

Metallogenic analysis – Defining and mapping mineral systems

Vladimir Lisitsin

Geological Survey of Queensland

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Outline

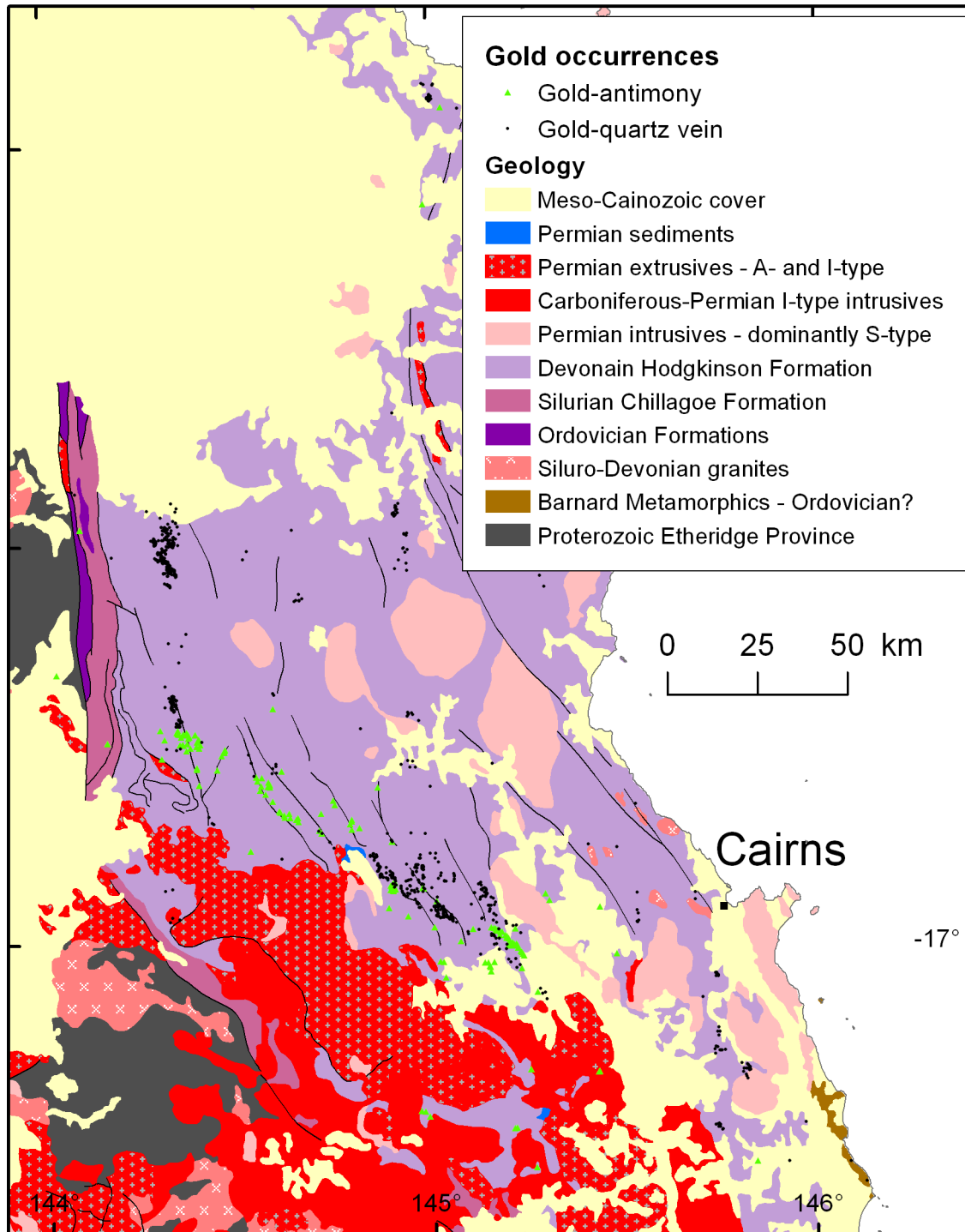
- Mineral system maps – aspiration and reality
- From mineral occurrence databases – to hierarchical metallogenic objects
- From traditional geological datasets – to mappable expressions of mineral systems
- Need for the geological surveys to revive the old concept of metallogenic maps with new ideas?

