

ATLAS OF GOLD COMPOSITIONS FOR BRITISH COLUMBIA

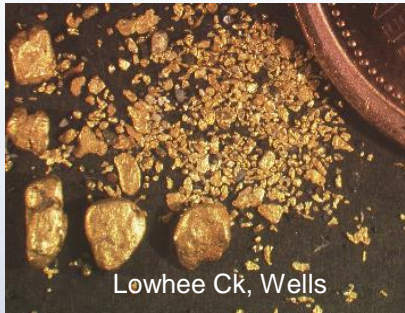


MDN
GEOSCIENCE LIMITED

Developing a New Tool for the Exploration Community



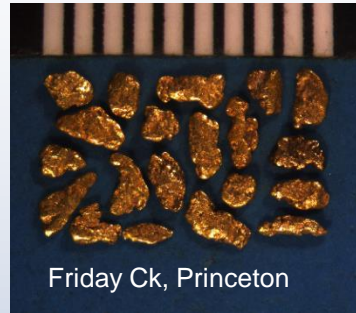
UNIVERSITY OF LEEDS



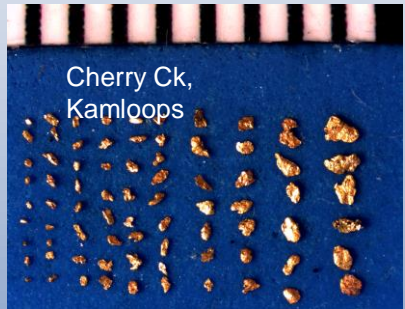
Lowhee Ck, Wells



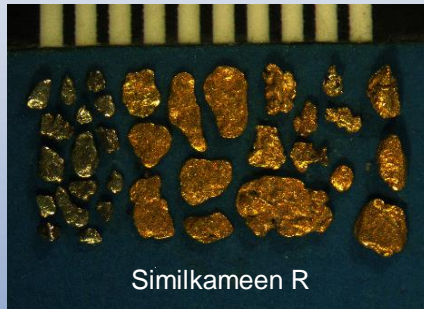
Moustique Ck, CGD



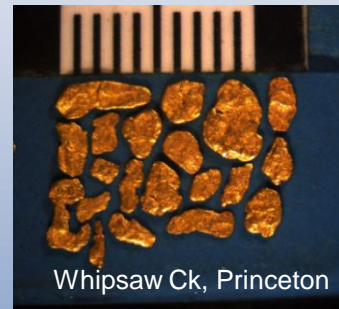
Friday Ck, Princeton



Cherry Ck,
Kamloops



Similkameen R



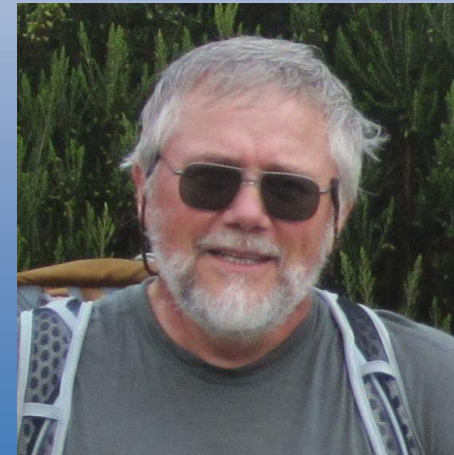
Whipsaw Ck, Princeton



Rob Chapman



Britt Bluemel



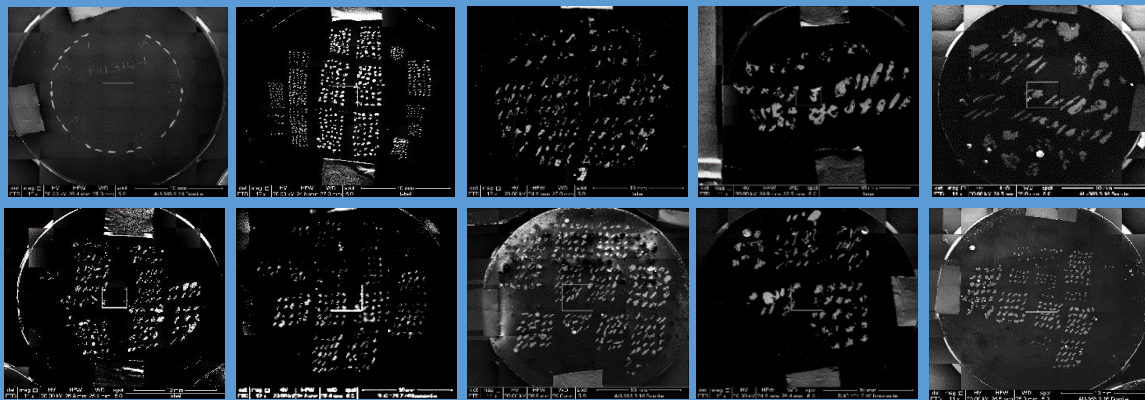
**Jim
Mortensen**



**Rory
Murphy**



**Dave
Banks**



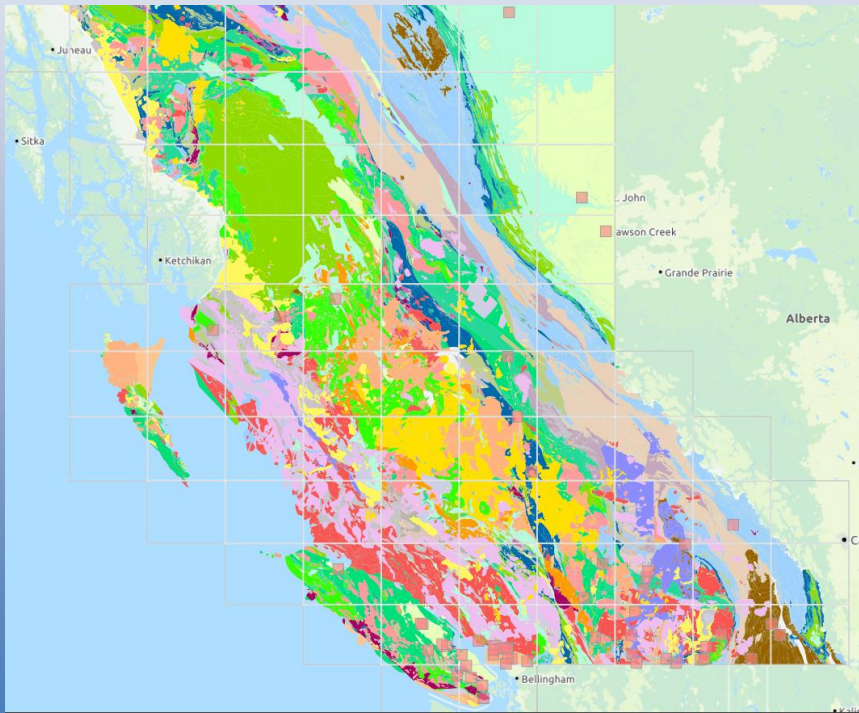
SEM images of some polished blocks

Project Overview: 1

What ?

