future



EOH: 249.5 m

Lithological Legend

- amphibolite
- basalt
- marl
- sandy mud
- silty gravel
- silty sand

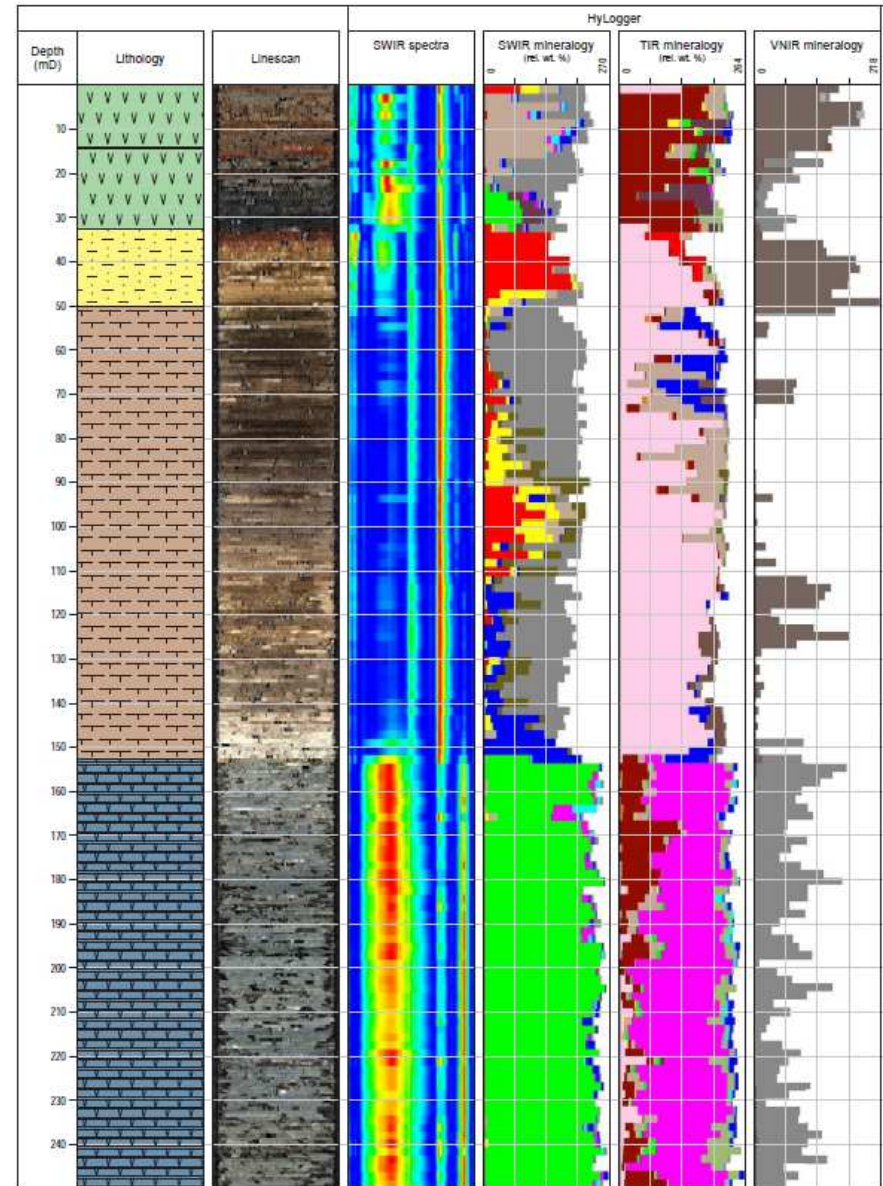


New data acquisition

Newly-acquired data helping to understand the geology and mineral systems potential of the Stavelly Arc

- Down-hole geophysics
- Rock properties
- HyLogger™ hyperspectral data
- Whole rock geochemistry and isotope analysis
- Geochronology