Mineral systems – conceptual definition

- “All geological factors that control the generation and preservation of mineral deposits” (Wyborn et al., 1994)
- A common emphasis on defining a combination of individual critical and constituent processes
- The general concepts are translated into mappable targeting criteria and used in exploration targeting

Mineral systems – from concepts to maps

- Many alternative definitions, approaches, terms and tools
- Large uncertainties on the composition and structure of many mineral systems – how they operate
- A major challenge of translation from (uncertain) concepts to specific maps
- A challenge of self-organised criticality – mineral systems cannot be reduced to a combination of (uncertain) components
- Mineral system ‘maps’ are not readily available or comparable



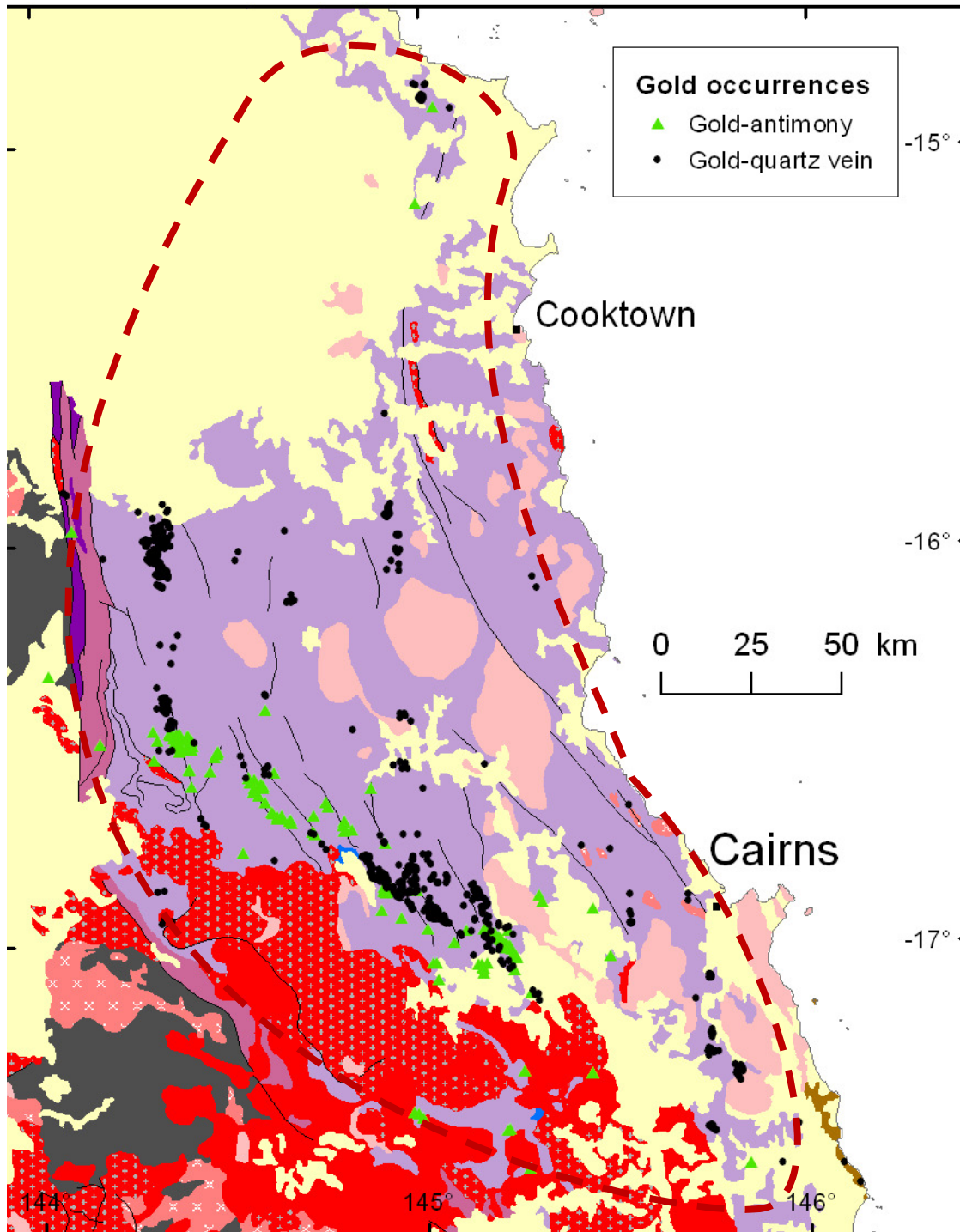
Common maps insufficient

- Geology and mineral occurrences – essential but insufficient to map a mineral system
- Reasons for uneven distribution?
- Large-scale metallogenic controls within the province?