We are developing a methodology whereby placer gold can be used as a deposit-style specific indicator mineral

Why is this useful?

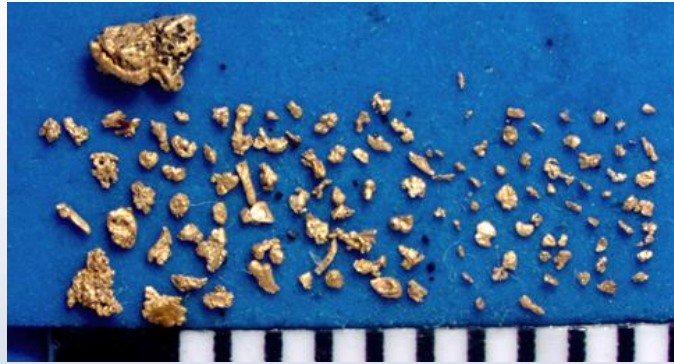


1. BC Geology is complicated

2. Placer gold is widespread
(not confined to placer mining areas).
The source deposit type may be unclear

3. If we could establish the type of deposit(s) that
yield placer gold at any particular locality it would
help targeting on the basis of local geology

Project Overview: 2



Any scale of exploration project

Development of gold compositional Atlas

Analysis

Compositional Signature

Comparison with deposit specific templates

Establishing source deposit type

Methodology to interpret data

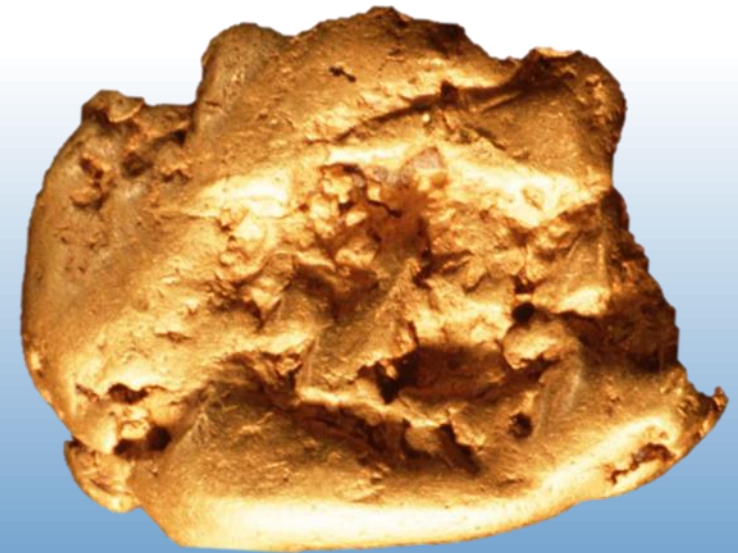
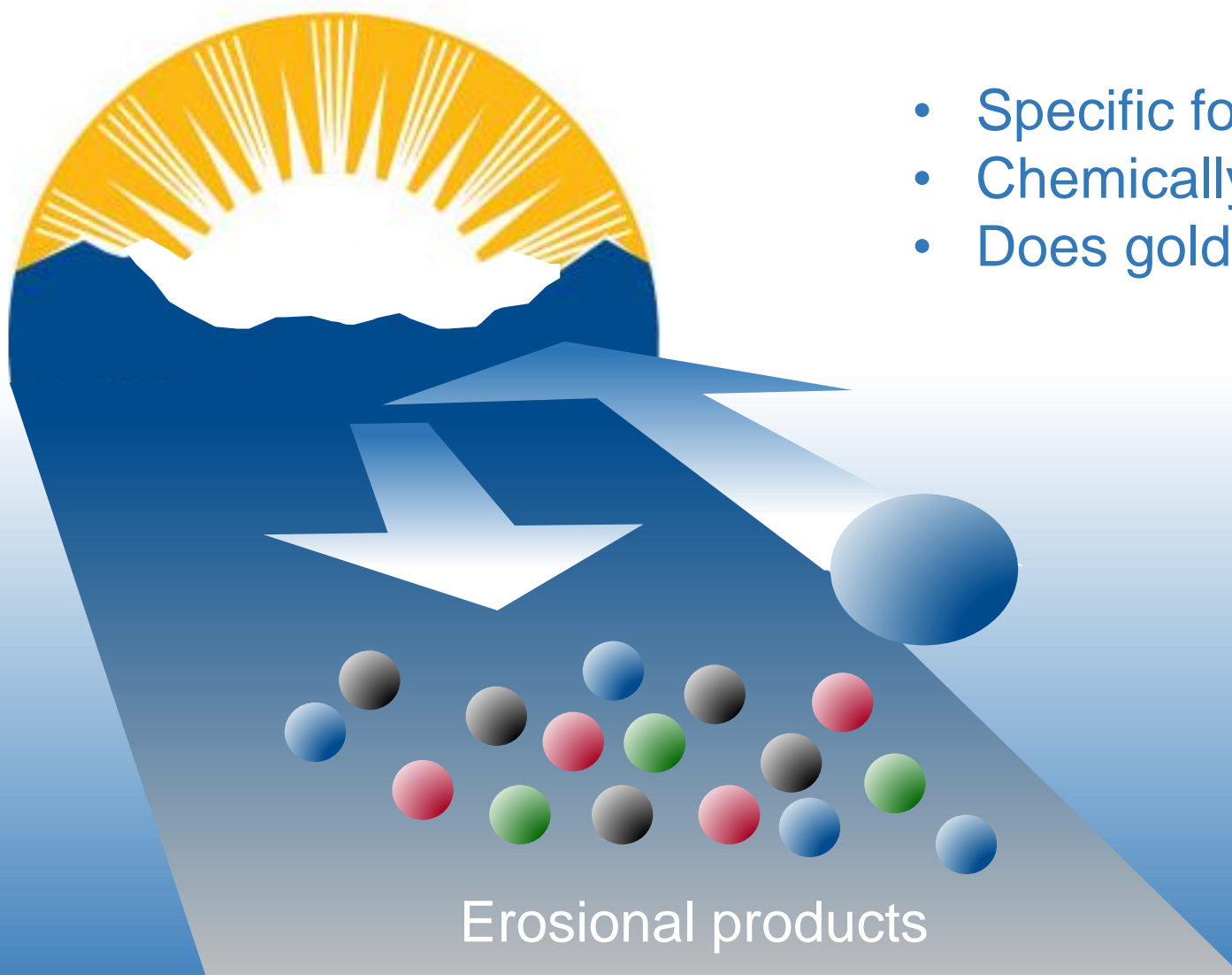
IMPROVED TARGETING

How will this be achieved ?