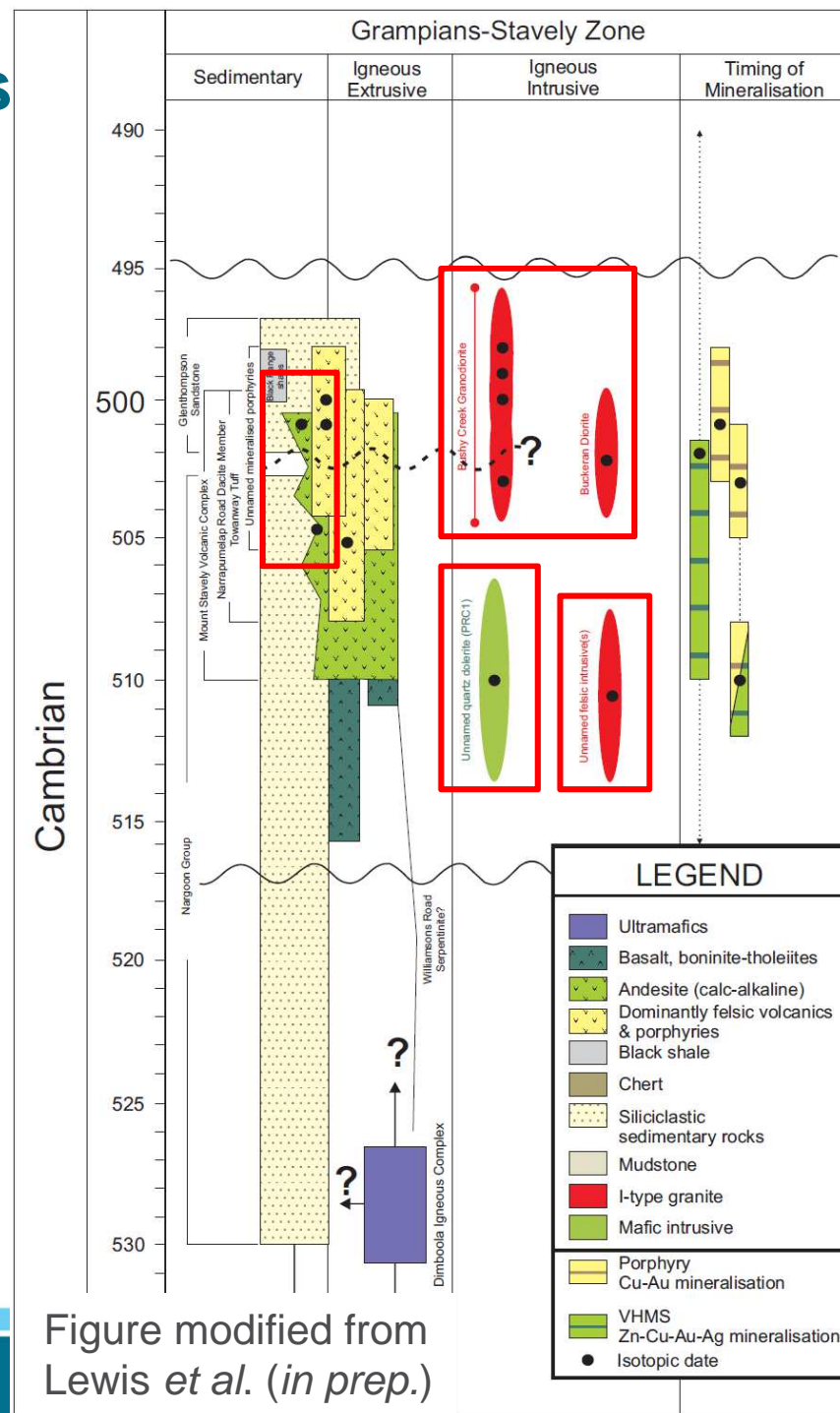
Partnerships with AuScope, University of Melbourne, GSSA, ANU, UTAS



New geochronology constraints

23 new SHRIMP U-Pb zircon ages
(Lewis *et al.*, *in press*; *in prep.*)

- ~510 Ma
 - Unnamed (arc-related?) felsic intrusive in eastern Grampians-Stavely Zone
 - Back-arc-like mafic intrusives in western Grampians-Stavely Zone
- ~504-502 Ma
 - Stavely Arc volcanics (MSVC)
- ~503-498 Ma
 - Post-tectonic intrusives

