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Data Integrity and Geological Understanding

Key Requirements for Successful Resource Estimation

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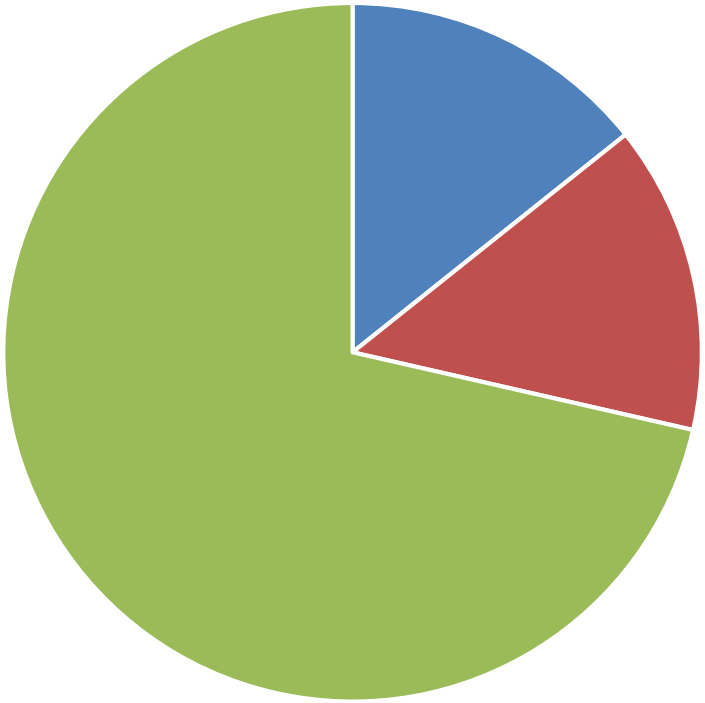
All resource estimates are made up of 3 parts

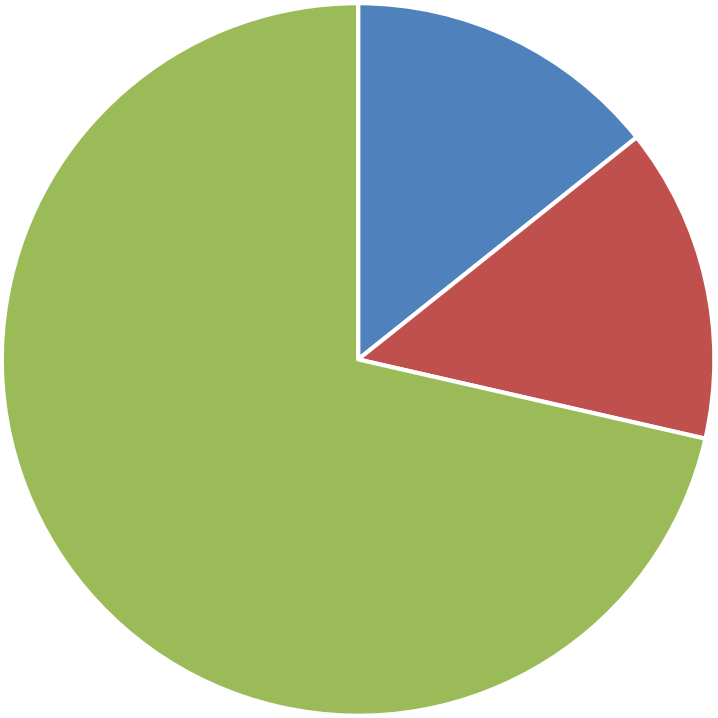
1. Data Review
2. Geological/ Structural interpretation and Modelling
3. Grade/ Density Estimation