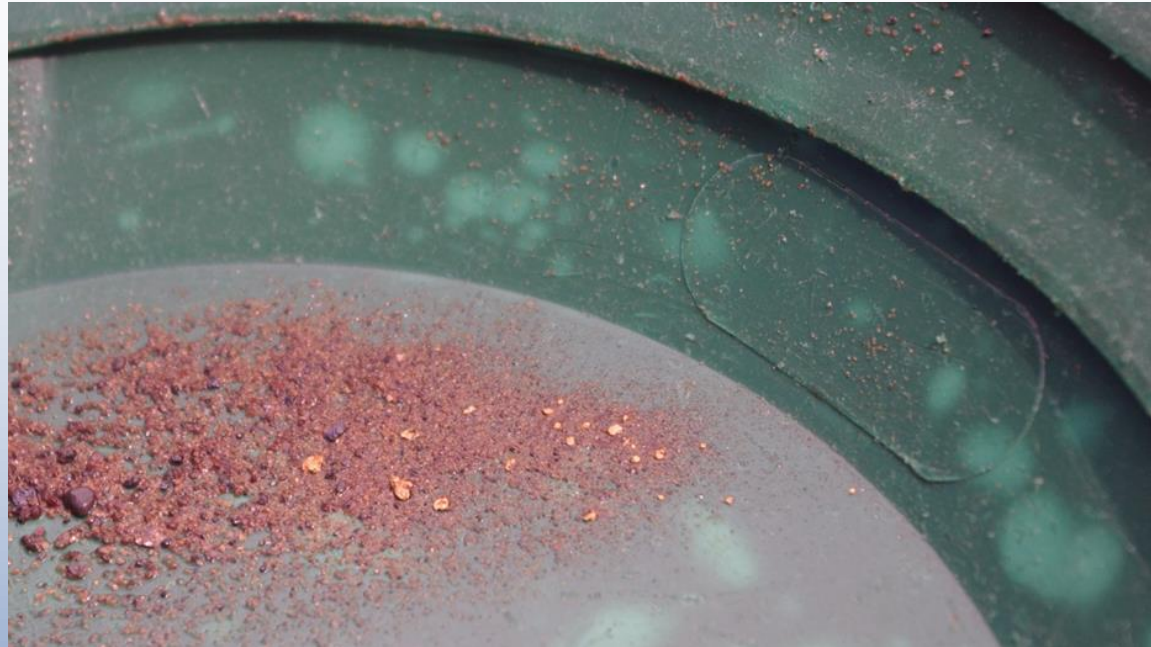
Project Principles: Indicator Minerals

Indicator Minerals need to be:

- Specific for the source of mineralization
- Chemically and physically durable
- Does gold fit the bill?



Project principles: Gold As An Indicator Mineral



Porphyry



Epithermal



Orogenic



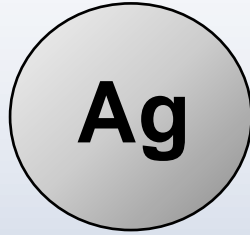
IRGD



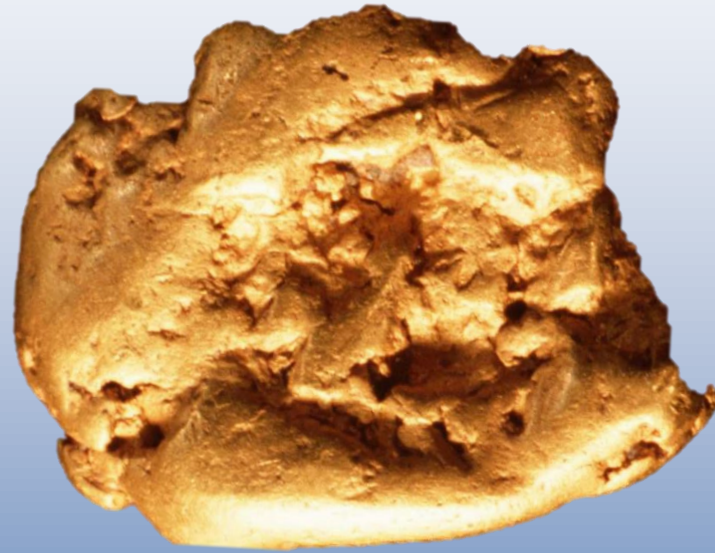
Skarn

Can we distinguish between gold from different sources?

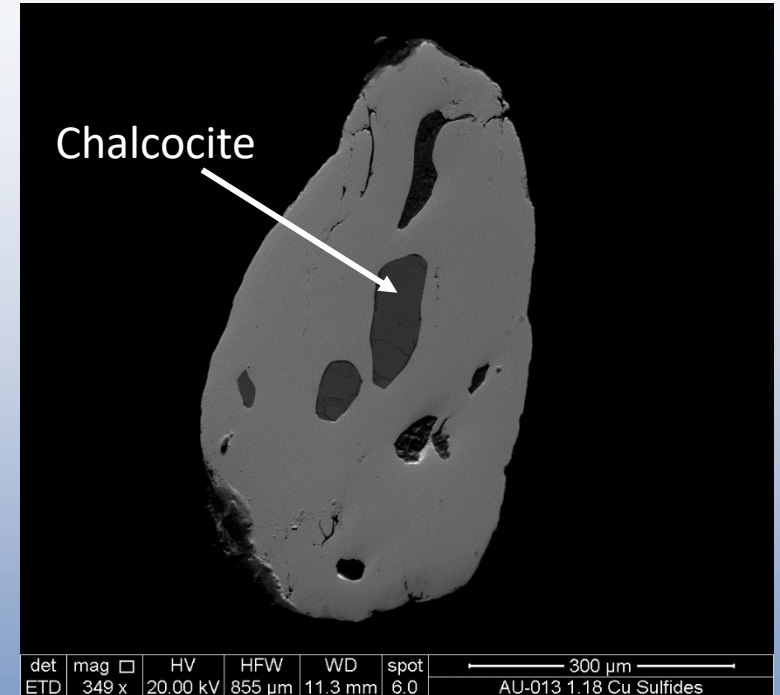
Project Principles: Features of Gold Particles That Can Be Useful Discriminants