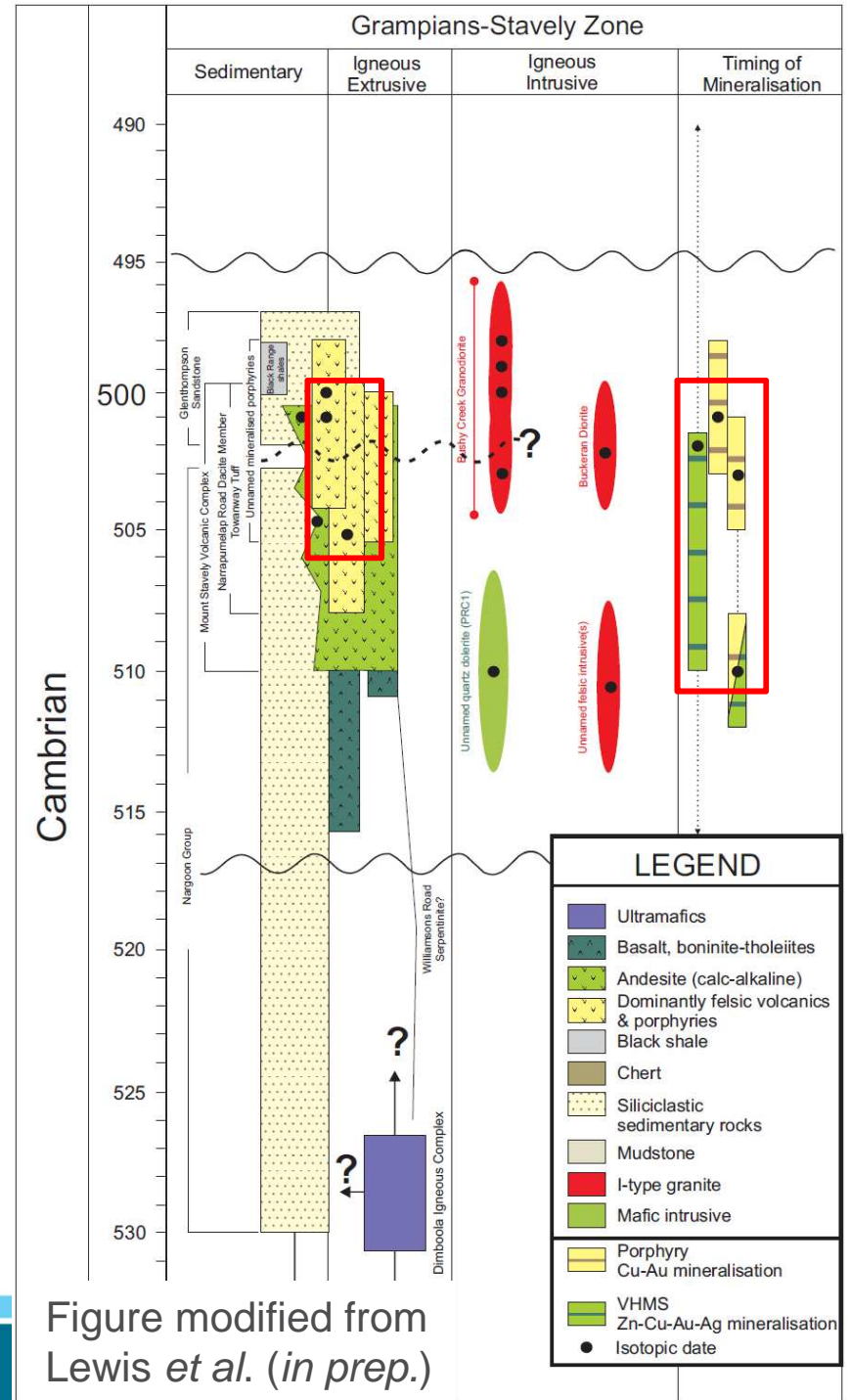


Timing of mineralisation

Porphyries dated to 506-500 Ma
(Lewis *et al.*, 2015)

Molybdenite Re-Os ages of 510-501 Ma
(Huston *et al.*, *in prep.*)