Real Life

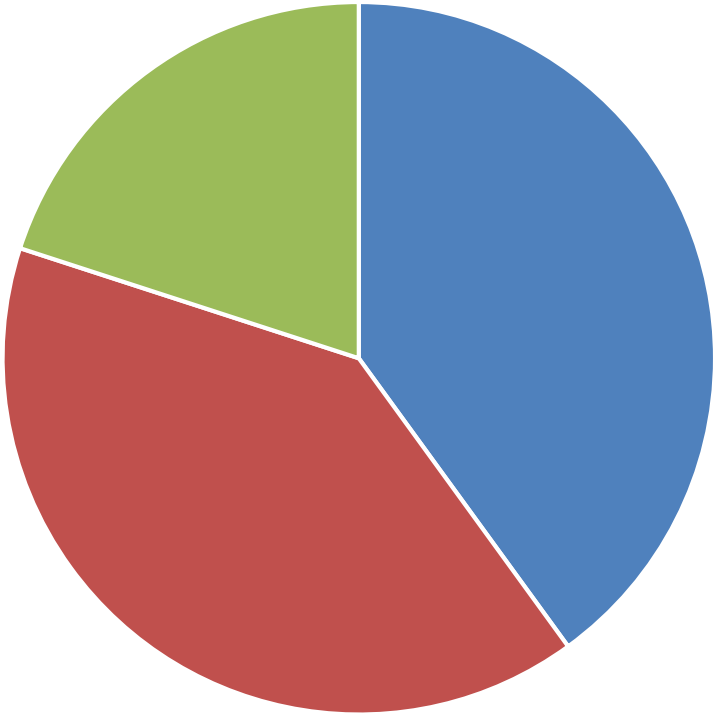


Data Review Geological Interpretation and Modelling Grade/Density Estimation

Real Life



Ideal Example



Data Review Geological Interpretation and Modelling Grade/Density Estimation

Introduction

1. Data Review
2. Geological Interpretation and Modelling

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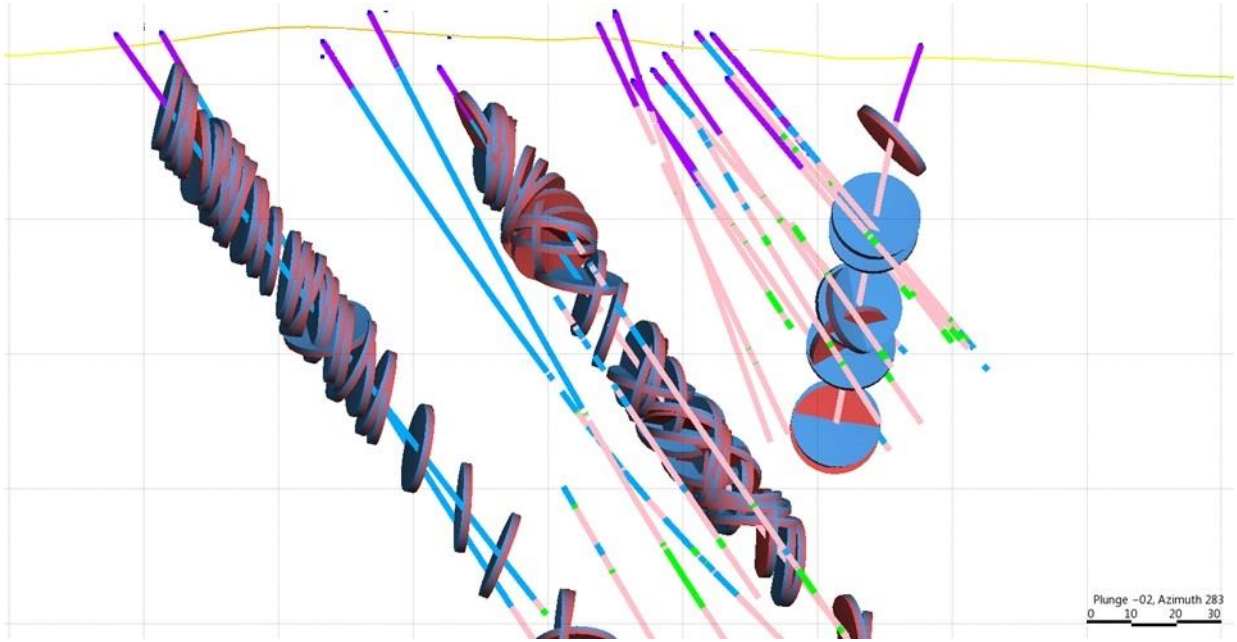
Data
Common Issues