Metallogenic objects as indicators of mineral systems

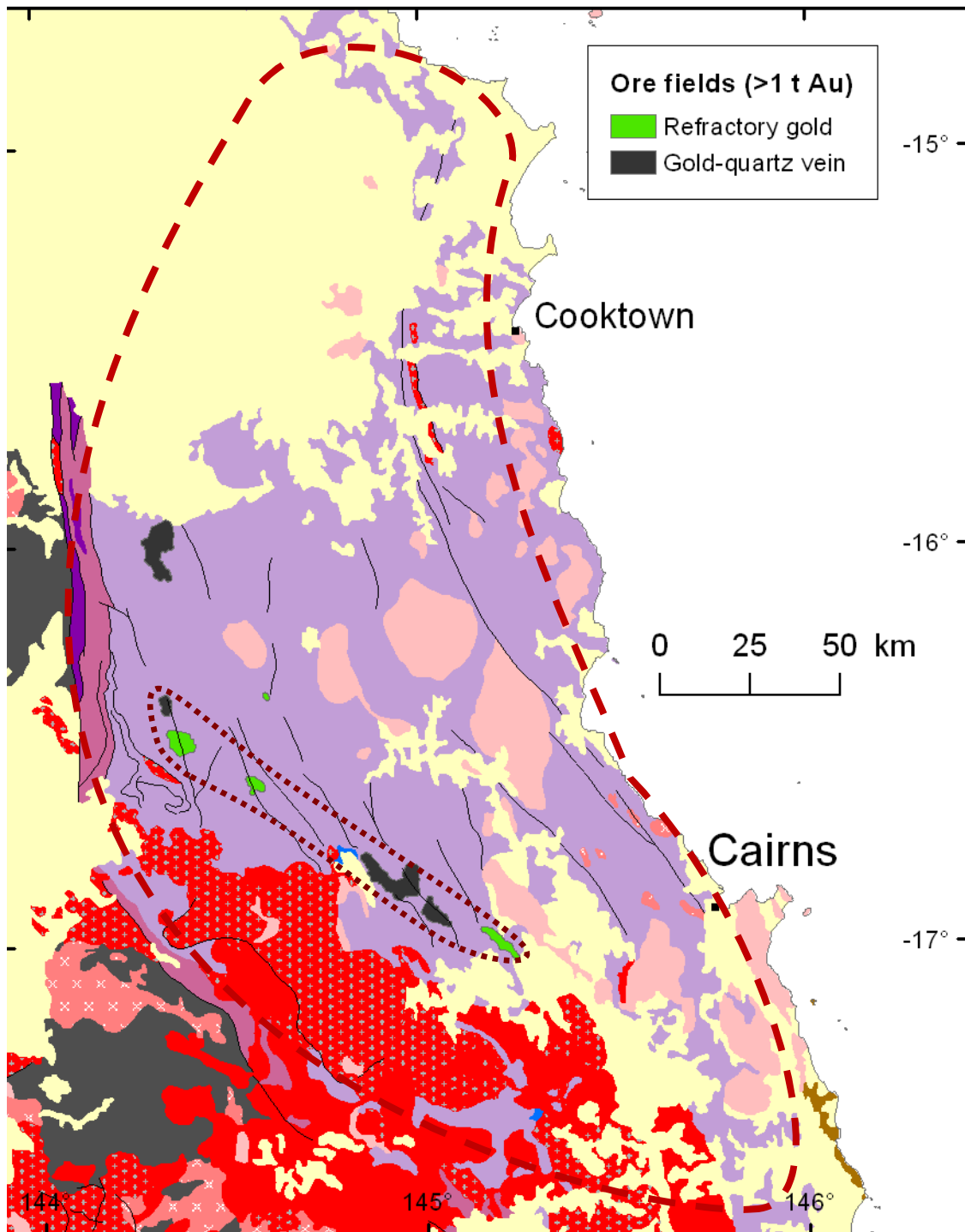
- Properties of known mineralisation is the most direct evidence of a mineral system
- Hierarchy of metallogenic objects:

| Metallogenic object | Common size |
|----------------------------|--------------------|
| Province | n x 100 km |
| Zone | n x 10 km |
| Ore field | n km |
| Deposit | n x 100 m |