Mineralisation at ~506-500 Ma
around Mount Stavely

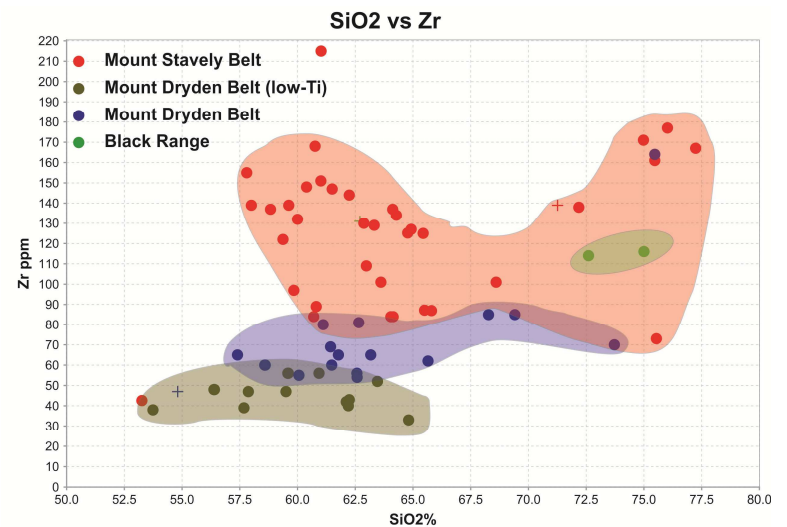
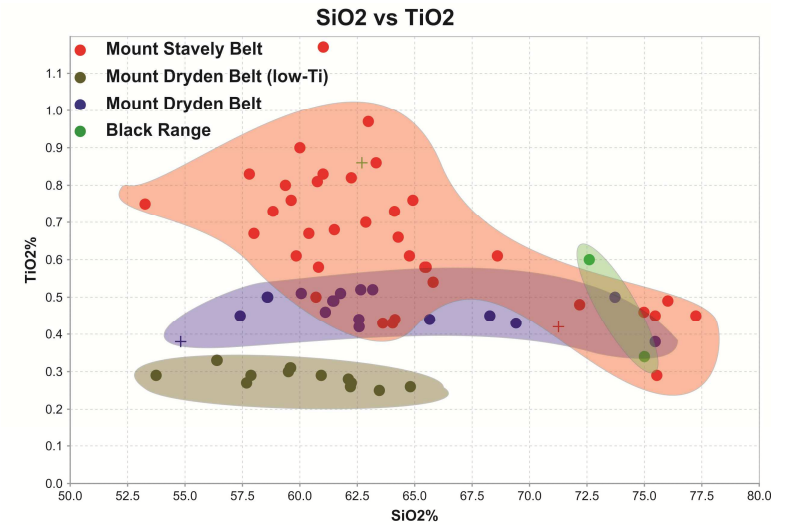
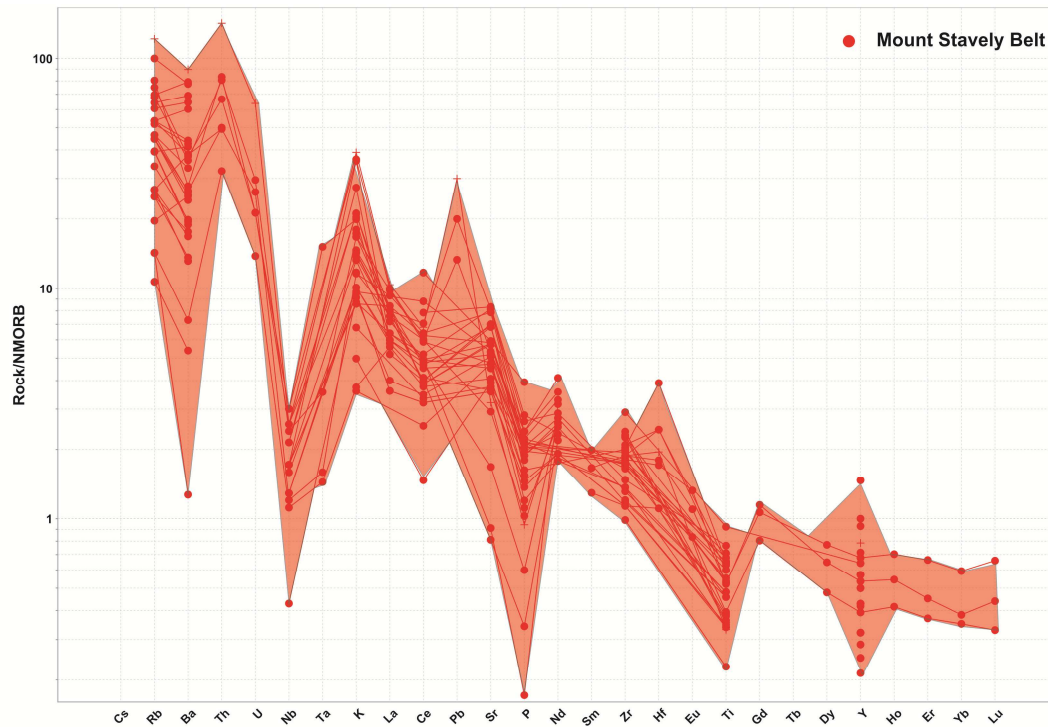


