

Mineral potential of the East Lachlan Orogen revealed

Prospectivity using spatial data analytics

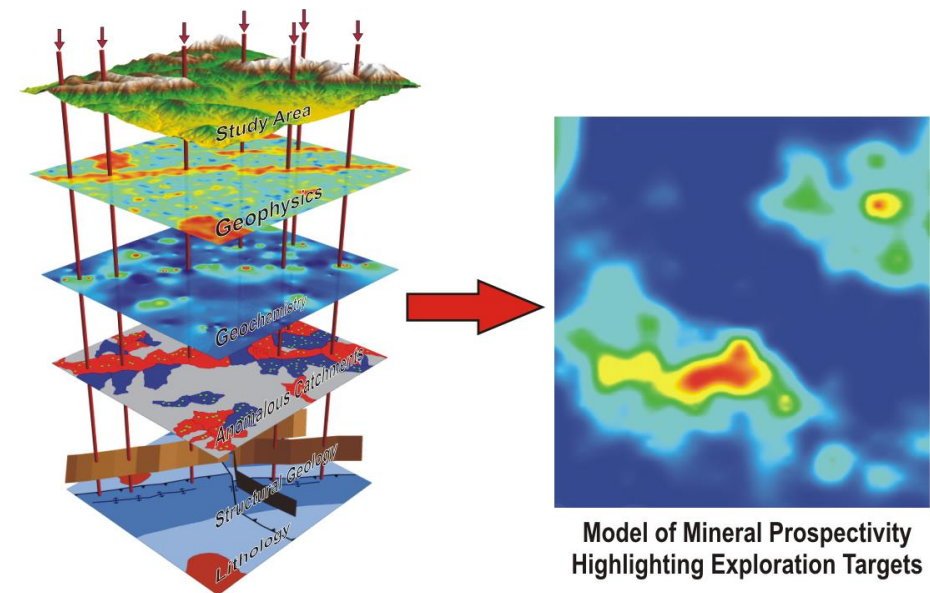
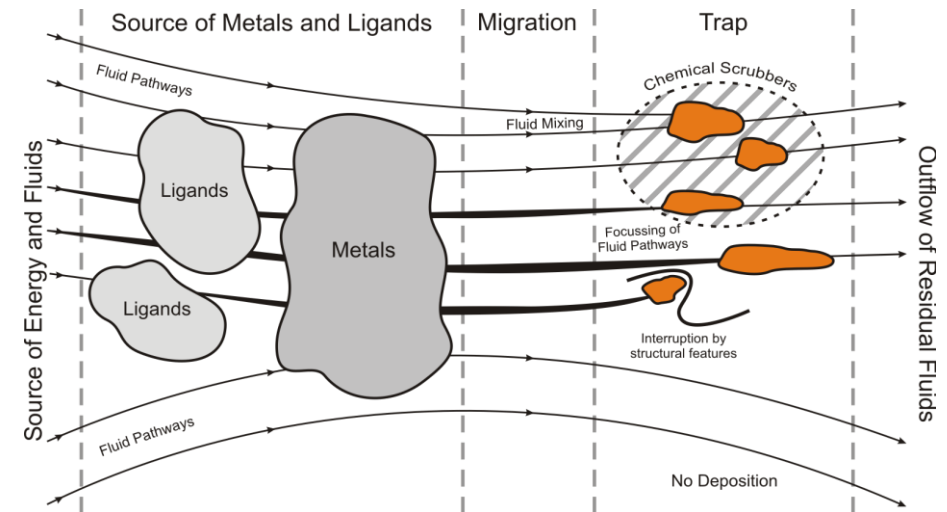
GSNSW is completing a statewide mineral potential mapping project that will:

- Develop mineral system models and identify economic potential for key mineral systems
- Replace the 'potential' layer in the current Mineral Resource Audit mapping
- Have results which can trigger land-use referrals
- Include Kenex spatial analysis
- Identify land-use pressures
- Result in availability of good metallogenic mapping, seamless geology and derivative maps.



Methodology

- Weights of evidence (WofE) approach was used:
- Training data selected by GSNSW experts for each mineral system.
- Predictive maps generated and WofE used to quantify spatial association with training points for each mineral system.
- Selection of predictive maps for inclusion in mineral potential maps and running models for each mineral system:
 - Maps need to be statistically valid, geologically meaningful, and practically useful.
- Mineral potential map produced.

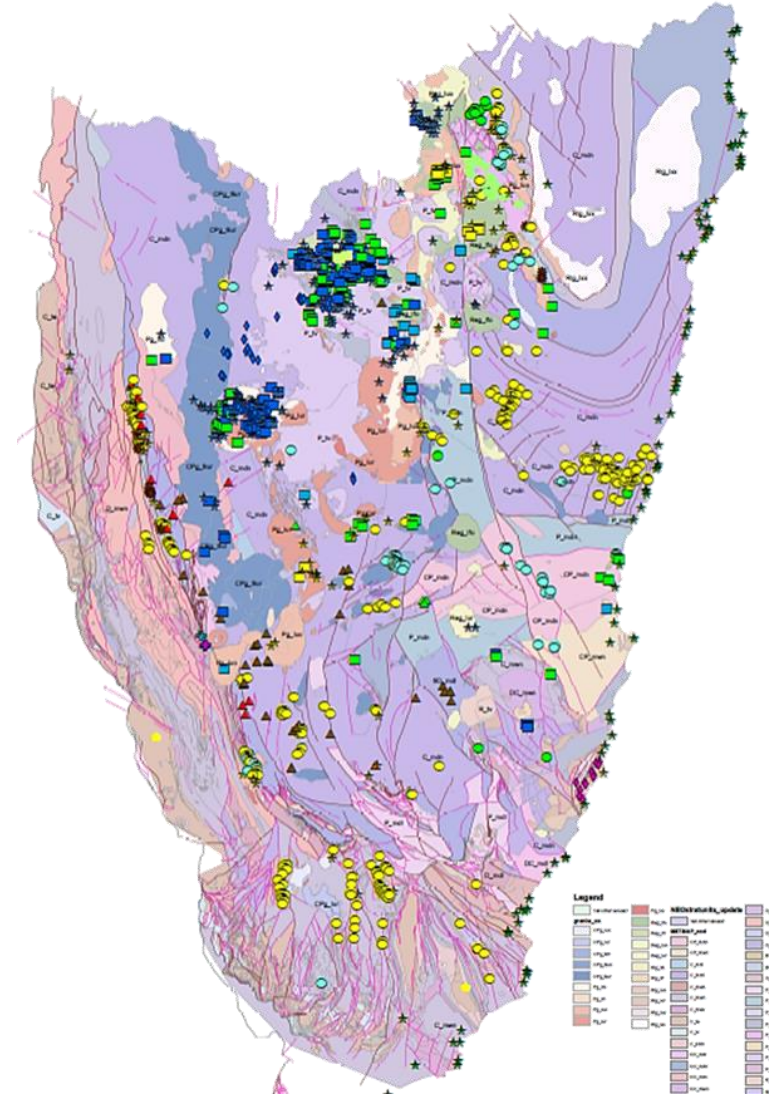


Southern NEO

1. **Intrusion-related tin-tungsten (IR Sn-W)**
[GS2017/0617](#)
2. **Intrusion-related gold (IR Au)**
[GS2017/0618](#)
3. **Orogenic gold-antimony (orogenic Au-Sb)**
[GS2017/0619](#)

Data package

- <https://search.geoscience.nsw.gov.au/product/2191>



Curnamona and Delamerian-Thomson

1. Shear-hosted iron-oxide copper gold (Copper Blow type)
2. Orogenic gold
3. Volcanic-associated massive sulphide (Grasmere type)
4. Broken Hill type Pb-Zn-Ag

[GS2018/0371](#)

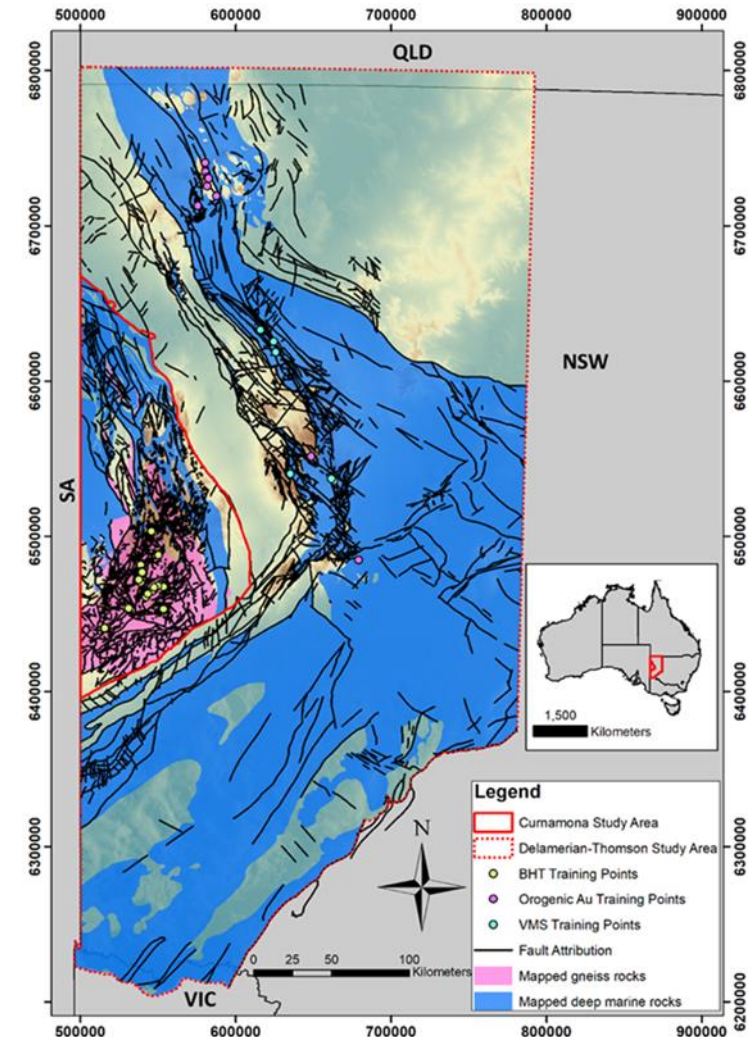
[GS2018/0372](#)

[GS2018/0370](#)

[GS2018/0400](#)