Alloy compositions



Mineral inclusions

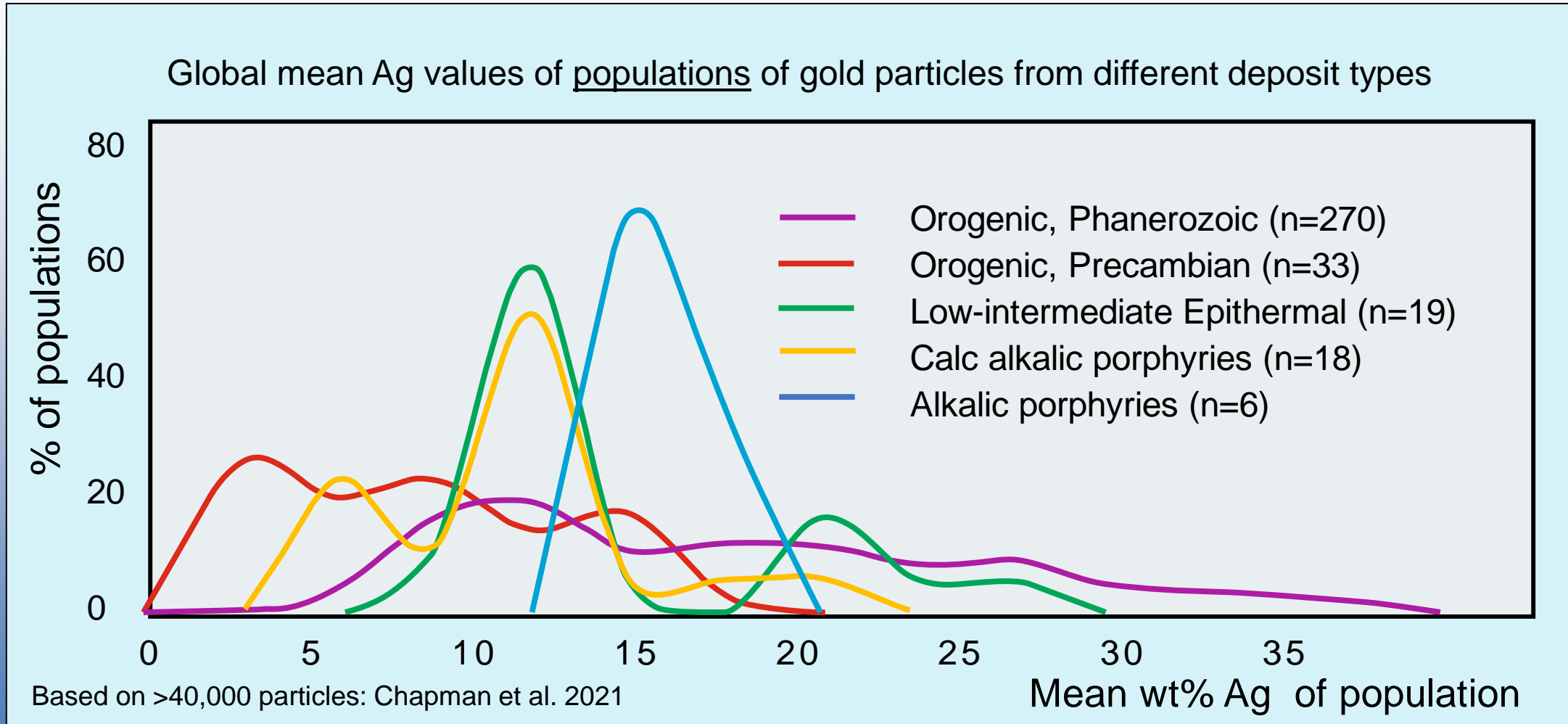


Does every gold particle from the same locality exhibit the same characteristics?

NO

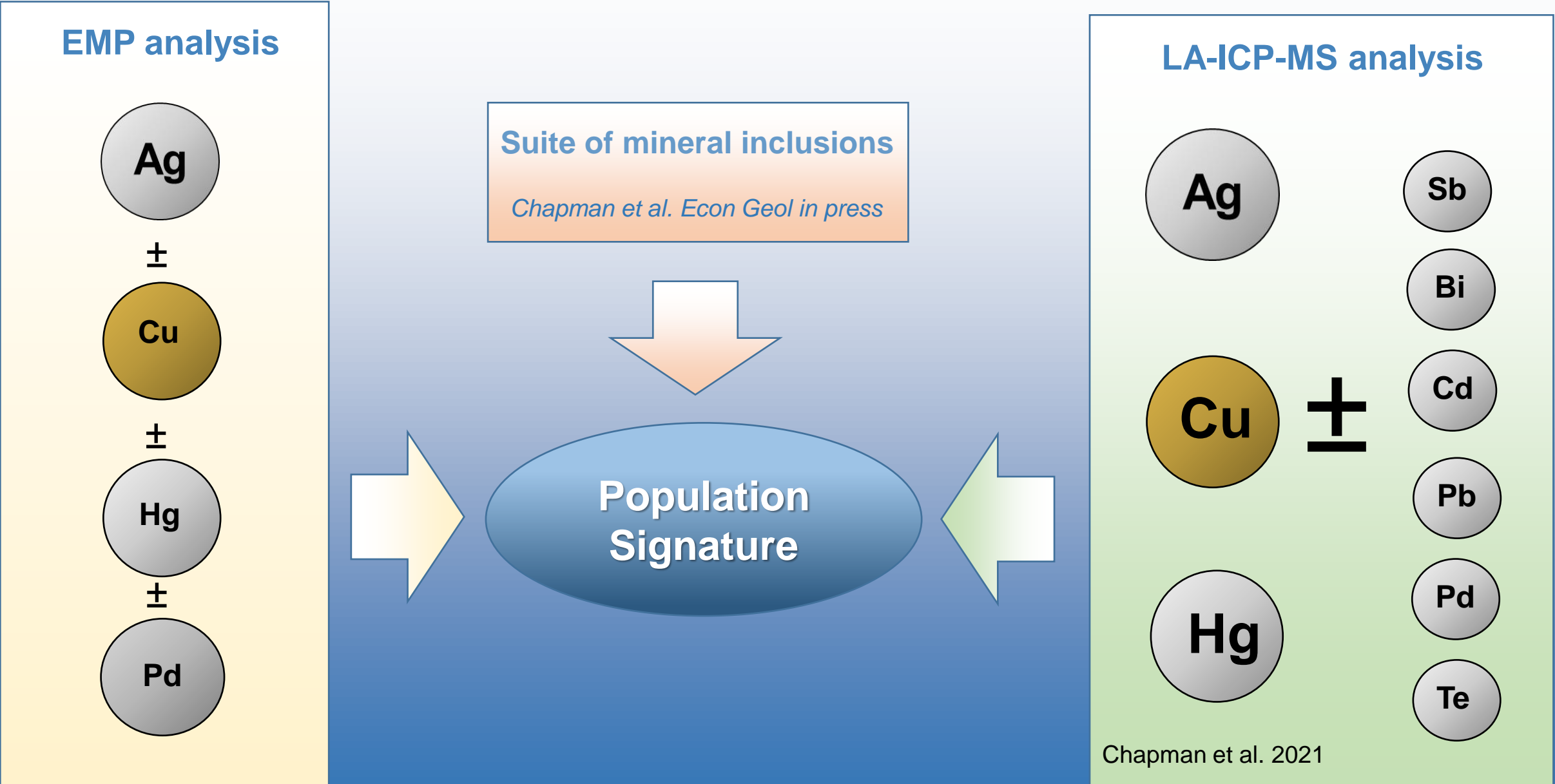
Need to study compositional RANGES in populations of particles from each locality

Project Principles: What's The Problem With Using Fineness As A Discriminant ?