Data

- Collar, DH survey, assay, lithology, density

- Additional
  - Structural data
  - Mineralogical observations
  - Alteration
  - Weathering

All data needs to be located in 3D



Data

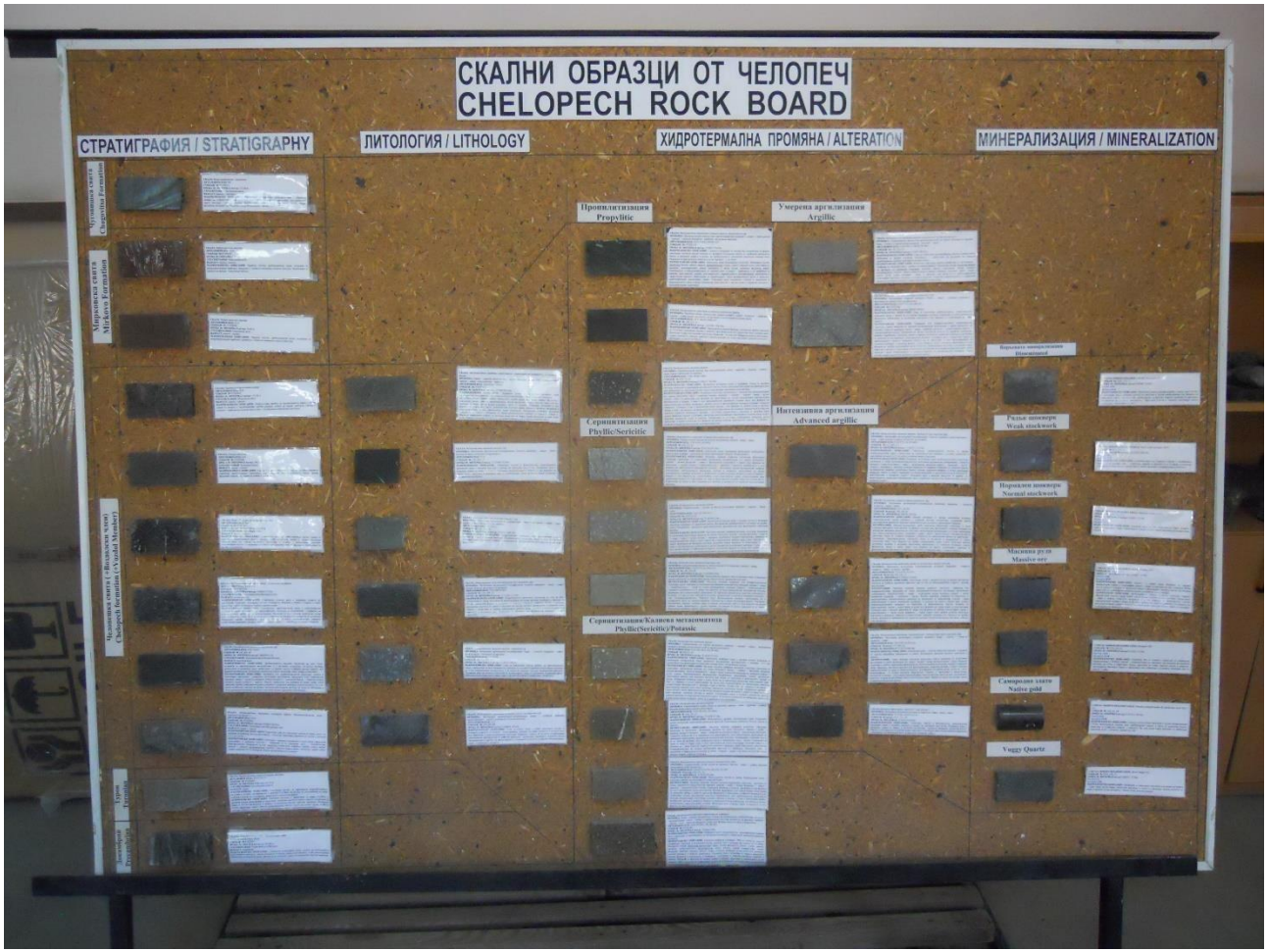
Lithology DATA

- How many phases of logging.
- How many geologists.
- How was it logged qualitative vs quantitative.