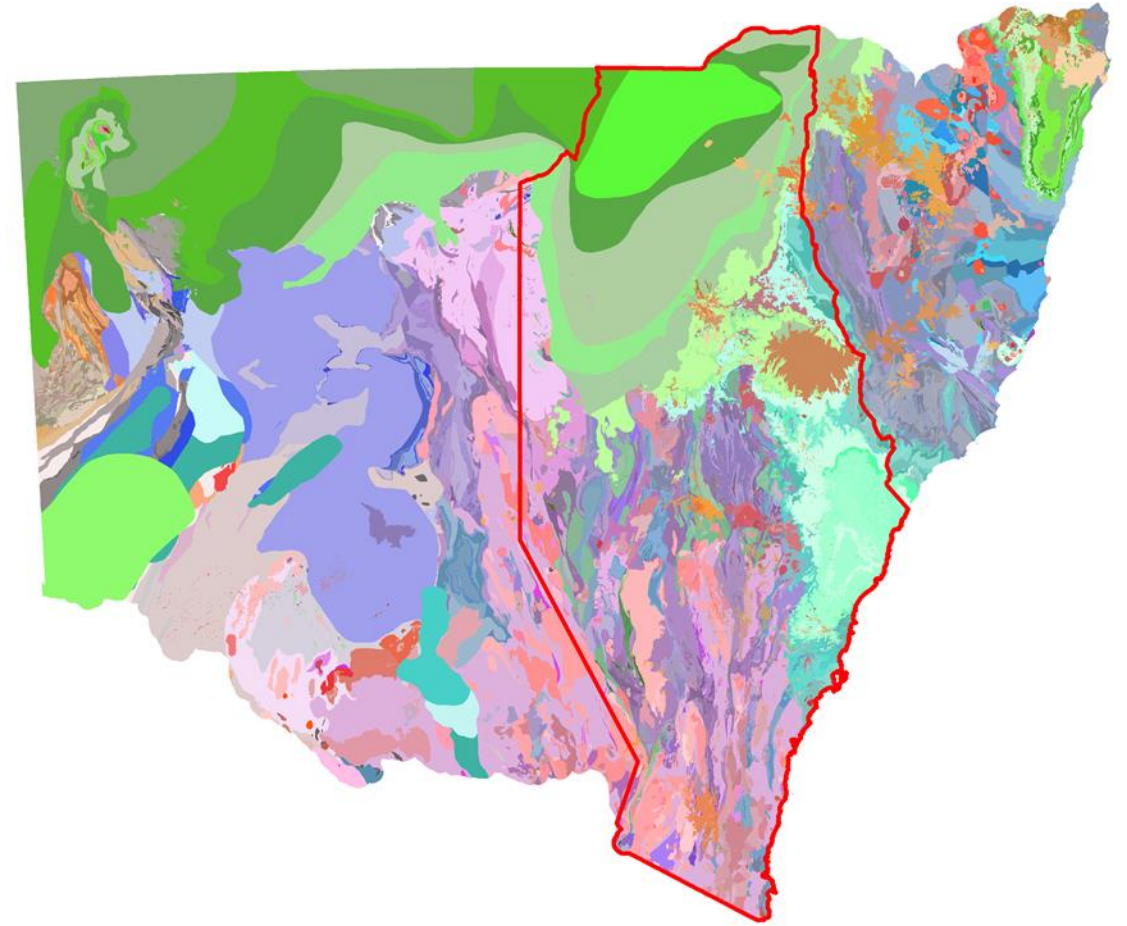
Data package

- <https://search.geoscience.nsw.gov.au/product/9233>



East Lachlan Orogen

1. Porphyry centred Cu-Au (Mac Arc)
2. Orogenic Au
 - Tabberabberan
 - Kanimblan
3. Volcanic-associated massive sulphide
4. Post Ordovician magmatic hydrothermal skarn systems

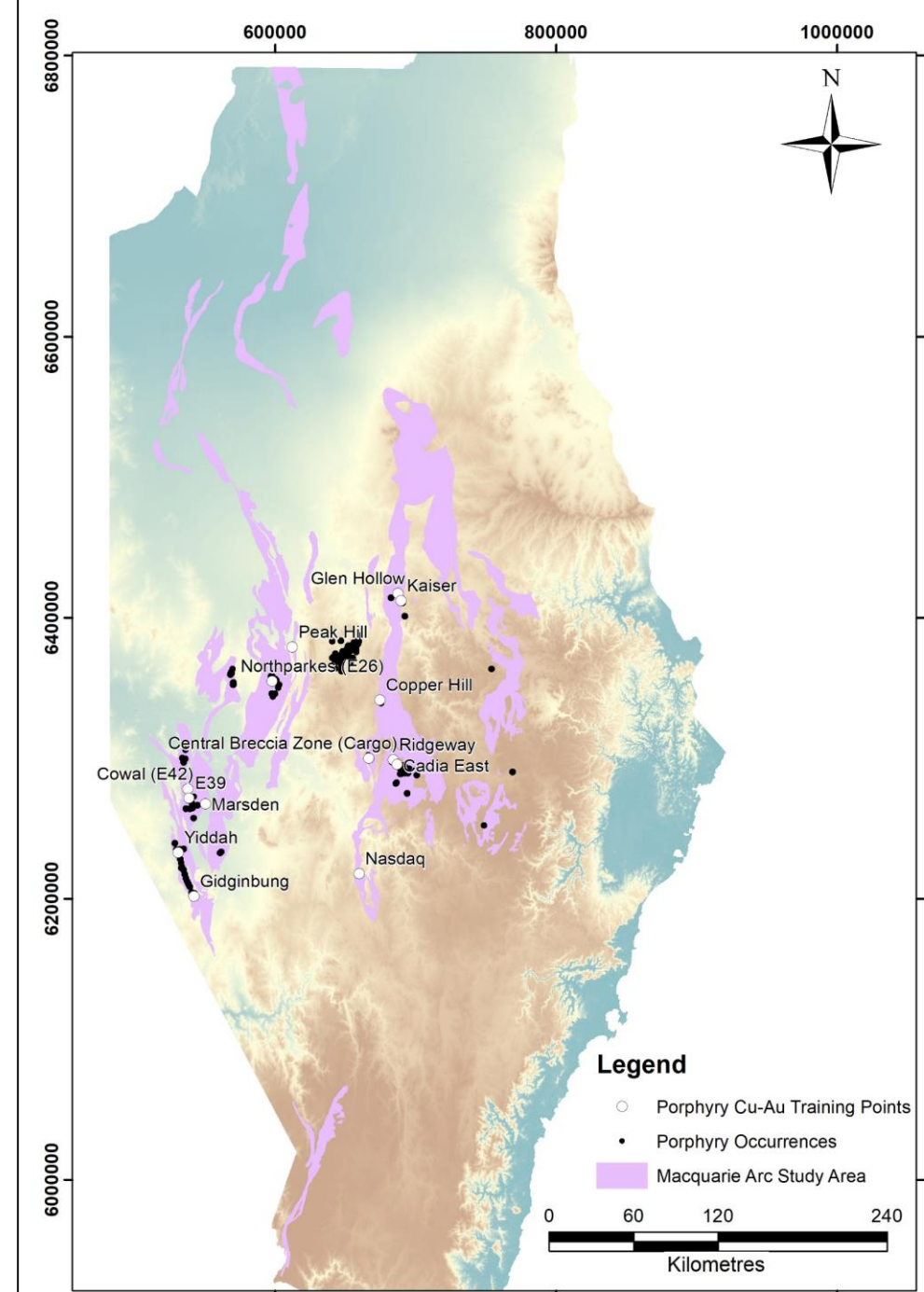


Datasets used in the ELO analysis

| Data type | GSNSW source database | Zone 55E (ELO) |
|---|---|-------------------------|
| Radiometric ages | Geobank radiogenic isotopes | 1727 analyses |
| Whole-rock geochemistry | Geobank whole rock geochemistry | 6133 analyses |
| Mineral occurrences | Geobank MetIndex | 12169 observations |
| Petrographic observations | Geobank petrology | 56126 observations |
| Field observations | Geobank field observations | 94548 observations |
| Structure points | Geobank field observations, MetIndex and seamless geology | 37945 compass readings |
| Fold axes | Geobank field observations and seamless geology | 2864 recorded |
| Drillholes (including lithology logs) | Geobank drillholes and wells | 45448 logged |
| Drillhole assays | Geobank assay results | 2903474 analyses |
| Surface major element analyses (pXRF) | Geobank assay results | 12763 analyses |
| Surface trace element analyses (soil, stream sed, pXRF) | Geobank assay results | 62367 analyses |
| Reactive rocks layer | Seamless geology | Complete |
| Igneous metal fertility | Seamless geology, whole rock geochemistry | Calculated and complete |
| Fault attribution | Seamless geology | 50740 mapped |
| Metamorphic map | Seamless geology | Complete |
| Geology | Seamless Geology | Complete |
| Geophysics | Statewide 50m grid magnetics, gravity, radiometrics, mag and grav worms | Surveyed and complete |

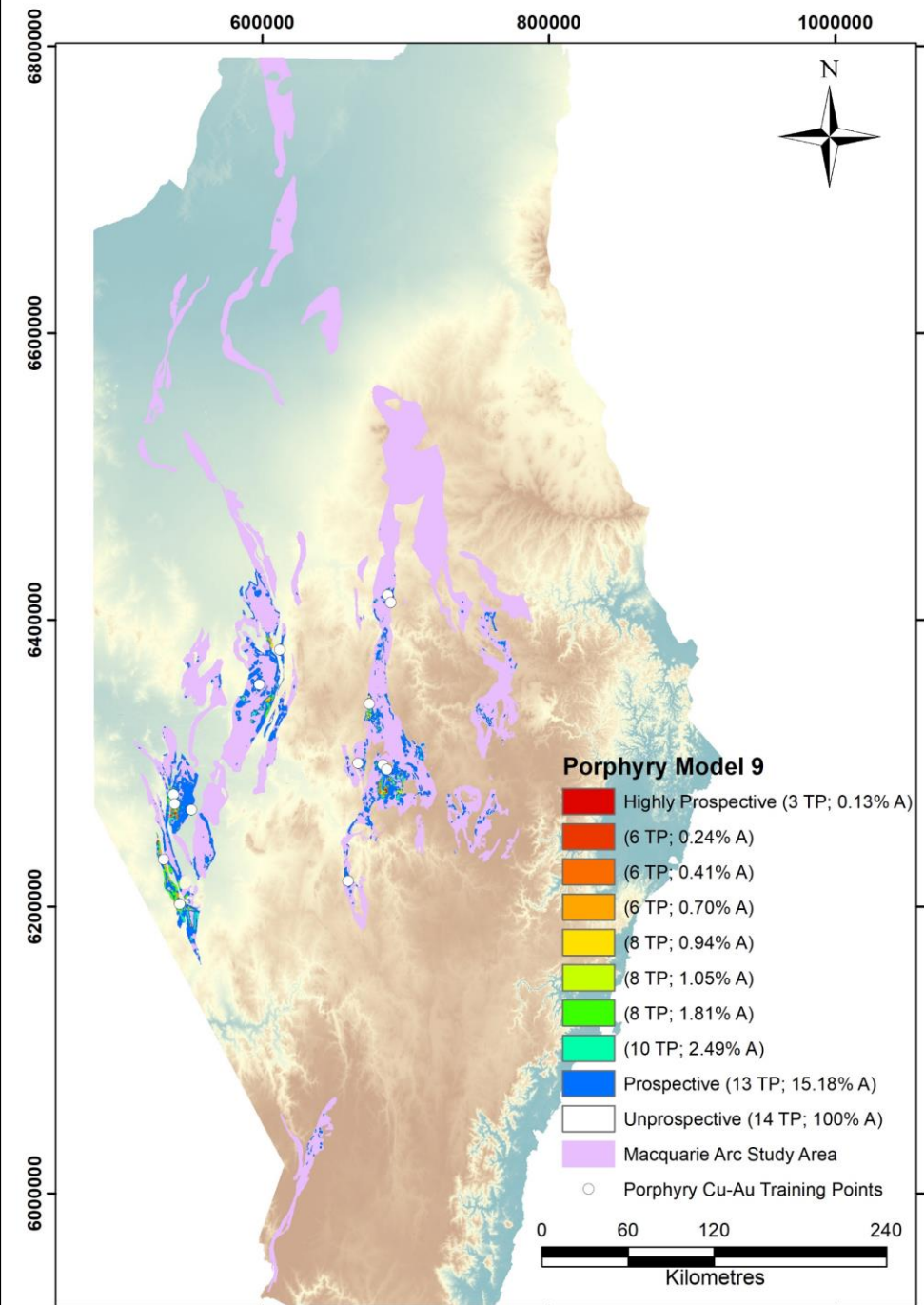
Porphyry Cu-Au

- Ordovician to early Silurian porphyry Cu-Au mineralisation associated with fertile magmas within the Macquarie Arc.
- The mineral systems knowledge tested using spatial analysis:
- 215 spatial variables tested
- 164 produced a statistically valid result
- 80 correlated well with the training points