Existing geochemistry of outcropping belts (pre-2009)

Arc affinities

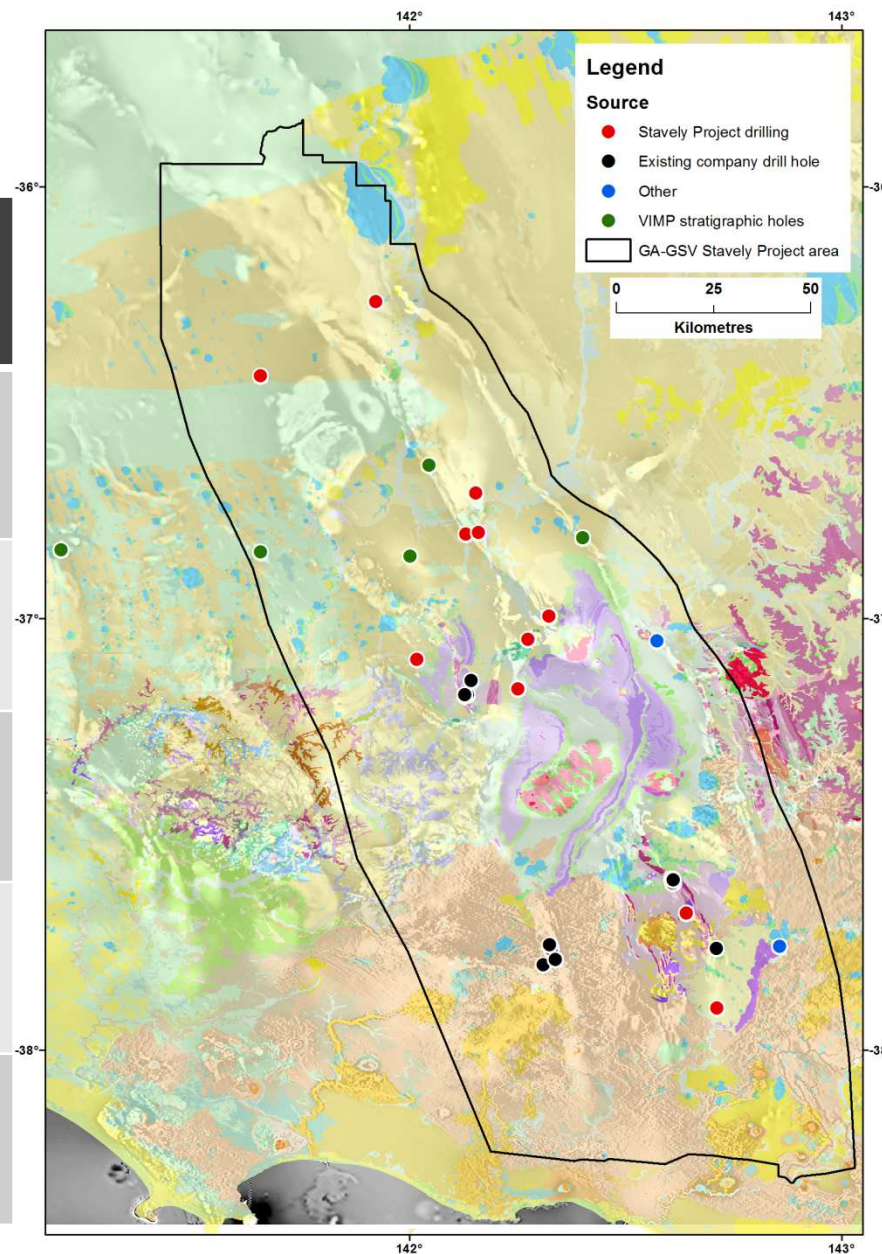
Significant internal variation

Variable data quality



New geochemical data

Source	Samples
Existing company drill holes	79
Stavely Project drilling	80
VIMP stratigraphic holes	6
Other	2
Total new Stavely Project analyses	167



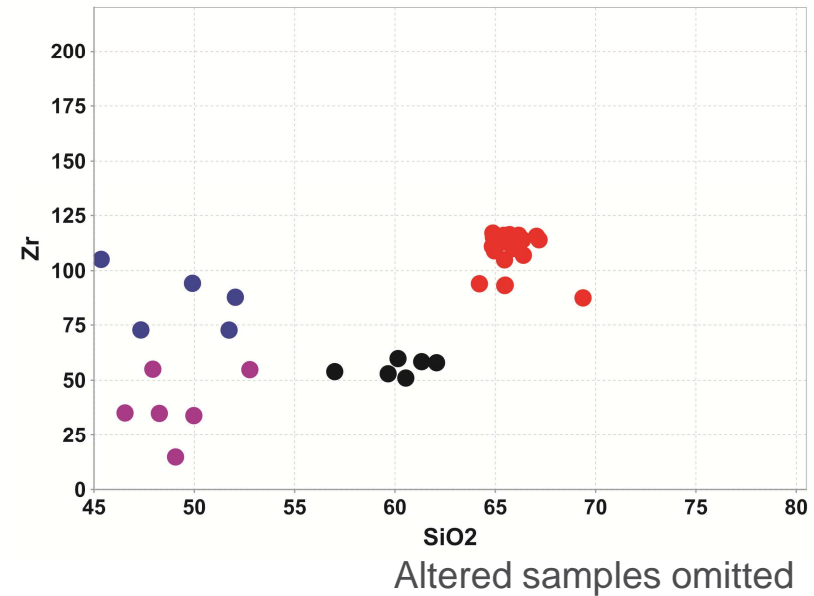
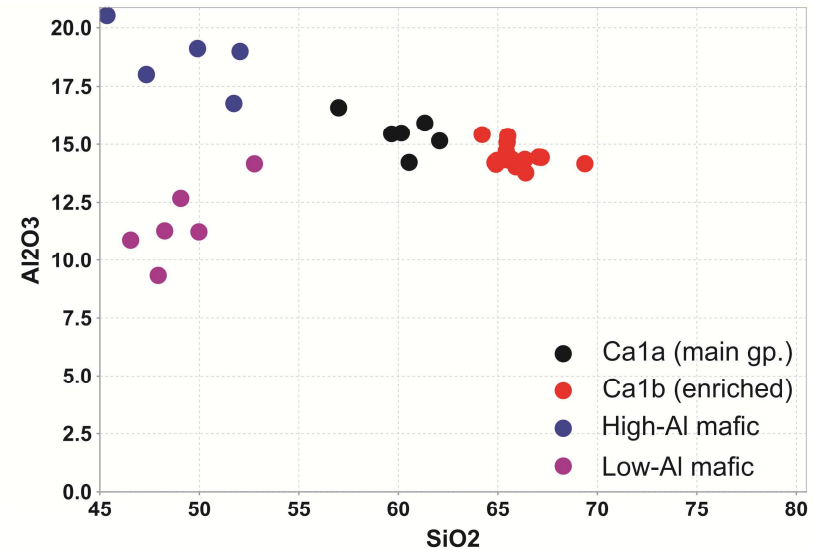
Calc-alkaline rocks

