



# Future developments

## Overview

Ore deposit studies

Exploration

Development of understanding between gold particle chemistry and ore forming processes (RC)

New analytical Approaches (RC)

Generating comprehensive data base (RC)

Integration of gold compositional studies with standard geochemical practices (NM)



Data interrogation

# Future developments

Development of understanding between gold particle chemistry and ore forming processes

## *Gold particle size:*

How does this relate to gold solubility?

How generic is gold formation by nanoparticles and what are the implications for gold particle studies ?

What generic role does crystal grain growth play in formation of coarse gold?



# Future developments

## Illuminating deposit models in terms of source- transport-trap

### Source

Are regional similarities between gold from different localities in orogenic gold camps evidence for a common source?

### Transport

Do subtle differences between signatures from nearby localities indicate different fluid rock interactions along a fluid pathway?

Can we correlate same/different signatures with structural understanding to illuminate fluid pathways?

### Trap

What do inclusions/trace element signatures of inclusions and alloy tell us about depositional mechanisms?

Can crystallographic studies tell us anything about mechanisms of gold particle growth through nanoparticle coalescence?

## 2.5 Future developments

**Illuminating deposit models in terms of source- transport-trap**

**Post depositional processes in the hypogene environment**

Invisible gold and other trace elements liberated from pre-existing sulphides

Transported either

- i. in solution
- ii. as nanoparticles
- iii. By 'Bi collector model

Contacting of pre-existing mineralization with later, hydrothermal system

Are there specific textures/compositional signatures associated with remobilization of gold

According to process?

# Future developments

## New analytical approaches

### *Quadrupole LA-ICP-MS studies*

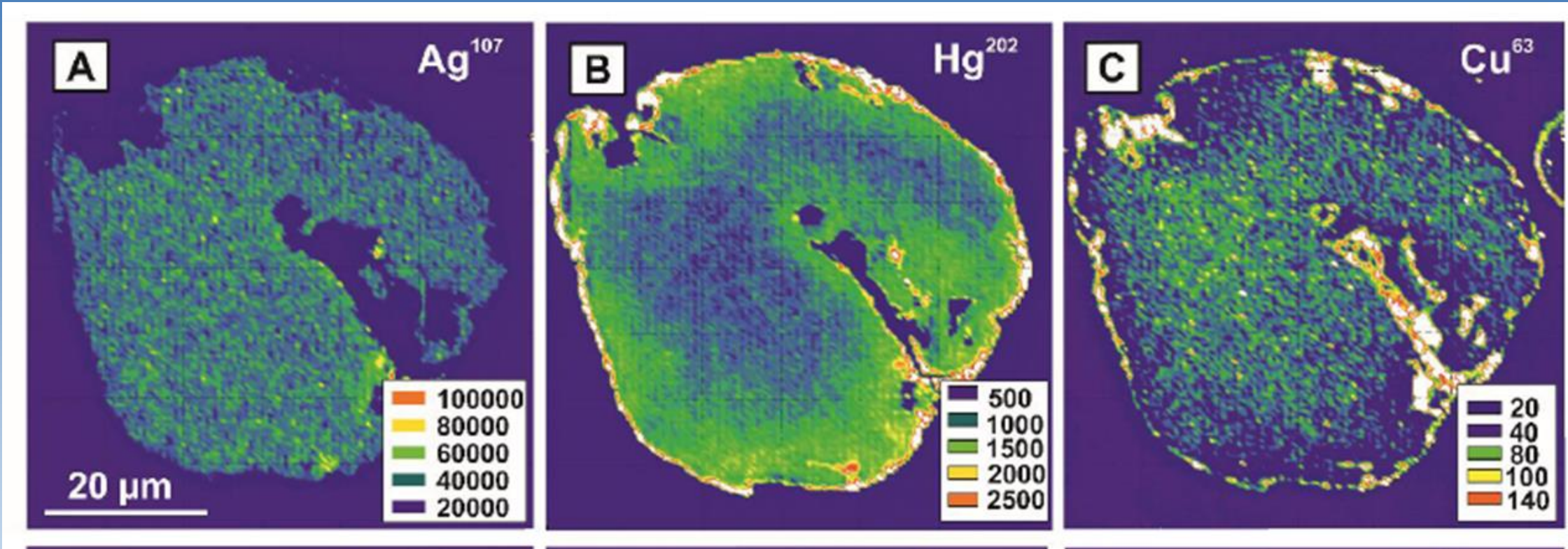
Increase number of (robust) data bases to establish whether specific elements are generic indicators of gold from specific deposit types.