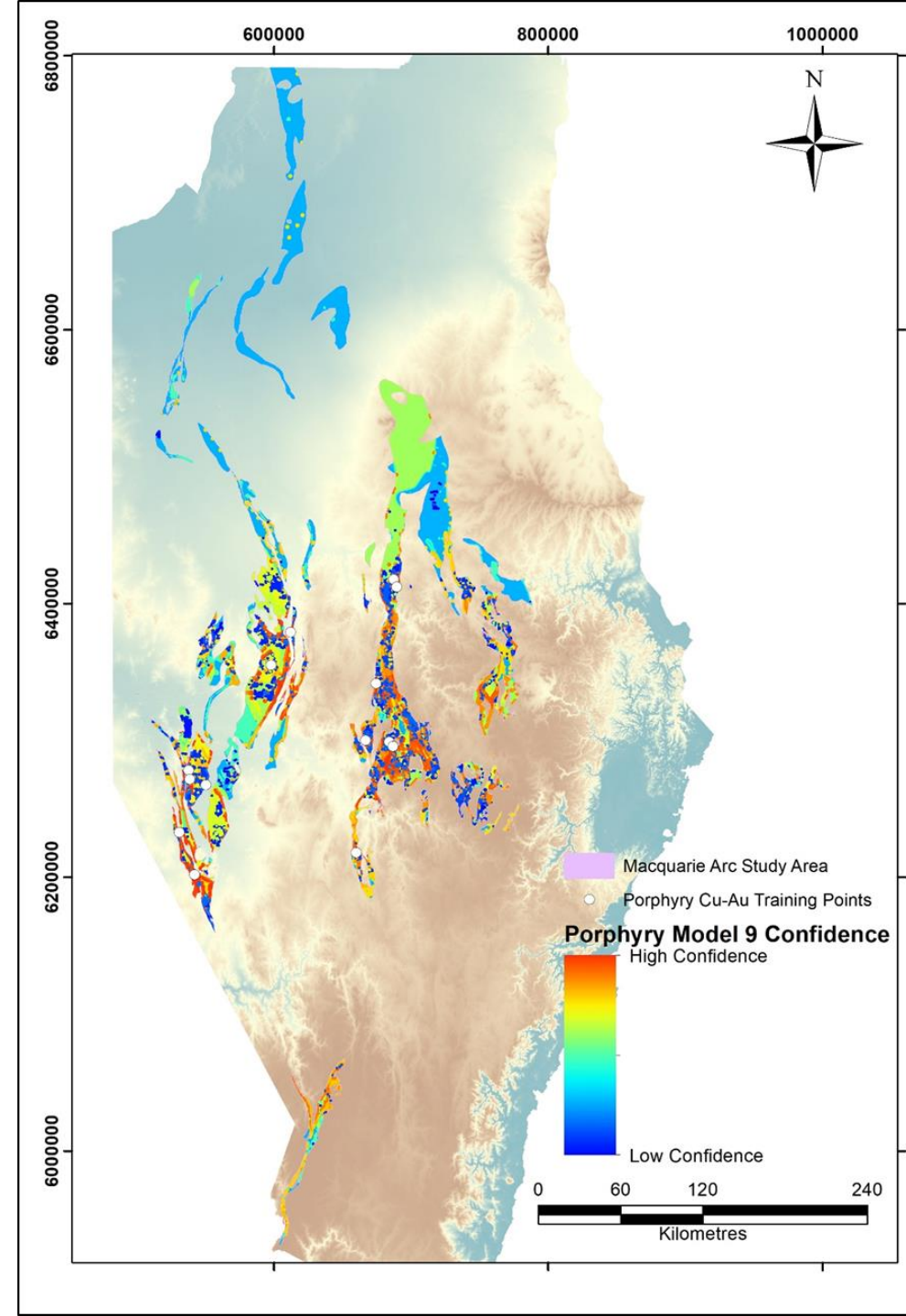
Porphyry Cu-Au

- Most highly prospective areas around the Cadia and Cowal districts.
 - Cadia East, Ridgeway, Copper Hill, Cowal, E39, Gidginbung in highly to very highly prospective area
 - Cargo, Combella, Peak Hill, Marsden, Yiddah in moderately prospective area
- Other highly prospective areas are located around Gidginbung, Copper Hill, and Glendale.
- Northparkes highlighted as weakly prospective.
 - Lack of faults mapped in the district
 - Deposit geometry at E26
- Kaiser is in an unprospective area
 - Absence of mapped intrusions and structures.
 - Seamless is being updated to resolve this.



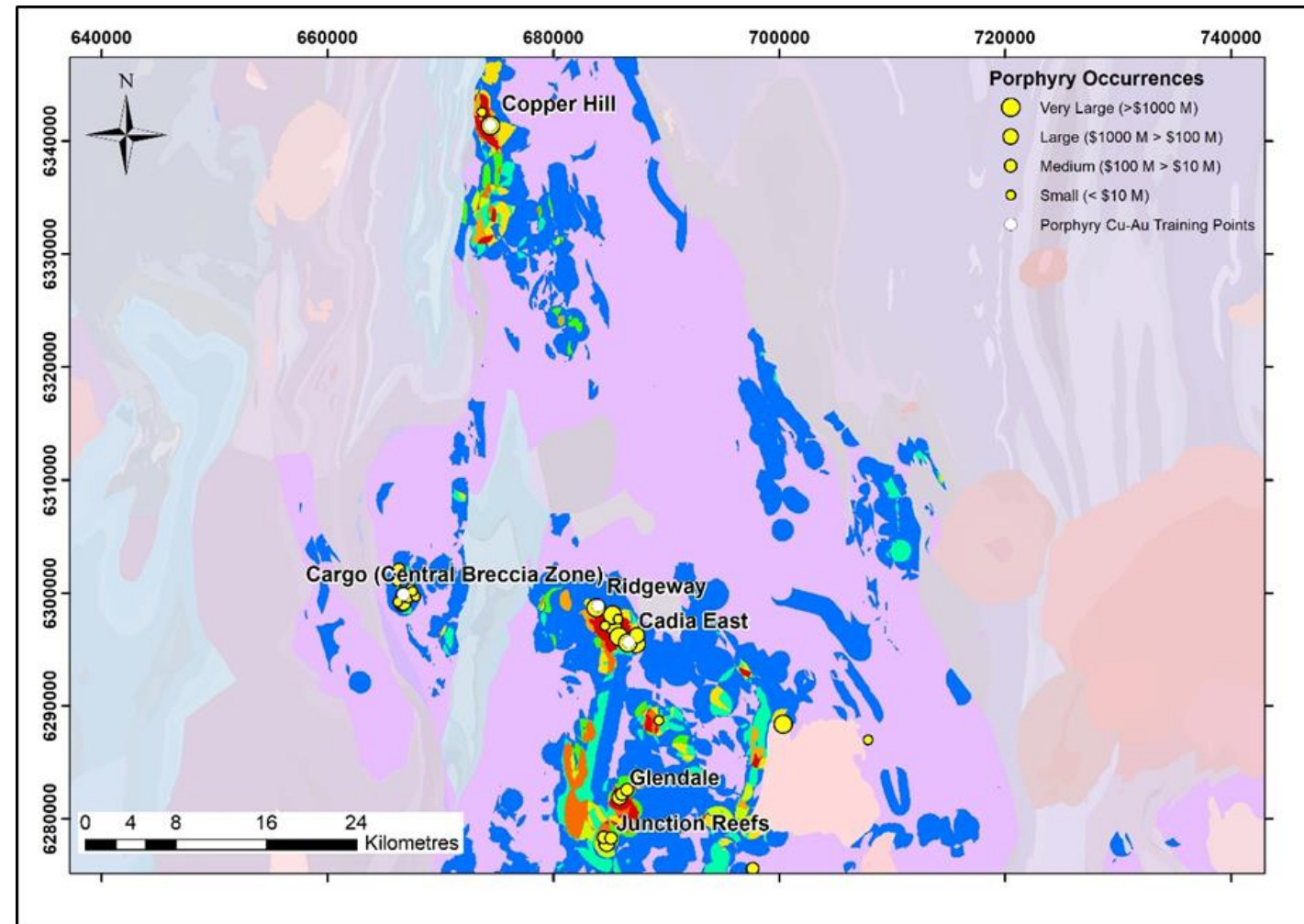
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 - Combella to NW is in prospective area.



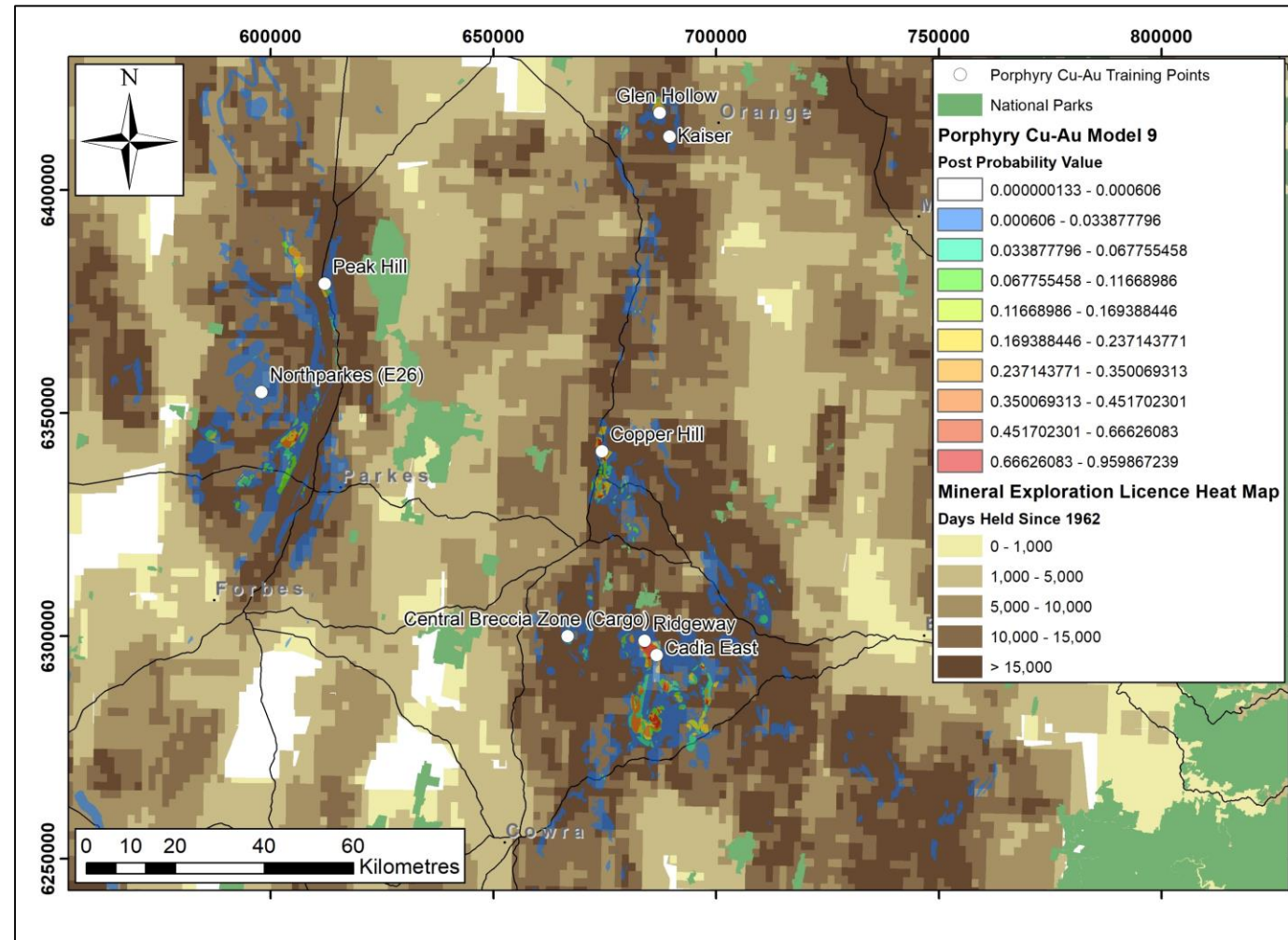
Porphyry Cu-Au

- Tested 33 different magma fertility parameters
- Modelling results emphasise importance of moderately to very strongly oxidised magmas that were also K-enriched.
- Regional-scale faults showed only moderate correlation with training points.
- Some areas haven't had the same intensity of historic exploration and may represent opportunities.