Main trend

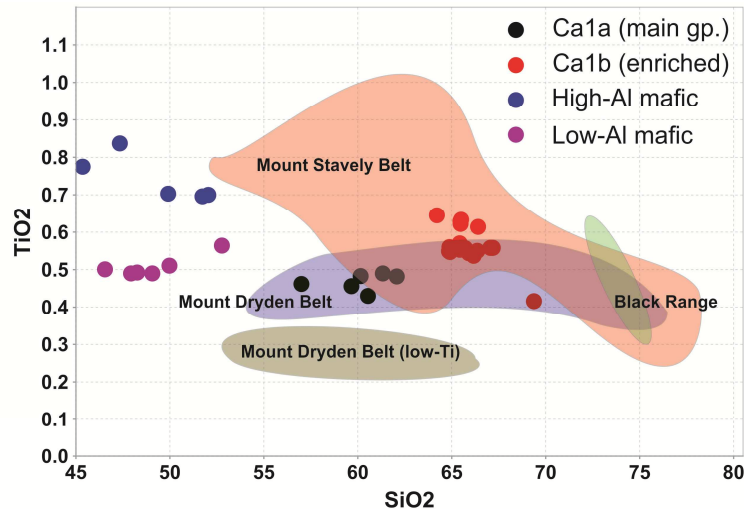
- CA1a: low- to high-K (mostly low-medium), ϵNd -3.9 to +1.9
- CA1b: medium-K, higher LILE, LREE, HFSE, ϵNd -0.7 to +0.5

Mafic rocks

- High-Al mafic: ϵNd +4.7 to +6.3
- Low-Al mafic: primitive chemistry (high Ni, Cr, $\text{Mg}\# = 58-73$), ϵNd -1.5 to -1.3

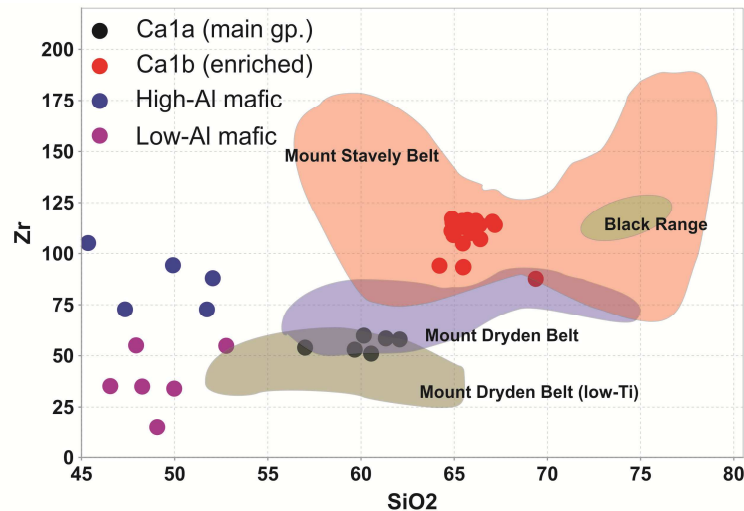


Mapping drilling results to known outcrop



Groups identified in drilling correlate with outcropping belts with known prospectivity

- ‘Main group’ (CA1a) volcanics similar to Mount Dryden Belt
- ‘Enriched’ (CA1b) volcanics similar to Mount Stavelly Belt