Opportunities from inclusions:

- i. trace element partitioning: e.g. do galena inclusions in gold from a low sulphidation epithermal system have the same trace element profile as galena in gold from an orogenic system?
- ii. isotope studies of elements in inclusions

# Future developments

New analytical approaches: LA-ICP-ToF-MS



Spatial covariance of trace elements in gold particles

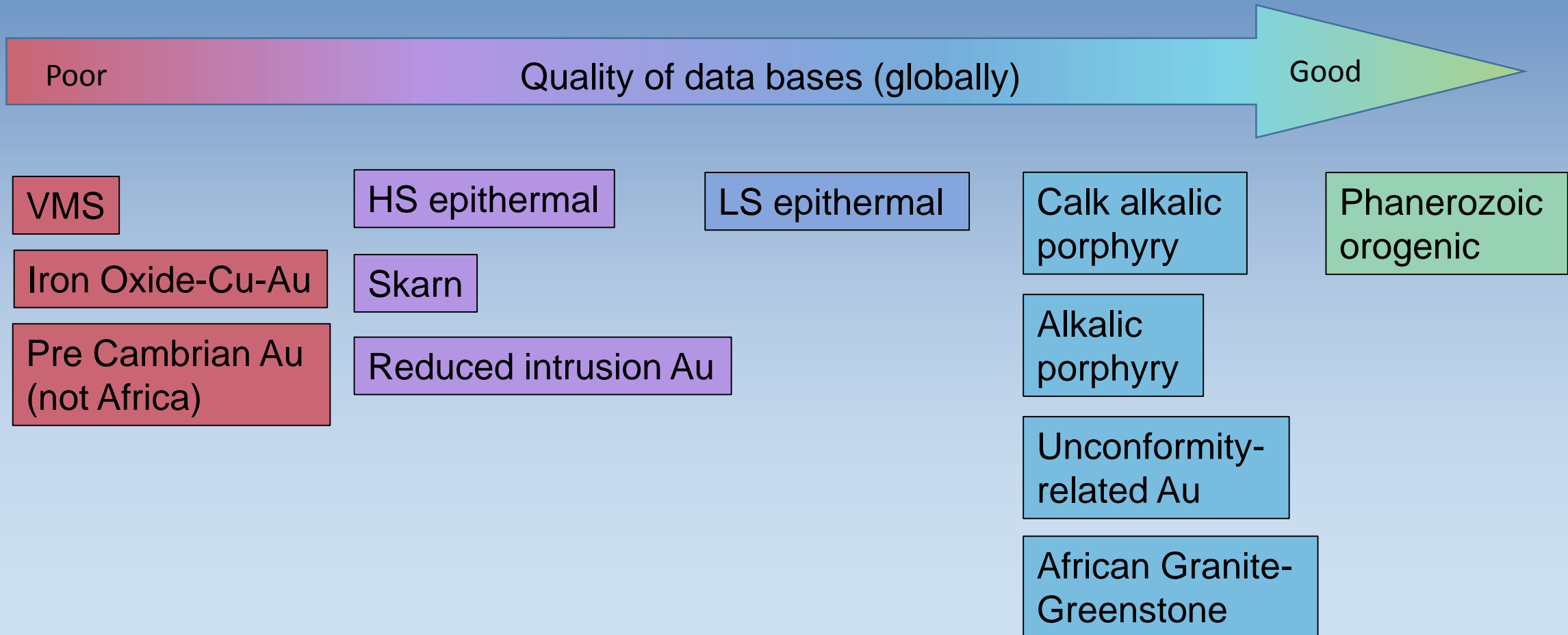
What is the significance of 'clusters'?

***Working out what this information can tell us!***

# Future developments

## Generating comprehensive data base

Classical approach of inclusion/EMP ± LA-IICP-MS continues to be valuable: 'Holes:' in the data base:





# Future developments

## Integration of gold compositional studies with standard geochemical practices

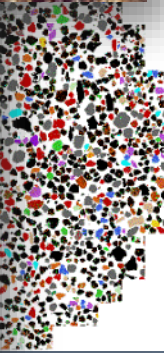
**Field-based XRD analysis** of HMCs – similar to portable XRF for fines – may provide instantaneous, fit-for-purpose data (but not for amounts < 5%)

Geological Surveys and exploration companies & consultancies encouraged to **include gold particle studies** along with standard geochemical methods.

For regional geochemical surveys, Geological Surveys may have collected HMCs but **not analysed** the samples: scope for industry involvement?

**Increasing use of robotic / semi-automated analytical methods:** QEMSCAN etc. are currently too expensive for exploration purposes – with wider adoption, costs should decrease.

**‘High-resolution heavy mineral analysis’** to categorize different varieties of specific heavy minerals – labour-intensive, but may be worthwhile to obtain further information on mineral provenance.



# Future developments

## Data Interrogation

### What's a result?

Currently there is a large emphasis on personal interpretation (by me, Norman...) not such a good basis for a wider methodology.

We have a project funded by Geoscience BC which is applying machine learning approaches to interpretation of new data

Data base containing sample populations from different deposit types

Classification algorithms

Compositional characterization of an unknown sample