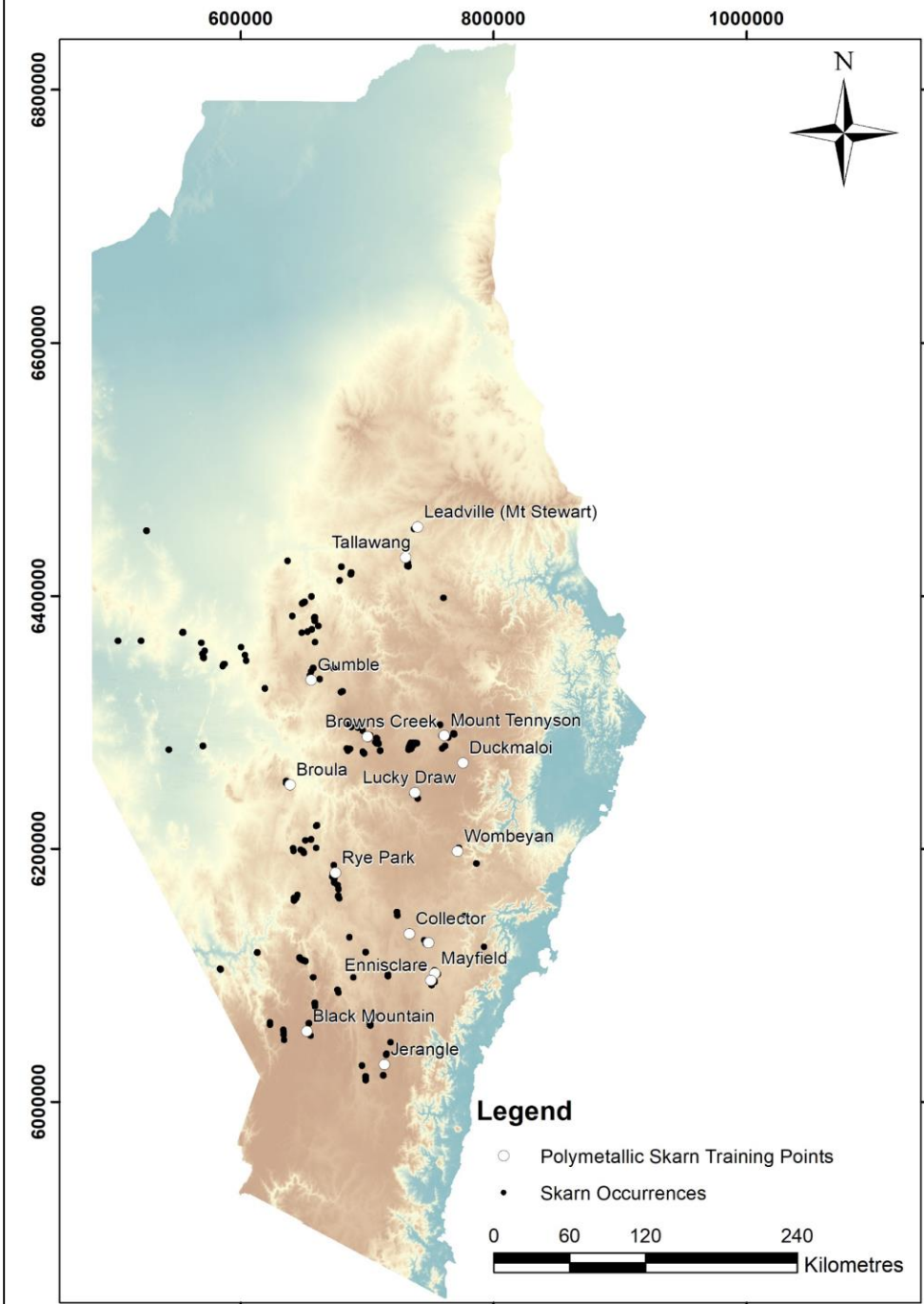
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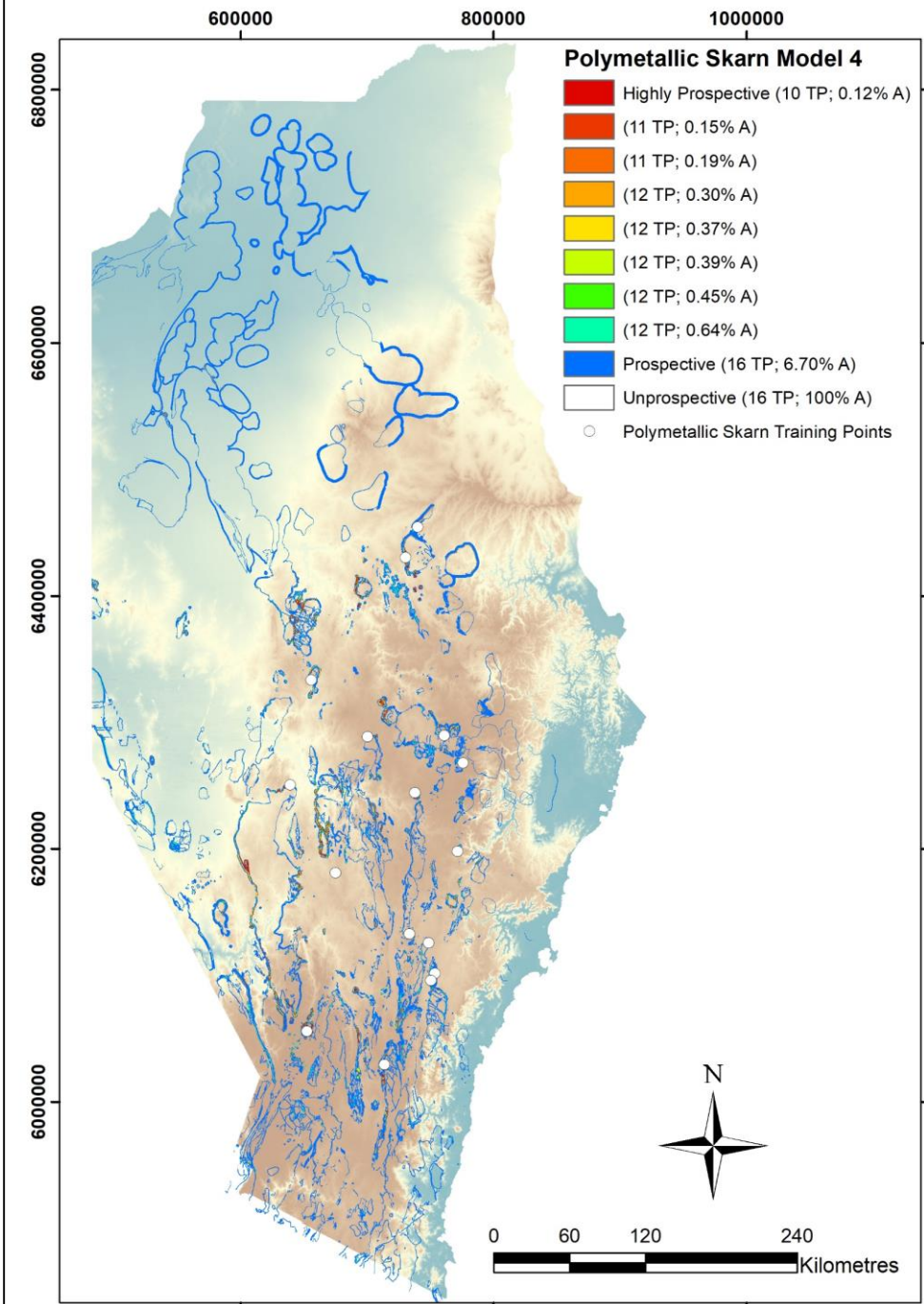
Polymetallic Skarn

- Mid-Silurian to mid-Carboniferous polymetallic skarn mineralisation associated with Tabberabberan and Kanimblan Cycle intrusions.
 - Skarns related to Benambran Cycle intrusions (e.g. Big Cadia) and metamorphic reaction skarns (e.g. Red Hill) were excluded.
- The mineral systems knowledge was tested using spatial analysis:
 - 228 spatial variables evaluated
 - 153 produced a valid predictive map
 - 89 correlated well with the training points