Take away message: Ag isn't much use on its own.....

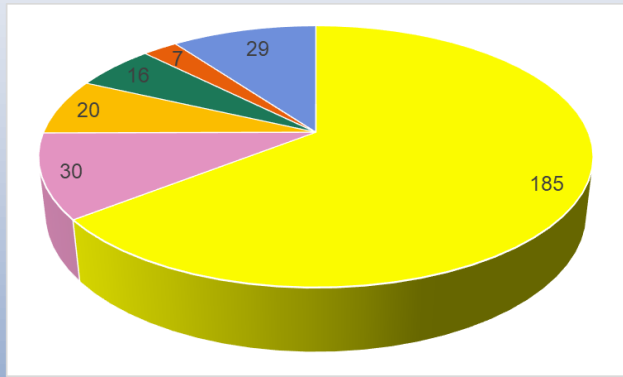
Project Principles: We Characterise Gold From A Locality By Compositional Range



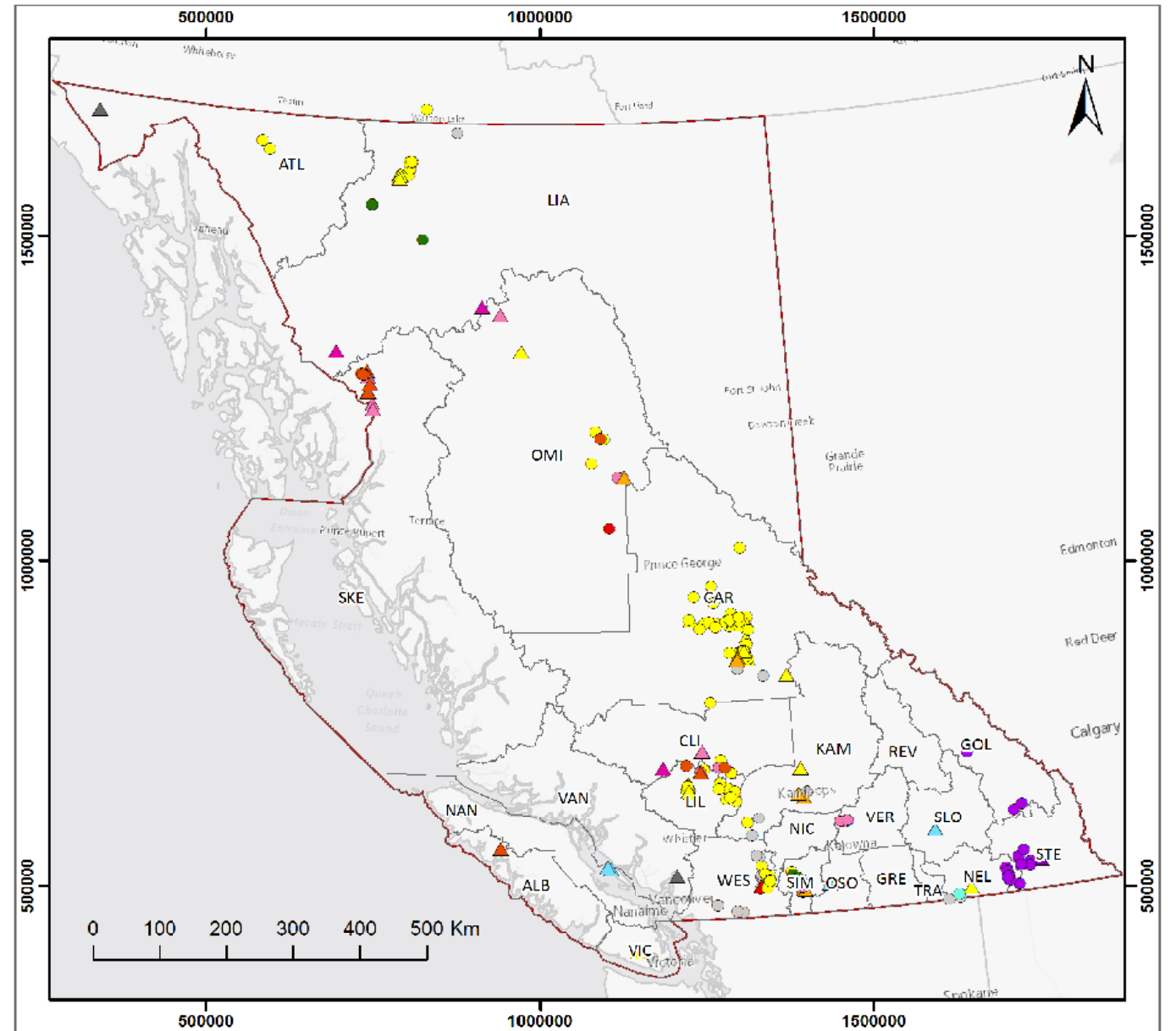
Project Outcomes: Data base

New and existing data from UBC and UoL sample collections

12509 particles
from 353 localities

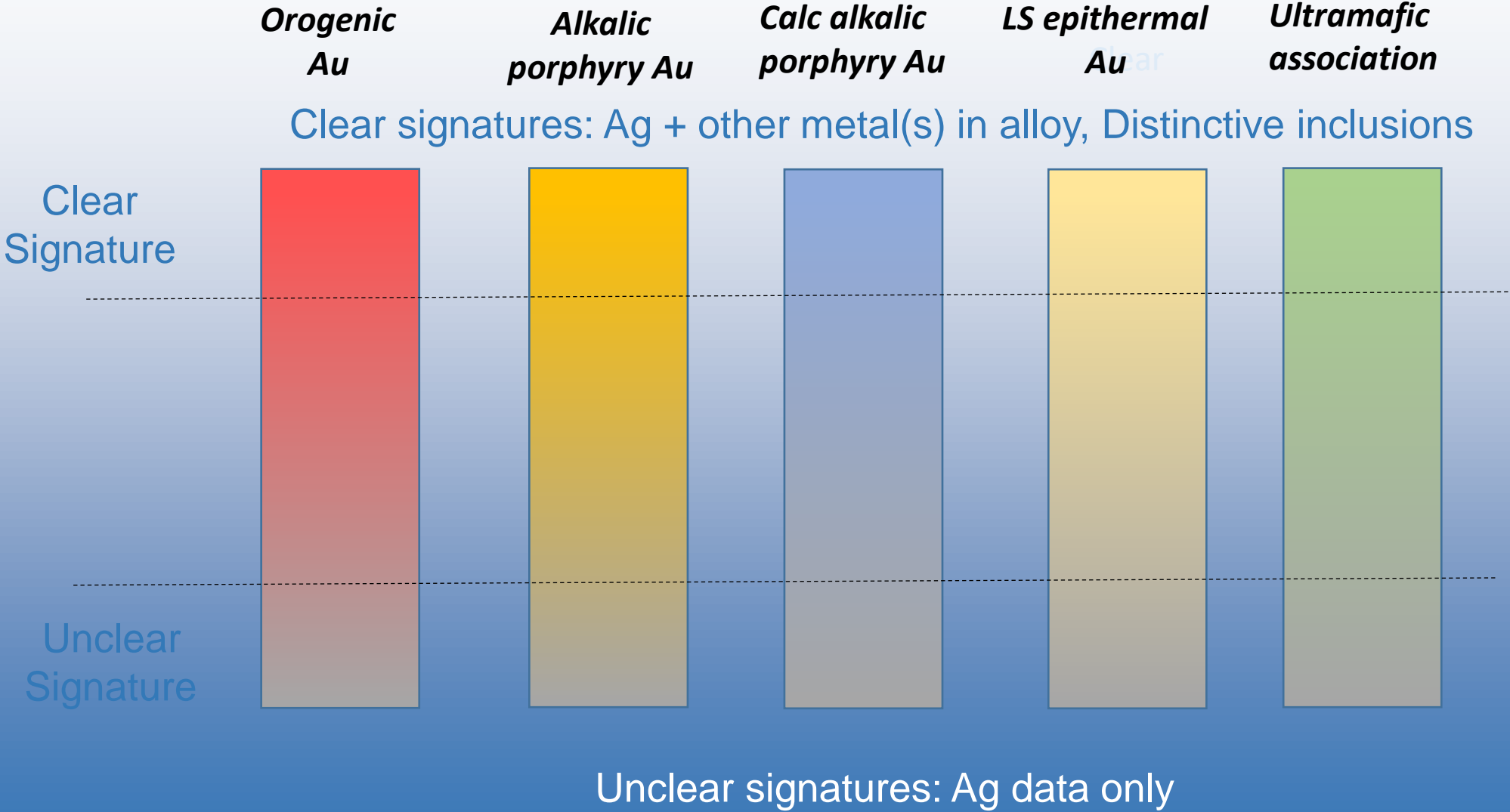


Mineralization style



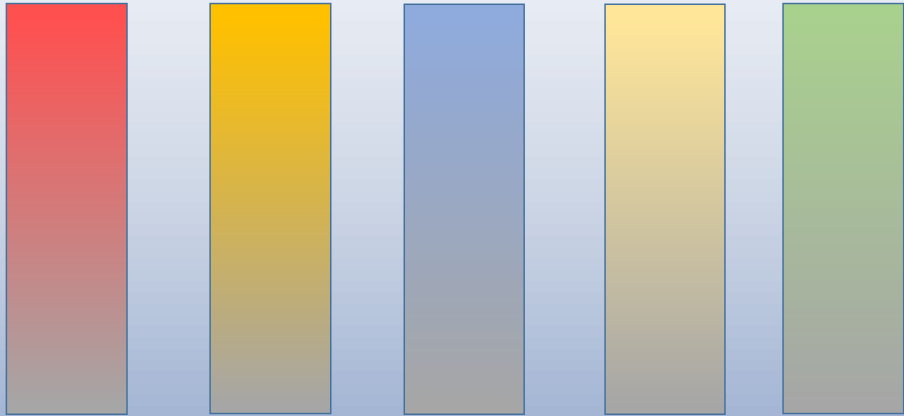
Project outcomes: Do signatures correspond to deposit type ?