- Was logging completed along side interpretive cross sections?

- Is there evidence that alternative models have been tested by drilling?

Lithology DATA



Data

SAMPLE DATA

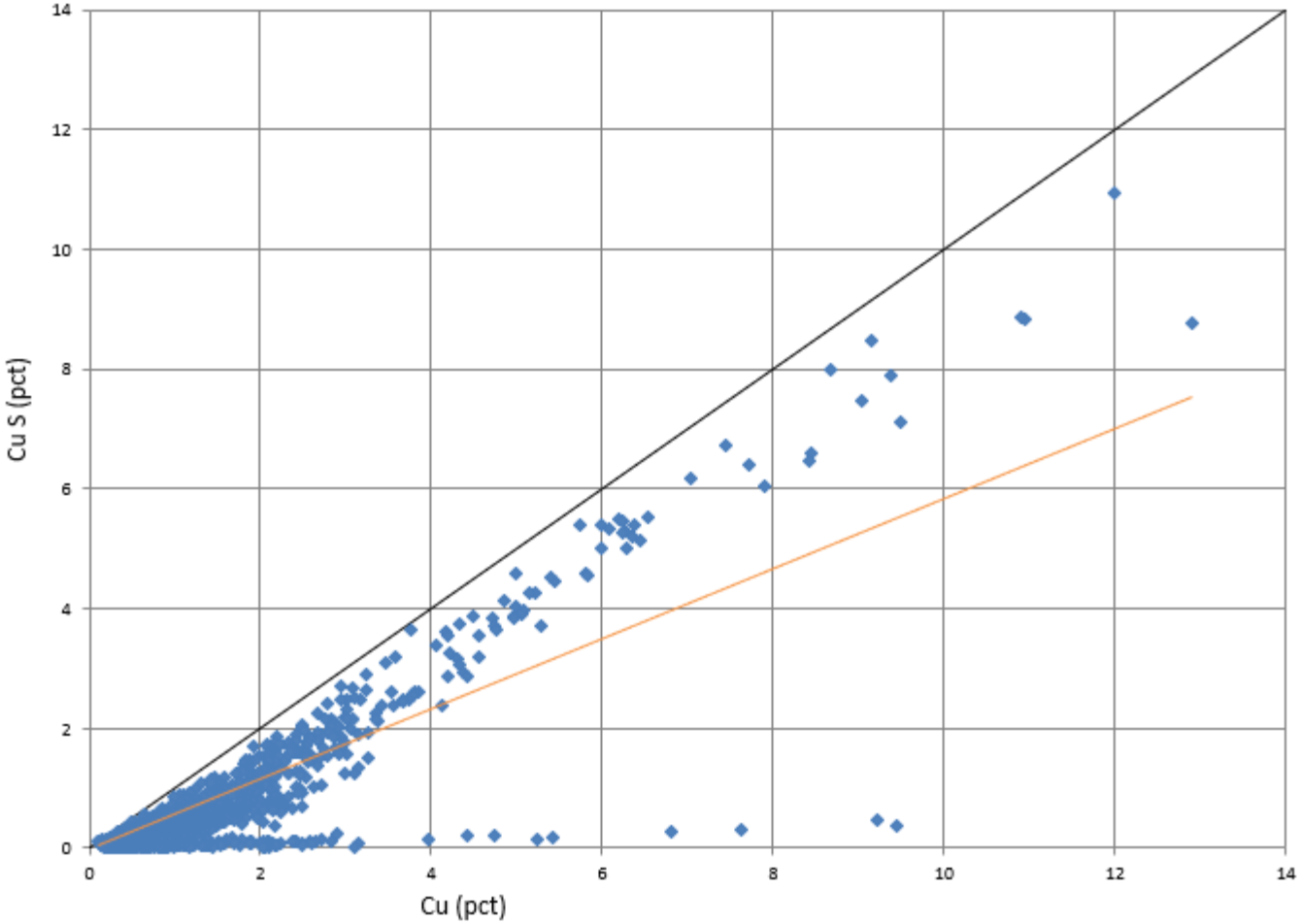
- Selective sampling
- Missing data – is it core loss, unmineralized or and Unknown?
- What is your recovery like?
- Different sample types: RC DD, Trench, Channel
- Different sample size: ¼, ½