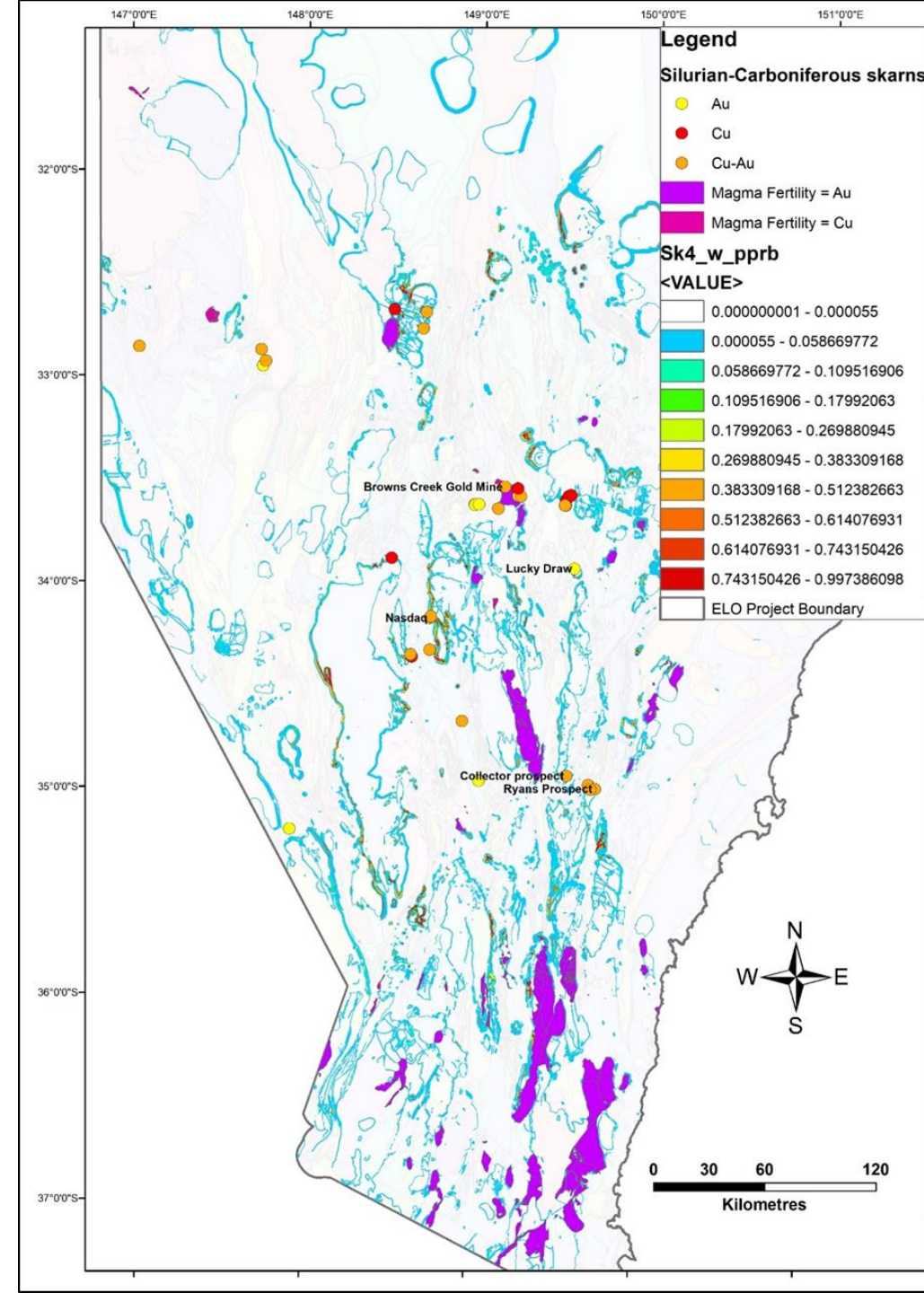
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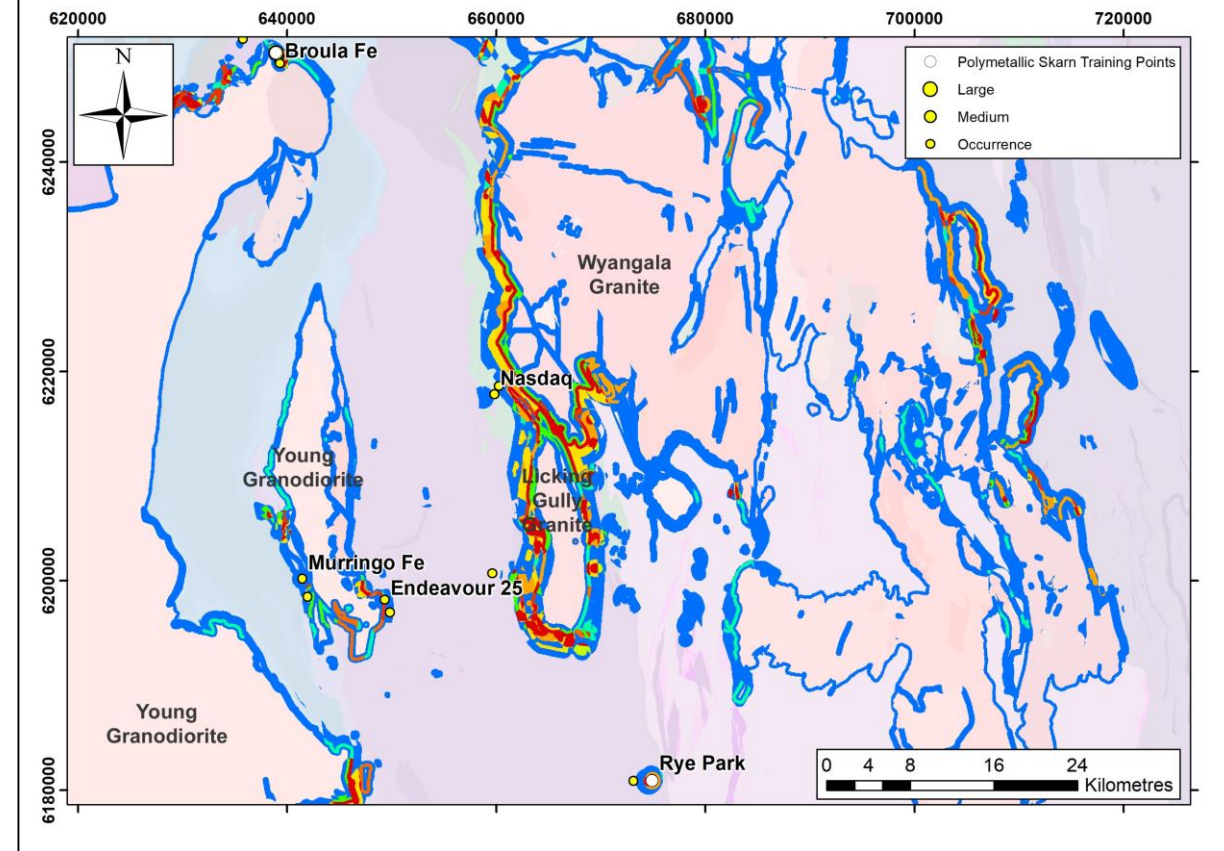
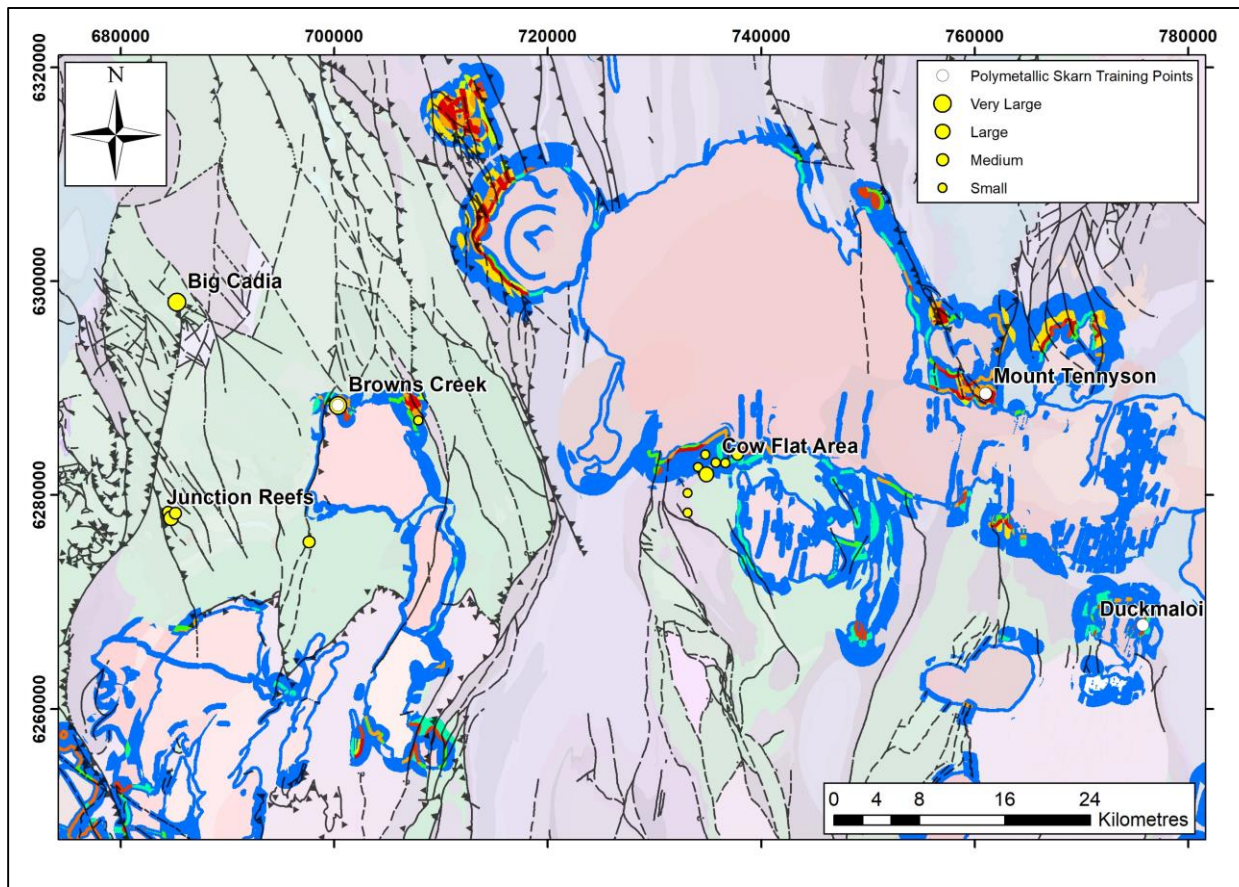
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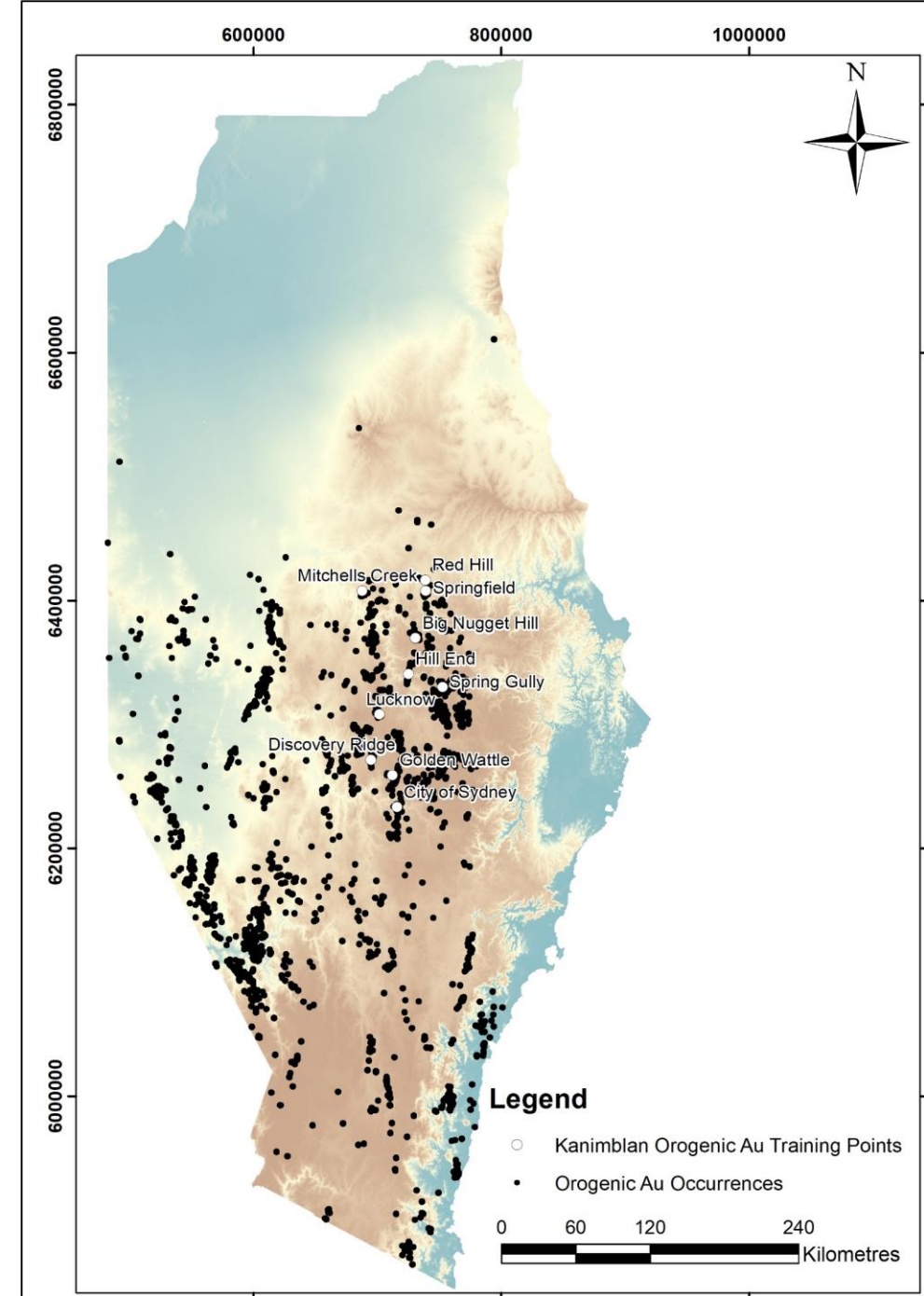
Highly prospective area around Cow Flat area and Young Granodiorite.



Prospective area is typically < 1km of causative intrusion and within the pluton's contact metamorphic aureole.