YES BUT

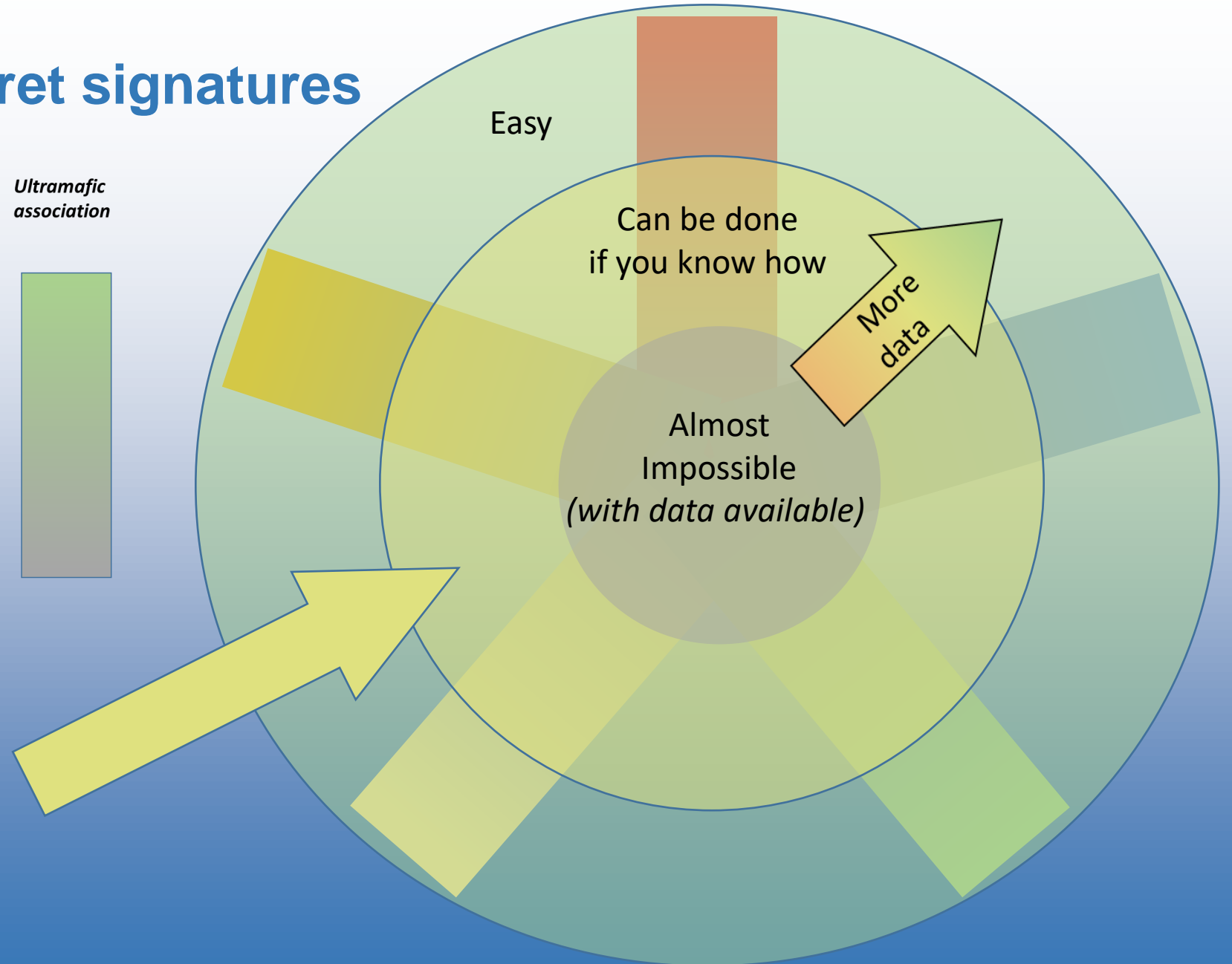


Project outcomes: Helping you to interpret signatures

Orogenic Au *Alkalic porphyry Au* *Calc alkalic porphyry Au* *LS epithermal Au* *Ultramafic association*



Project input:
Helping you address
this area



Project Outcomes:

Create Geochemical Template (or “workflow” or “what do I do if I’m not Rob?”)

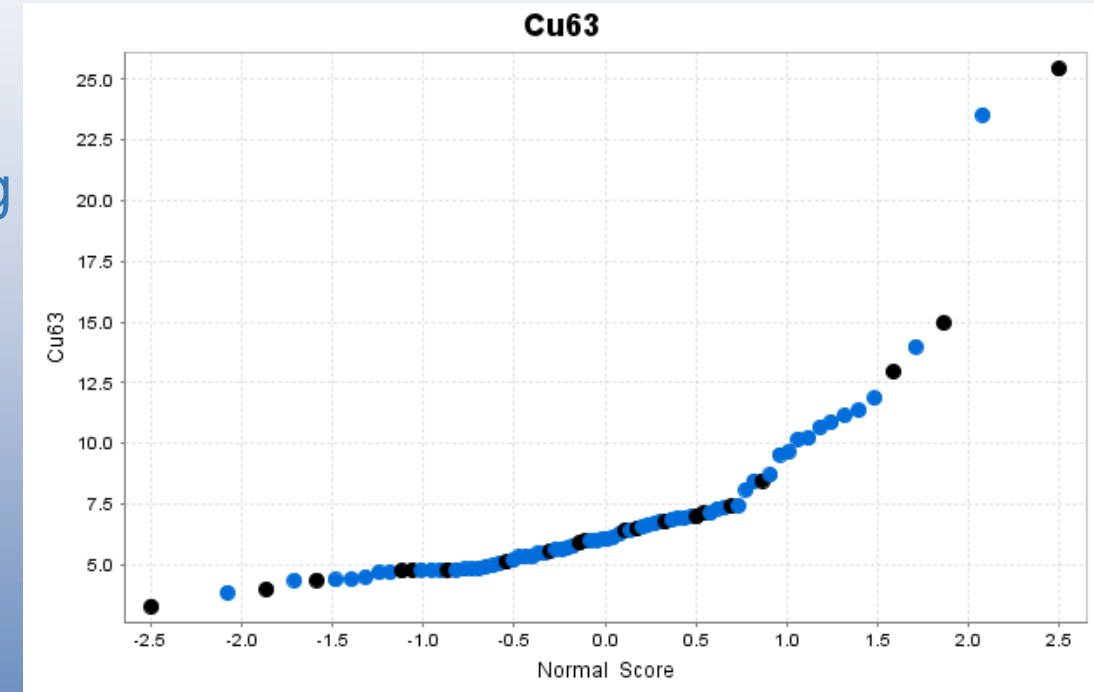


1. Data Pre-Processing

- Cleaning (replace 0's and <'s with + ½ DL)