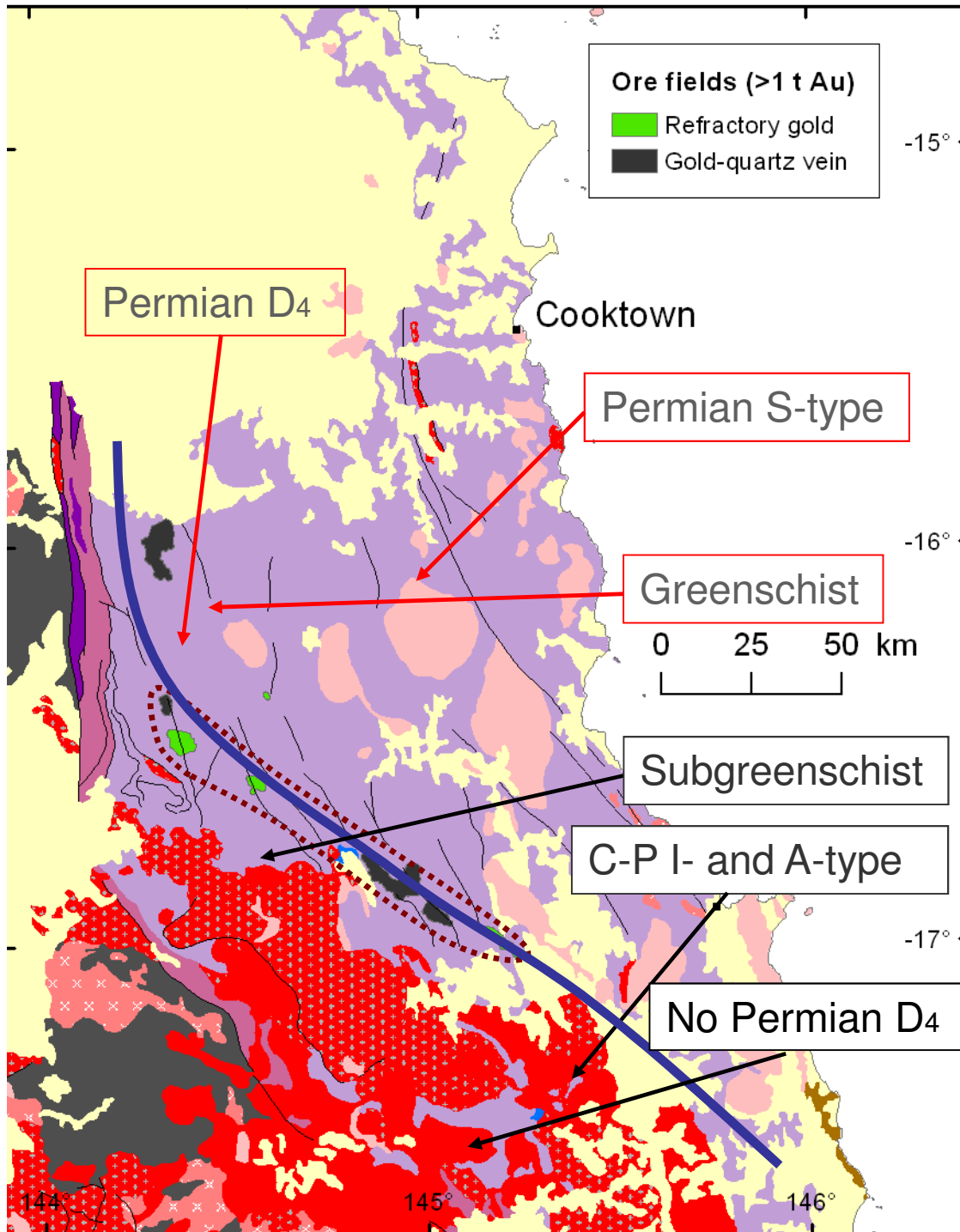
Metallogenic province

- 1,000 recorded primary orogenic gold occurrences
- Province - the maximum spatial extent of the mineral system



Metallogenic zone and ore fields

- 1,000 recorded primary gold occurrences
- 8 significant **ore fields** with >1 t contained gold
- Most deposits are in a single narrow **metallogenic zone**



Metallogenic zone

- The zone is oblique to the regional structures
- It represents a major crustal domain boundary, as indicated by igneous geochemistry and regional metamorphic grades

Summary

- Traditional geological maps are insufficient
- Need consistent maps of essential metallogenic information that would adequately characterise mineral systems:
 - Geochronology and genetic links of mineralisation
 - Lithospheric to local-scale domains and damage zones
- Geological surveys are uniquely positioned to collect and provide such **information**