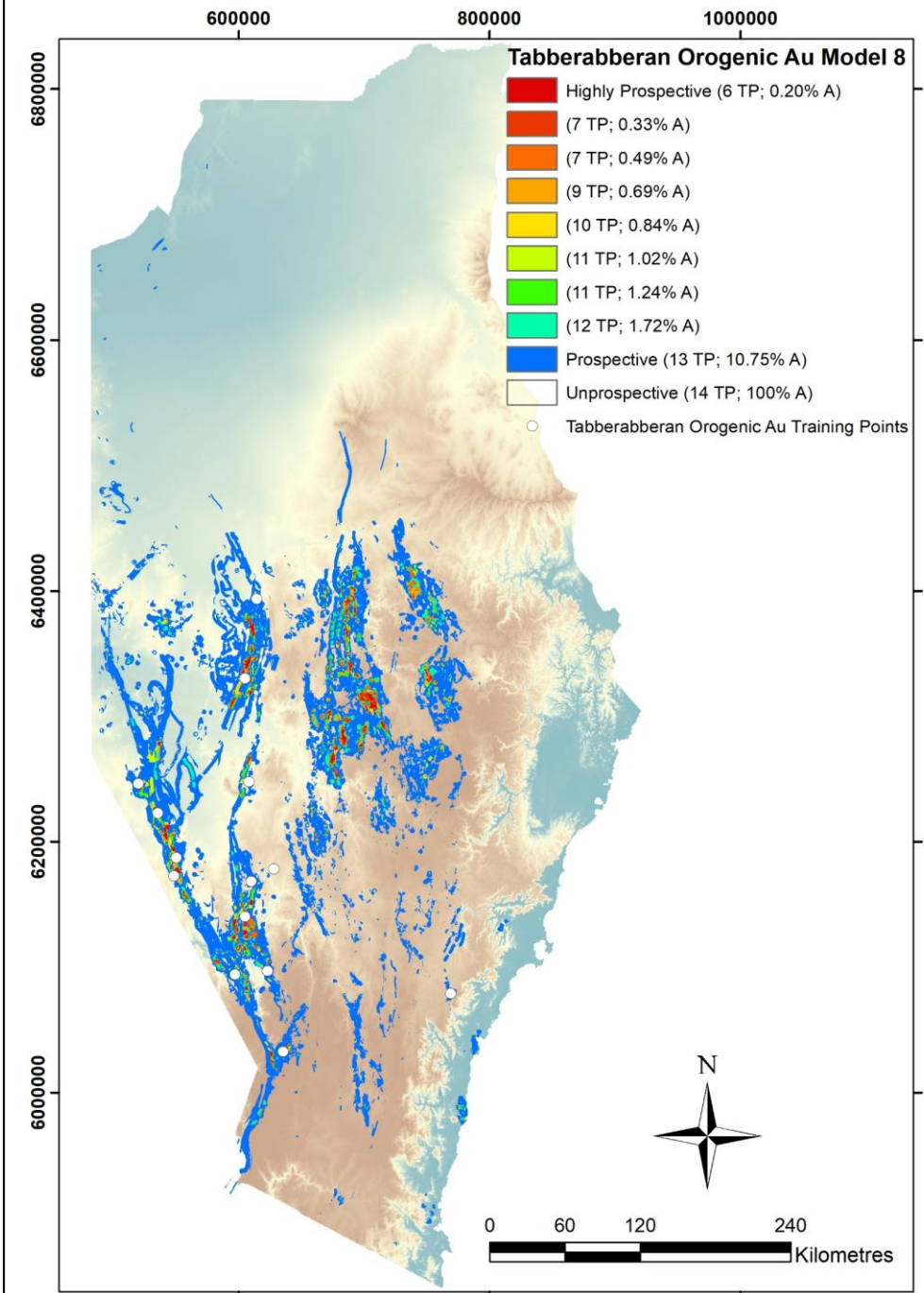
Orogenic Au

- Low sulfide structurally controlled quartz veins related to Early Carboniferous Kanimblan Orogeny within/adjacent to Hill End Trough.
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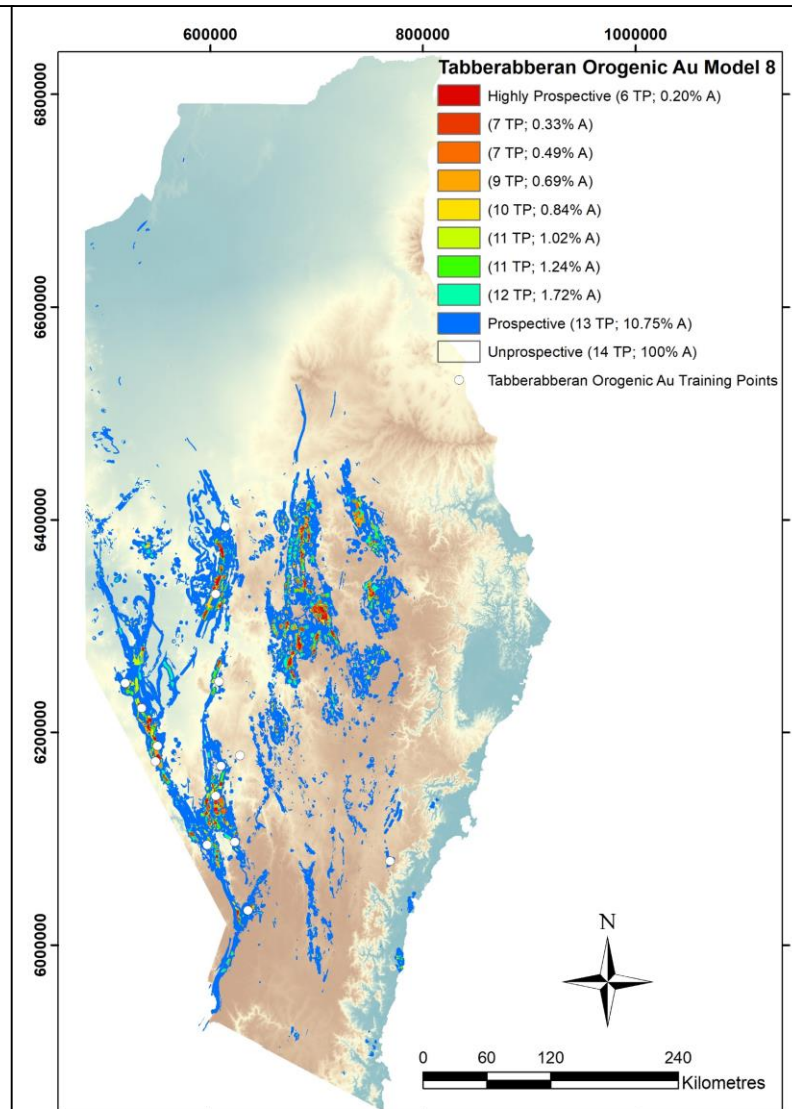
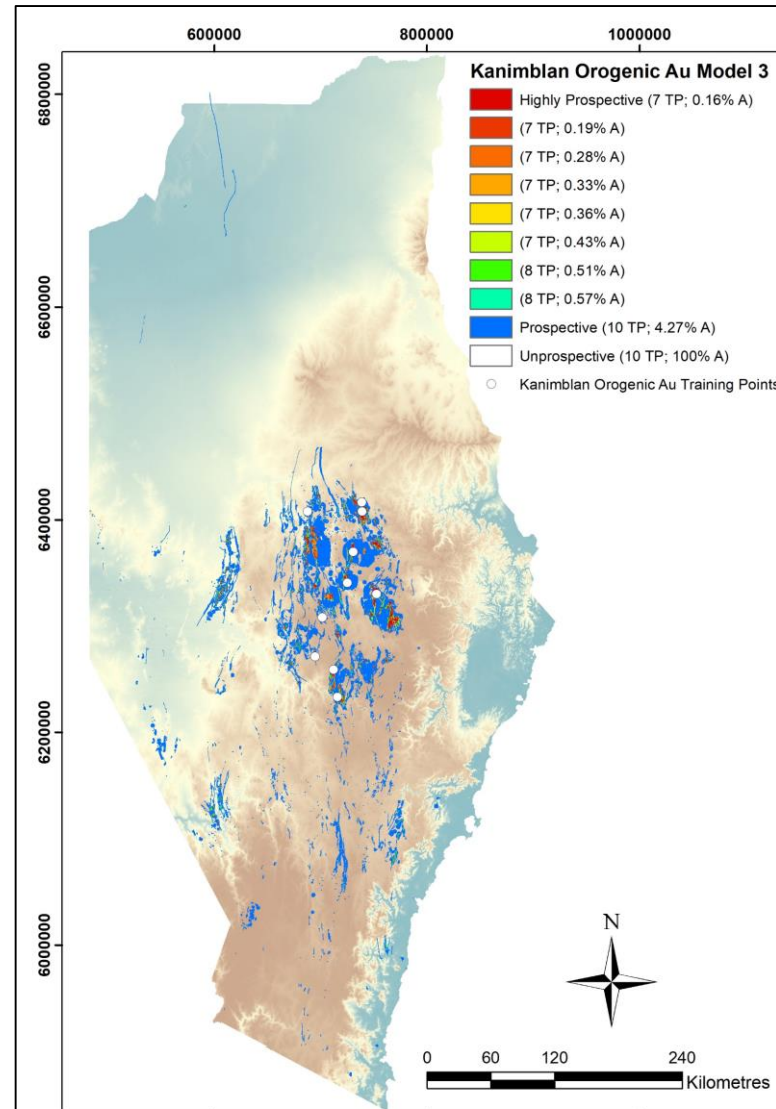
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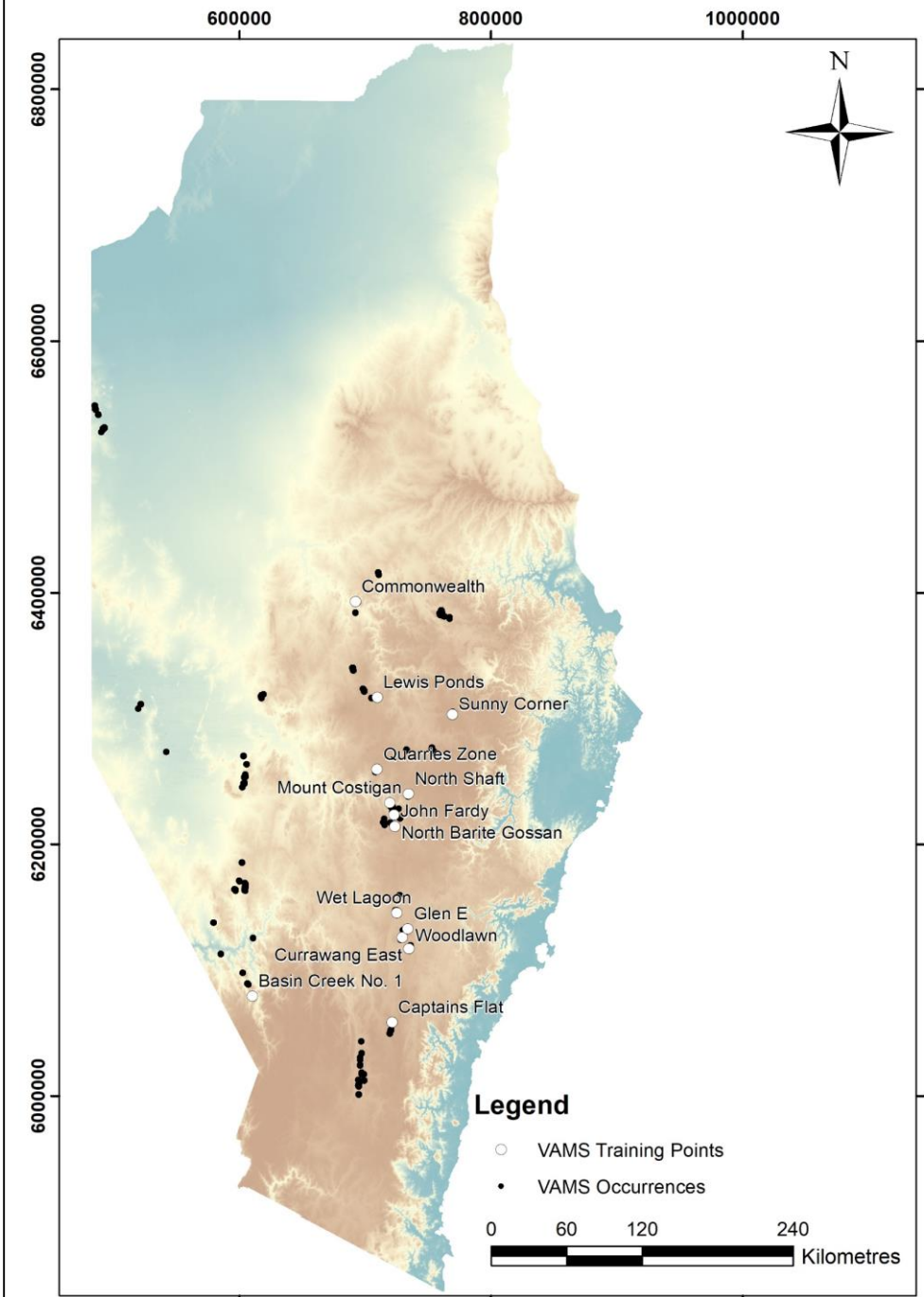
Kanimblan vs. Tabberabberan

- Similar source maps used in each model
- Both mineral systems relate to greenschist facies metamorphism
 - Higher grade during Tabberabberan, making it difficult to map for Kanimblan
- Kanimblan system uses pre-existing structures from Tabberabberan
- Parts of Hill End Trough prospective for Tabberabberan orogenic Au despite dominant event being Kanimblan in the area.