- Balancing (Synthetic Minority Oversampling Technique*) the deposit classes

2. Linear Discriminant Function

- Classified technique, requires *a priori* knowledge
- Select best subset of elements for discrimination
- Au Cu Hg Pb Pd Sn Co Rh

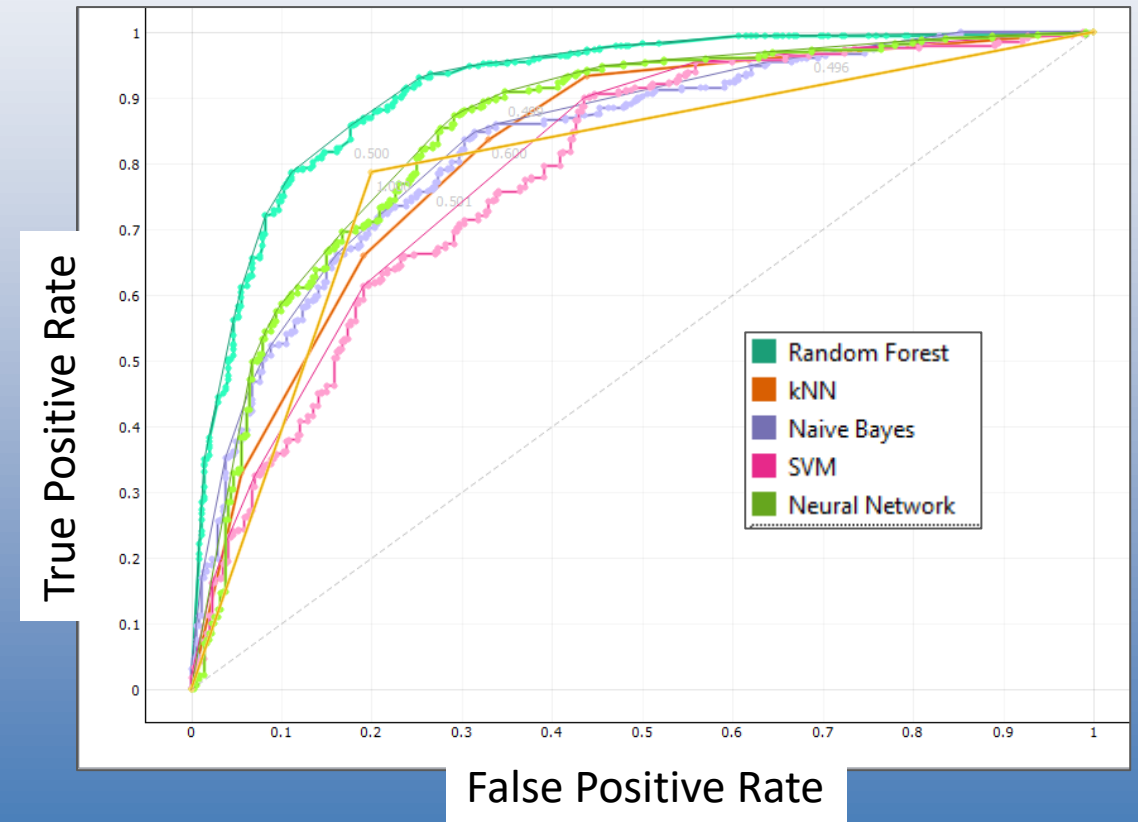


Results of synthetic minority oversampling technique to overcome class imbalance. Blue datapoints are synthetic, and black datapoints are natural. Note that all synthetic datapoints fall within the range dictated by the natural datapoints.