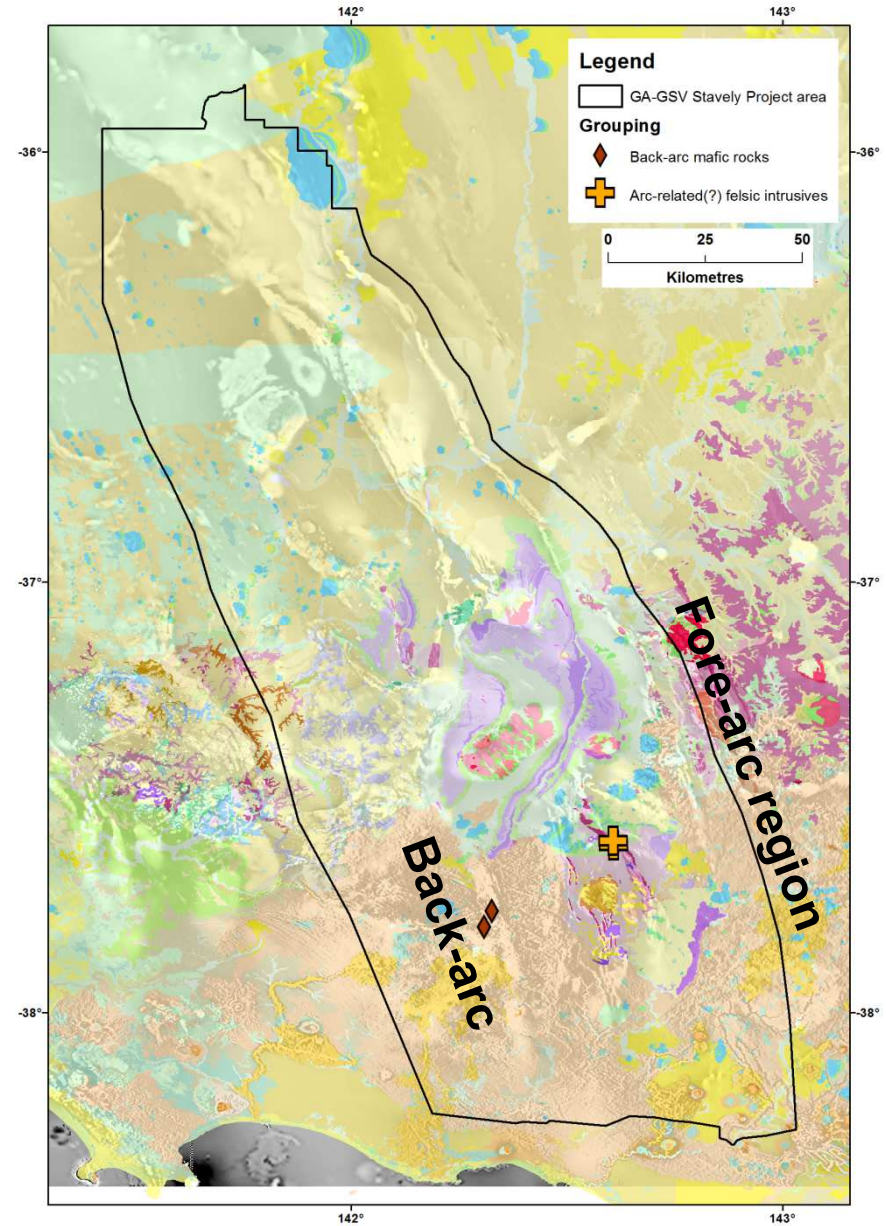


Results consistent with a relatively evolved arc setting

Putting it all together

~510 Ma

- Arc-related(?) felsic intrusive (east)
- Back-arc-like mafic intrusives (west)



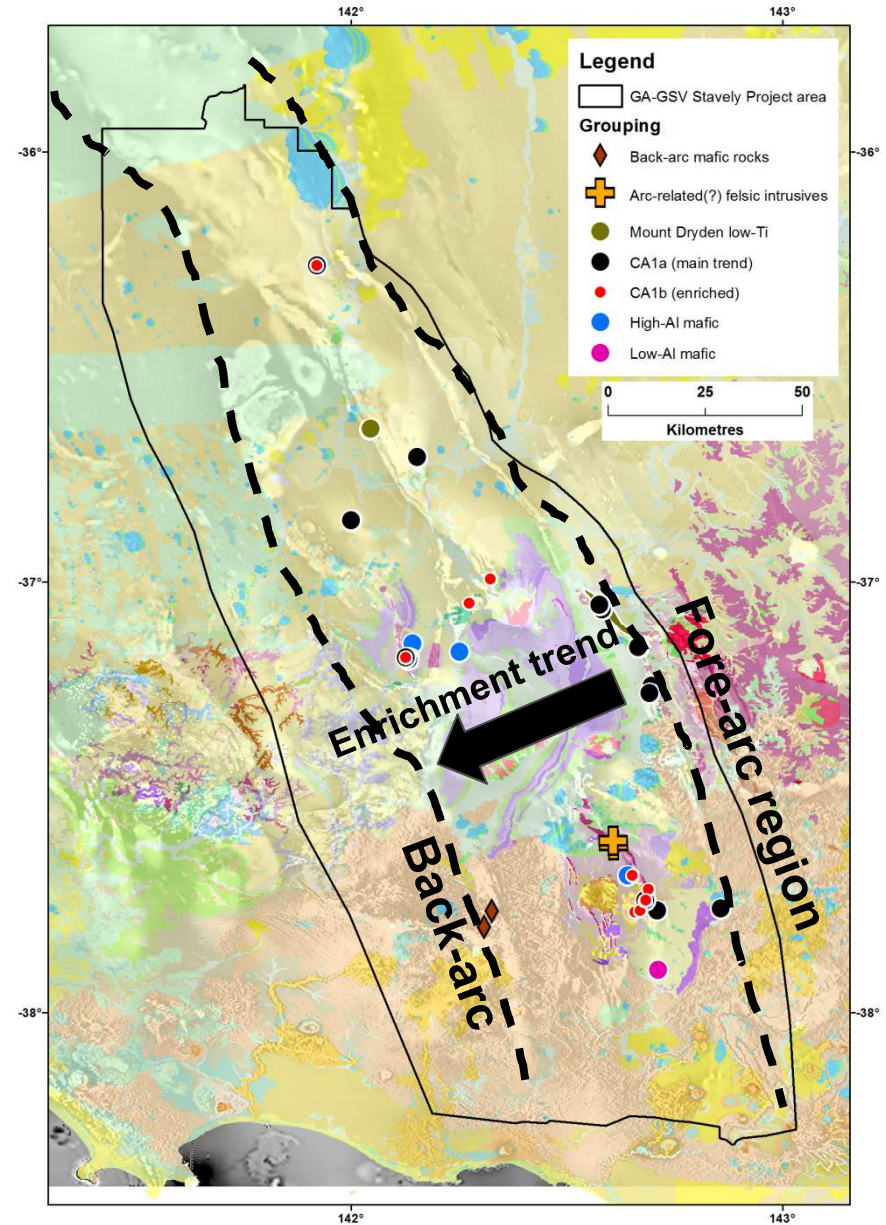
Putting it all together

~510 Ma

- Arc-related(?) felsic intrusives (east)
- Back-arc-like mafic intrusives (west)