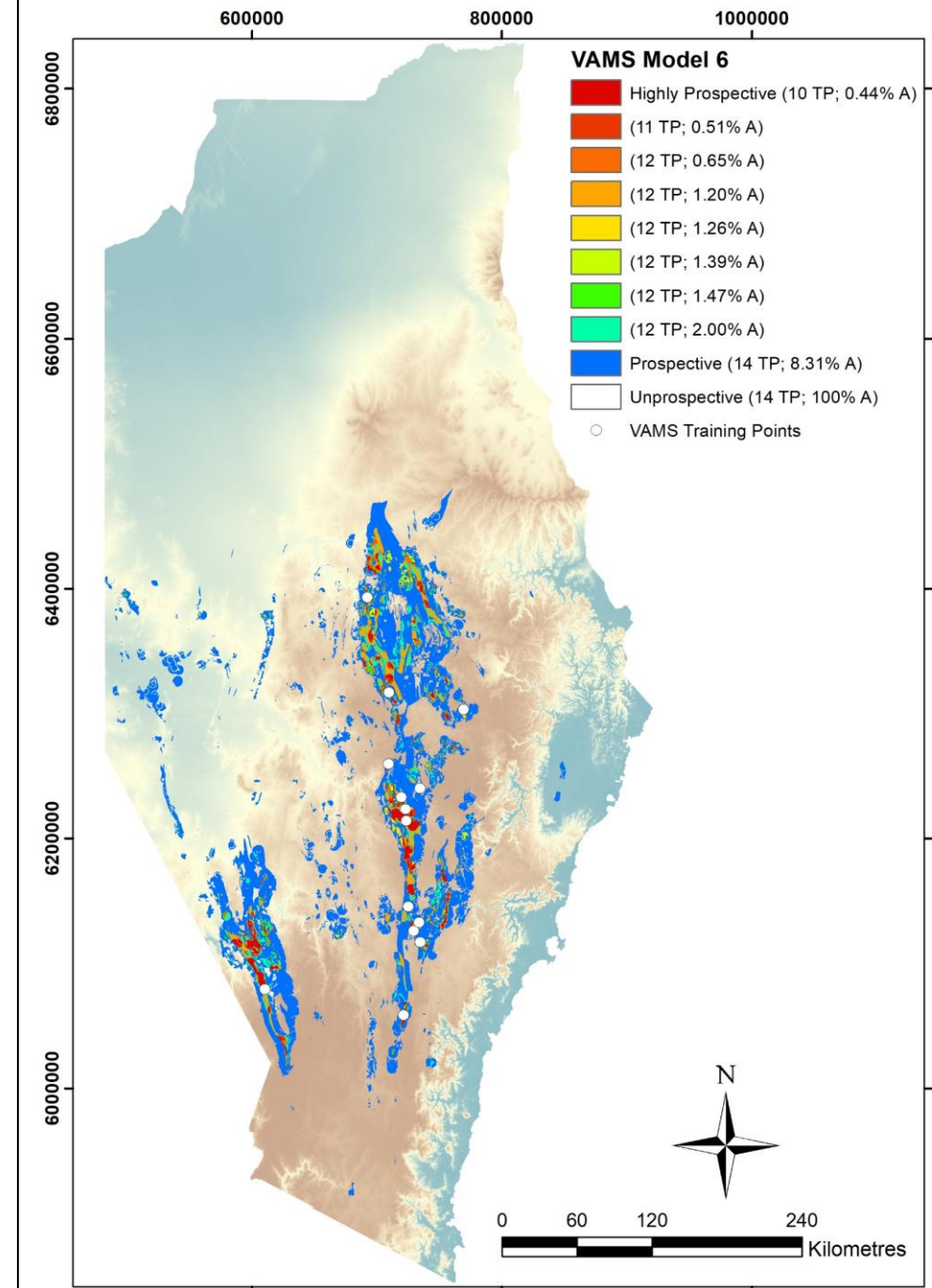
VAMS Mineral System

- Stratabound accumulations of sulfide minerals hosted in deep-water extensional basins that formed in the Middle Silurian (Tabberabberan Cycle).
- The mineral systems knowledge was tested using spatial analysis:
 - 138 spatial variables tested
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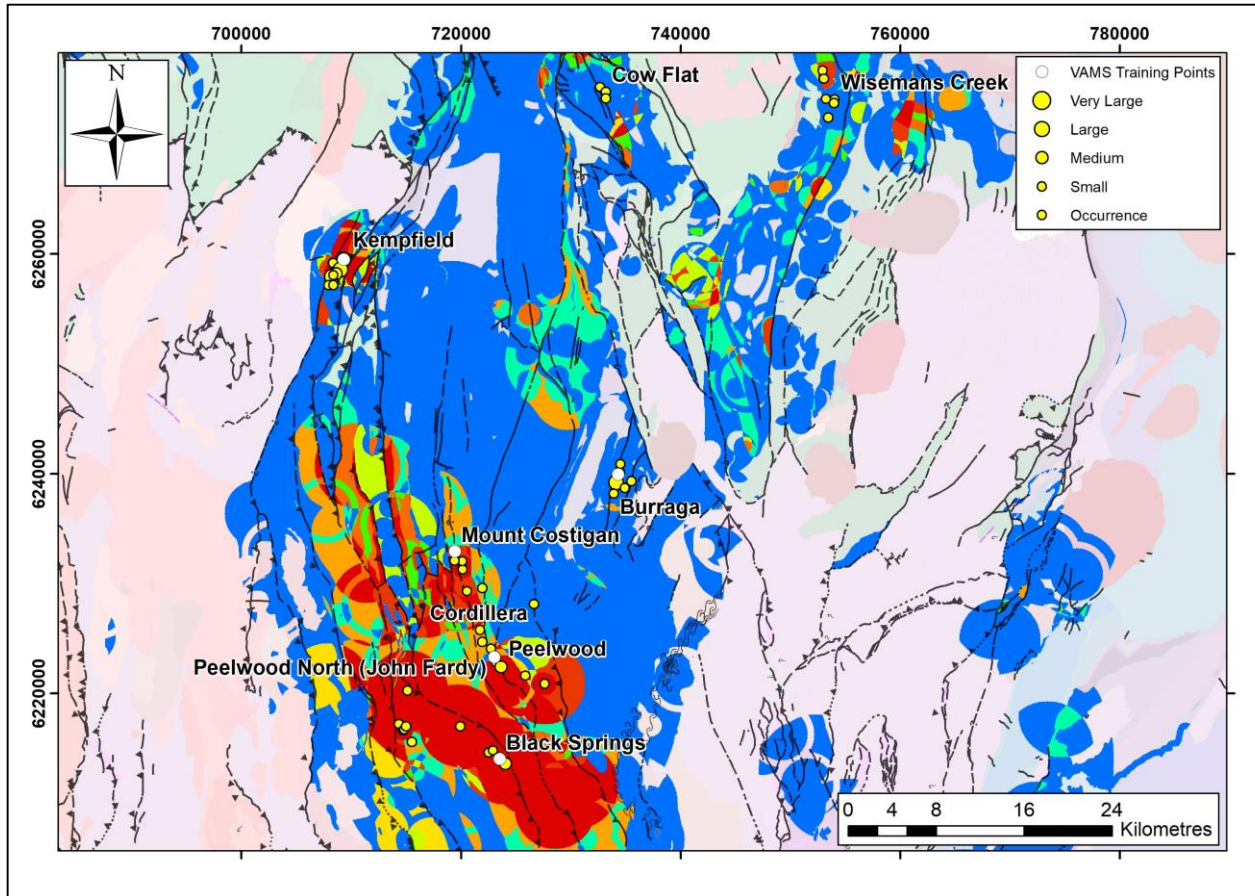