Project Outcomes:

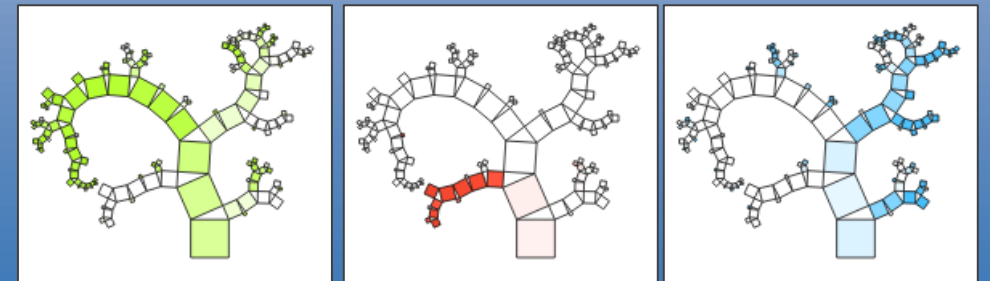
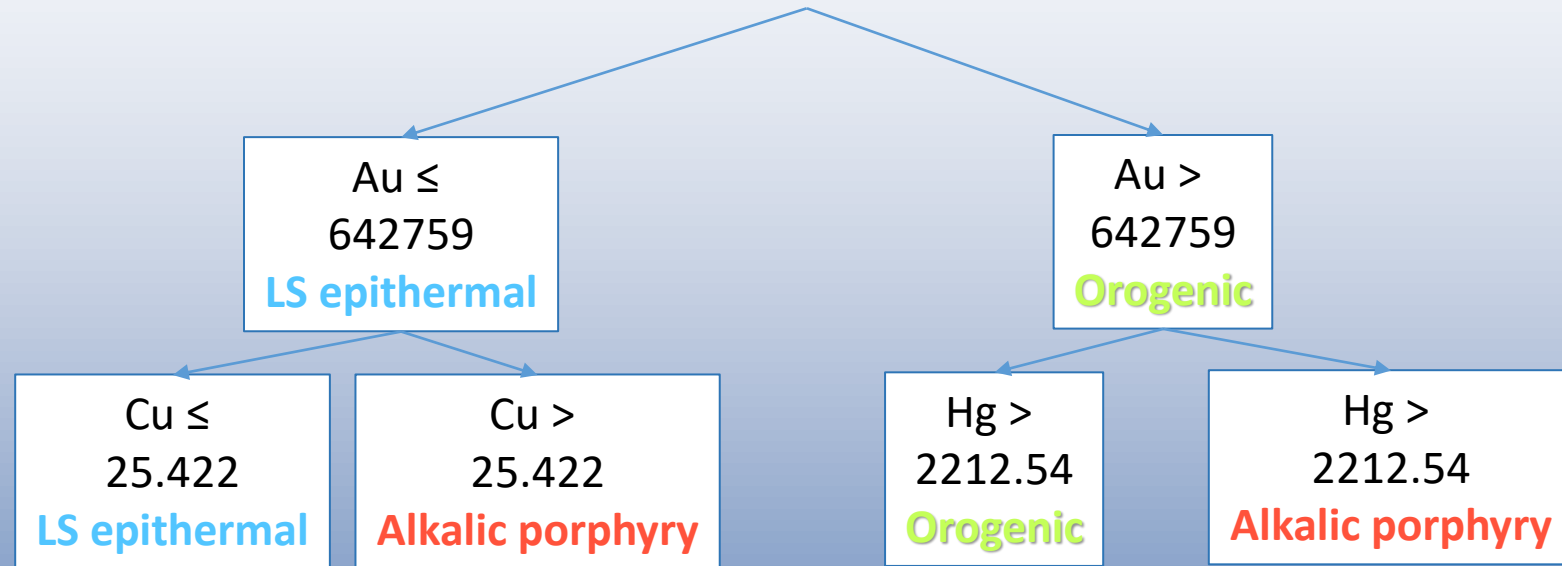
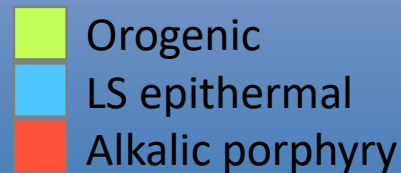
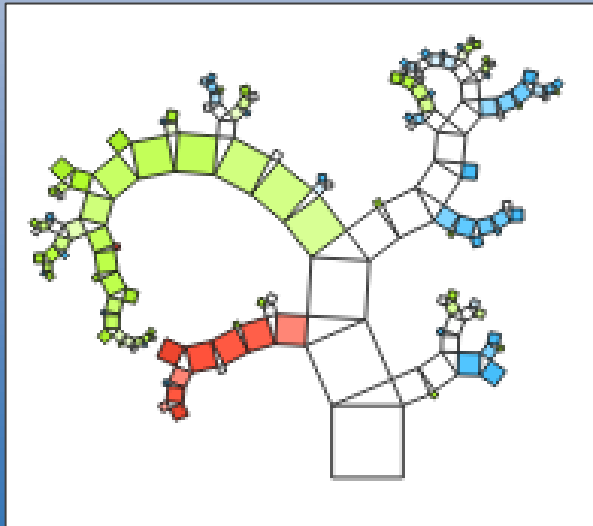
Create Machine Learning Classification Algorithm

1. Train and test several machine learning algorithms
 - kNN (nearest neighbours)
 - SVM (support vector machine)
 - RF (random forest)
 - Neural Network
 - Naïve Bayes
2. Evaluate by Classification Accuracy and ROC Curve Analysis (aka AUROC)
 - ✓ RF has CA of 0.84



Project Outcomes: Machine Learning Classification Model for Future Public Use

1. Visualize results
2. Apply RF classification algorithm to new incoming data



Project Wrap Up

1. Complete LA-ICP-MS analysis
2. Wrap up SEM analysis of some sample suites from UBC (including skarns)
3. Refine compositional templates
4. Publish data base
5. Produce 'user manual'
6. Project launch at Roundup 2022

Thanks for your attention, and questions?