~510(?) – 500 Ma

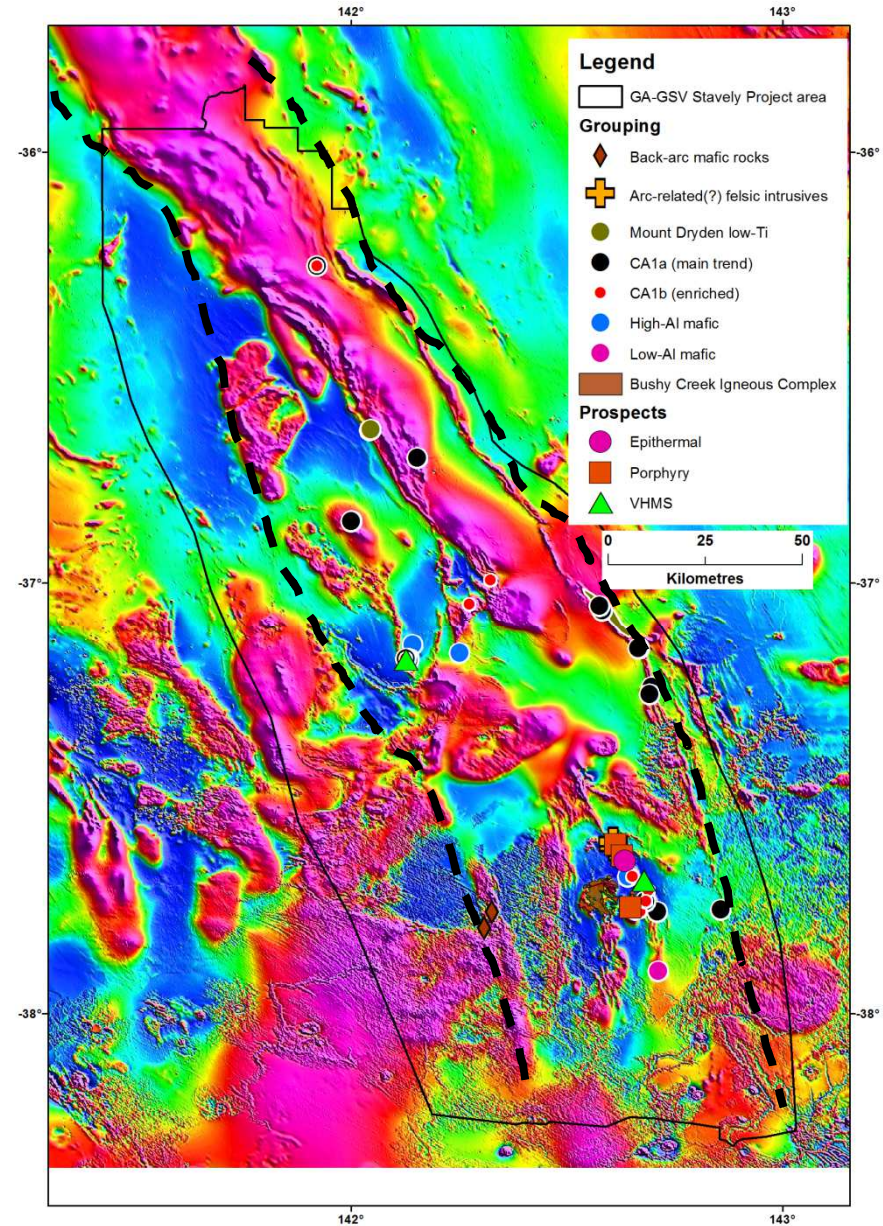
- Calc-alkaline volcanics erupted in an evolved arc setting
- General enrichment away from volcanic front (complicated by later deformation)



Putting it all together

~506-498 Ma

- Post-tectonic intrusives in Stavelly area (~503-498 Ma)
- Porphyry-epithermal and VHMS mineralisation
 - 506-501 Ma in Stavelly area
 - Spatial association with 'enriched' volcanics



Summary and conclusions

14 fully-cored stratigraphic holes (2708 m) drilled in the prospective Stavelly area

Prospective rocks intersected beneath cover similar to those associated with porphyry mineralisation around Mount Stavelly

Cover depths relatively shallow (typically <150 m)

New data consistent with geological models for the Stavelly Arc

Stavelly Project delivery

Field data released July 2015

Upcoming releases:

- HyLogger™ hyperspectral data
- Lithological logs
- Petrophysical data
- Geochronology and geochemistry

Regional synthesis and Explorer's Guide to be delivered early 2016



Acknowledgements

Navarre Minerals, Stavely Minerals, Austpac Resources

Geochemical data sources

Tolliday (1978), Crawford (1982), Donaghy (1994), Maher et al. (1997), Crawford et al. (2003), Whelan et al. (2007), D. Taylor (pers. comm.), OZCHEM



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Thank you

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