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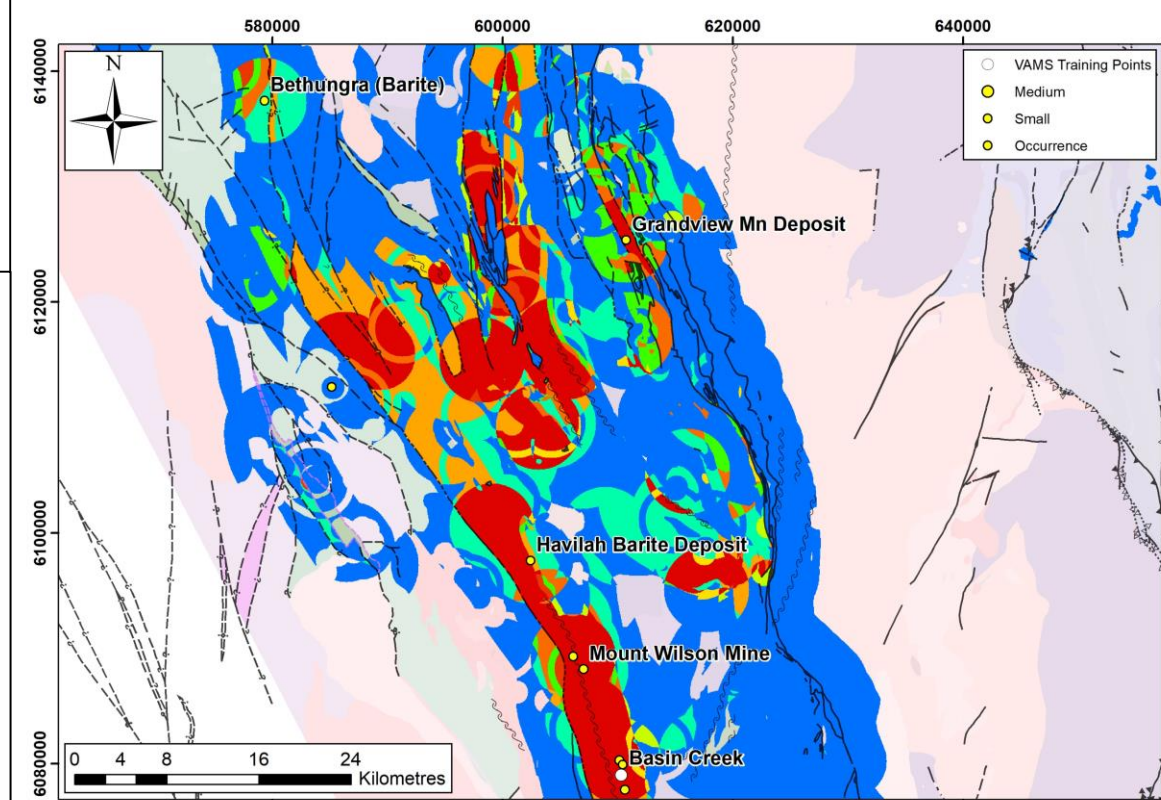
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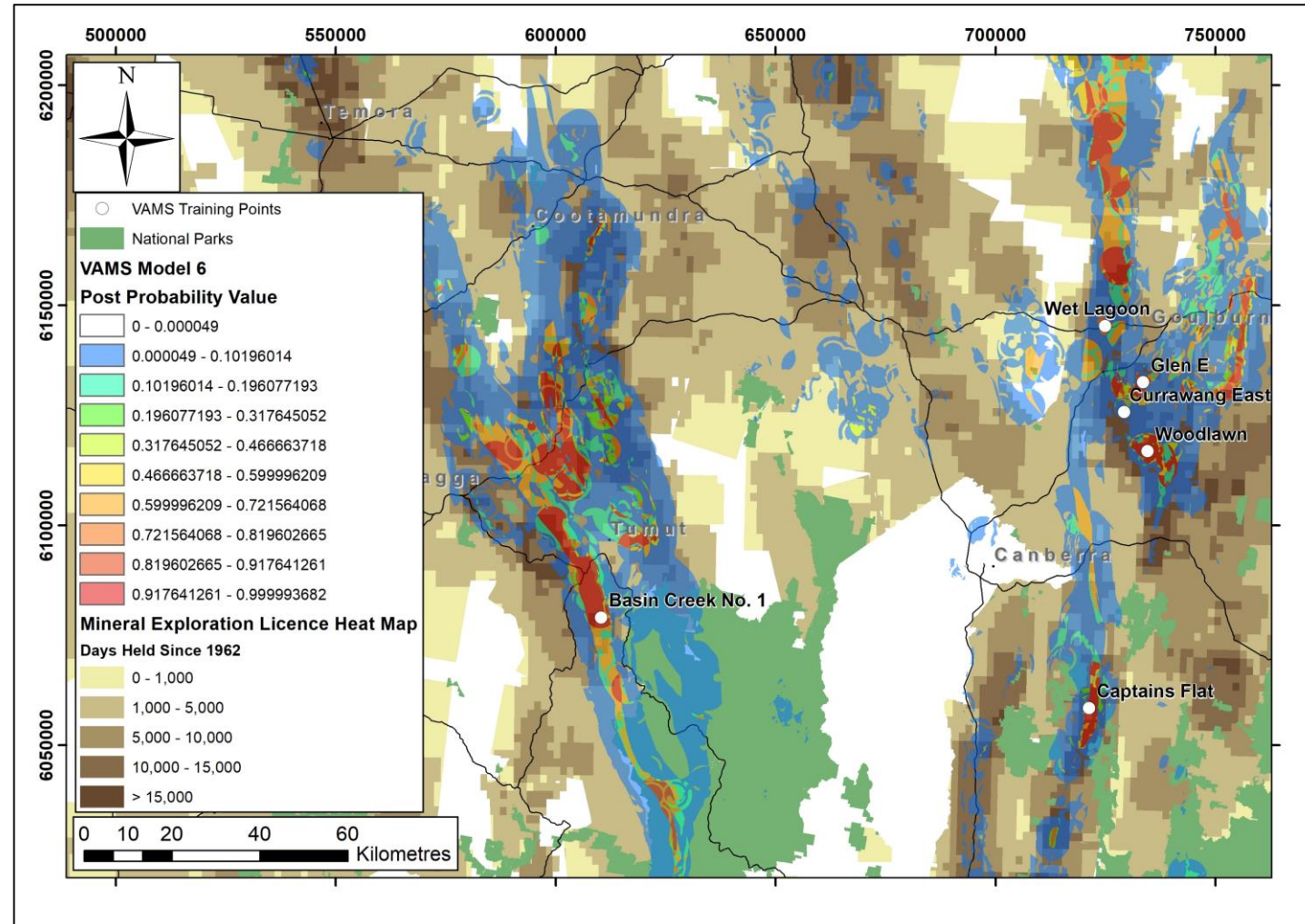
- Highly prospective area around Mount Costigan to Wet Lagoon.
- Low to moderate prospectivity to south of Bathurst Batholith



- Elevated prospectivity in the Tumut Trough highlights untapped potential.
- Modelling confirms key ideas about basin bounding and extensional faults, exhalative horizons, and syn-volcaniclastic sedimentary rocks.
- Challenge to map the causative heat sources/intrusions for the mineral system.

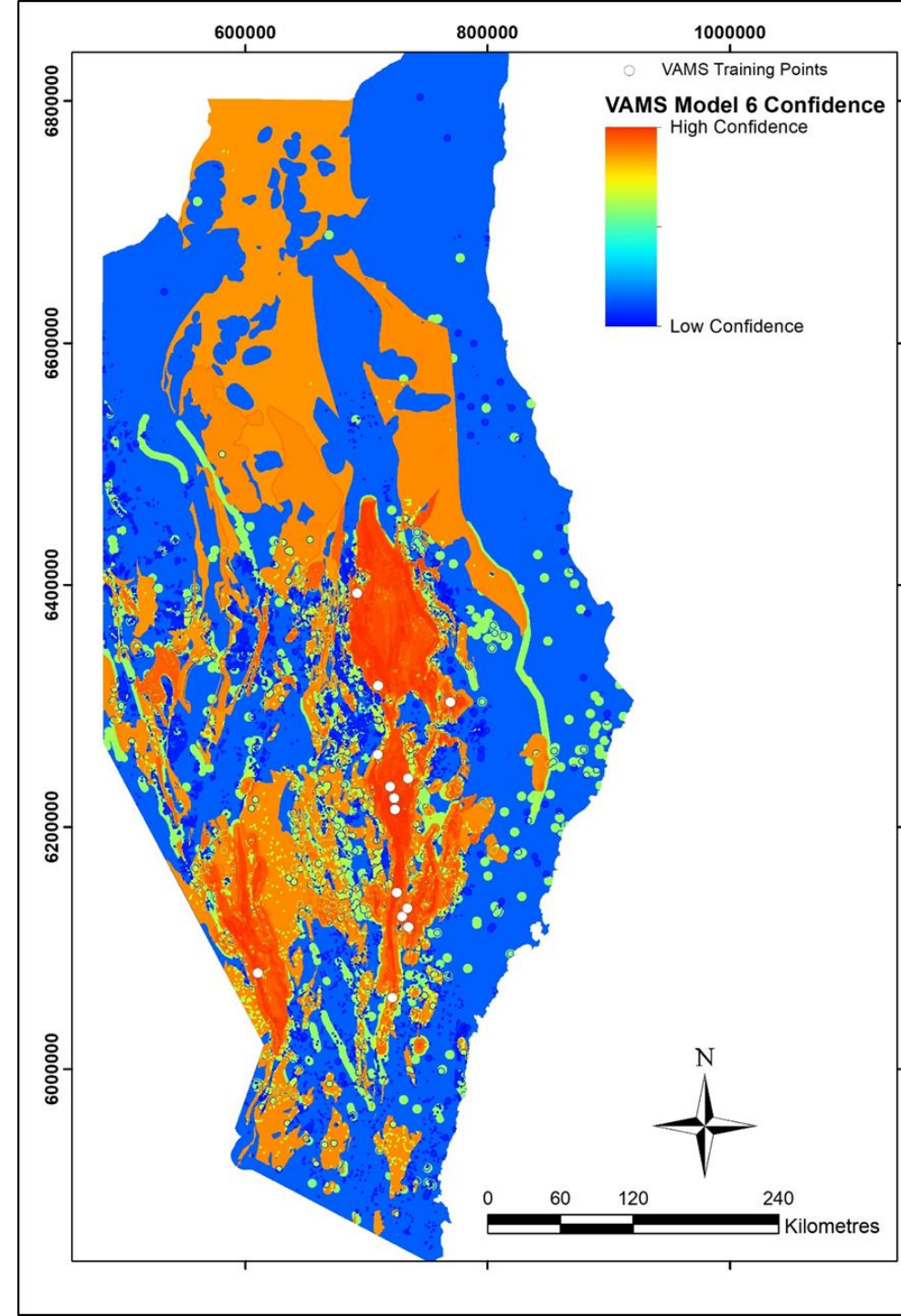
VAMS Mineral System

- Exploration heat map indicates there are still some relatively underexplored areas with moderate to high VAMS potential.
- May represent exploration opportunities for industry.



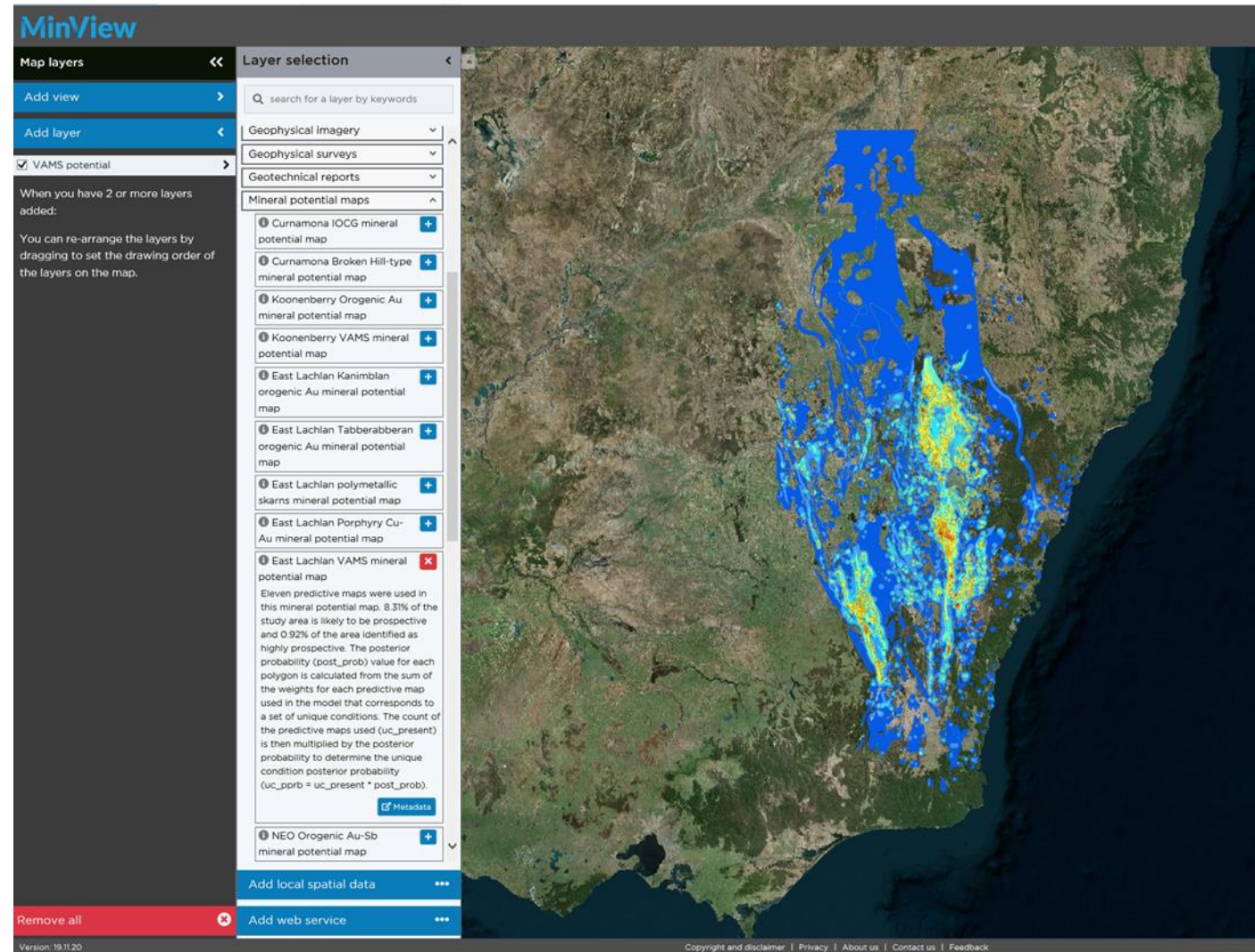
Outputs

- A Mineral System Atlas for the Eastern Lachlan Orogen is downloadable as a digital data package from DIGS:
- <https://search.geoscience.nsw.gov.au/product/9253>
- A wide range of predictive maps have been created.



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