Data

ASSAY DATA

- Analysis method – total vs partial
- Are multiple analysis techniques comparable
- Does your analysis technique cover the tenor of mineralisation?

Data



Data

DENSITY DATA

- How was is measured? Is it appropriate for the type of rock? Does it account for voids?

- 3D distribution, have you captured all rock types and mineralisation styles. Weathering – often suffers from sample loss so oxide material may not be well represented.

- Density can be highly variable, so the more sampling the better!

Data

QAQC

- QAQC isn't just for chemical analysis. It should be considered for all data that is captured.

- Examples
- Down hole structural data

- Geophysical techniques

- Density

QAQC Example

Structural Quality from oriented drill core

Core orientation confidence Criteria.

Based upon how many orientation marks line up when core is marked up before structural measurements are taken.

Confidence levels for oriented intervals used to separate good from bad data

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Geology

Common issues

- Inadequate emphasis on structure leading to gross errors in the architecture of the deposit.
- Issues surrounding interpretation of high and low grade material.
- Inadequate emphasis on lithology leading to smearing of grades across lithological boundaries.
- Failure to recognise that different controls may exist for different metals in polymetallic deposits.
- Manipulation of estimation techniques as a substitute for geology (i.e. MIK).

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Au deposit in Central Africa

Geology

Gold Project – Central Africa

Orogenic gold deposit

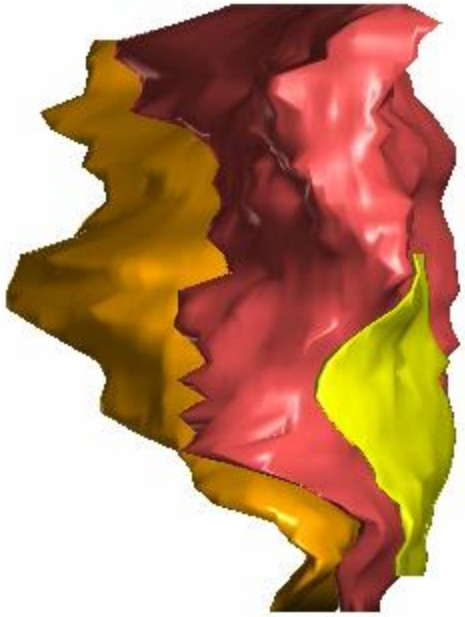
Gold mineralistion hosted in by Fe rich sediments within an extensive stock work

Large open pit Mineral Resource

4.43Moz @0.45 g/t Au COG (151Mt @1.3 g/t Au)

Depressed gold price

Geology



Gold Project – Central Africa

- Reviewed geology
  - Surface mapping
  - Relogged holes distributed through out the deposit – identified marker horizons within the stratigraphy that could be logged across all holes.
- Reviewed structural model
  - 5 cross cutting faults
  - Axial planar fault
  - Offsetting later faults to the north east
  - Some faults mineralised, some barren
- Generated mineralised domains for stratigraphic mineralisation for 3 domains. Generated domains for fault hosted mineralisation.

Increased complexity, higher modelling COG.

Geology

Geology

Old resource (2012)

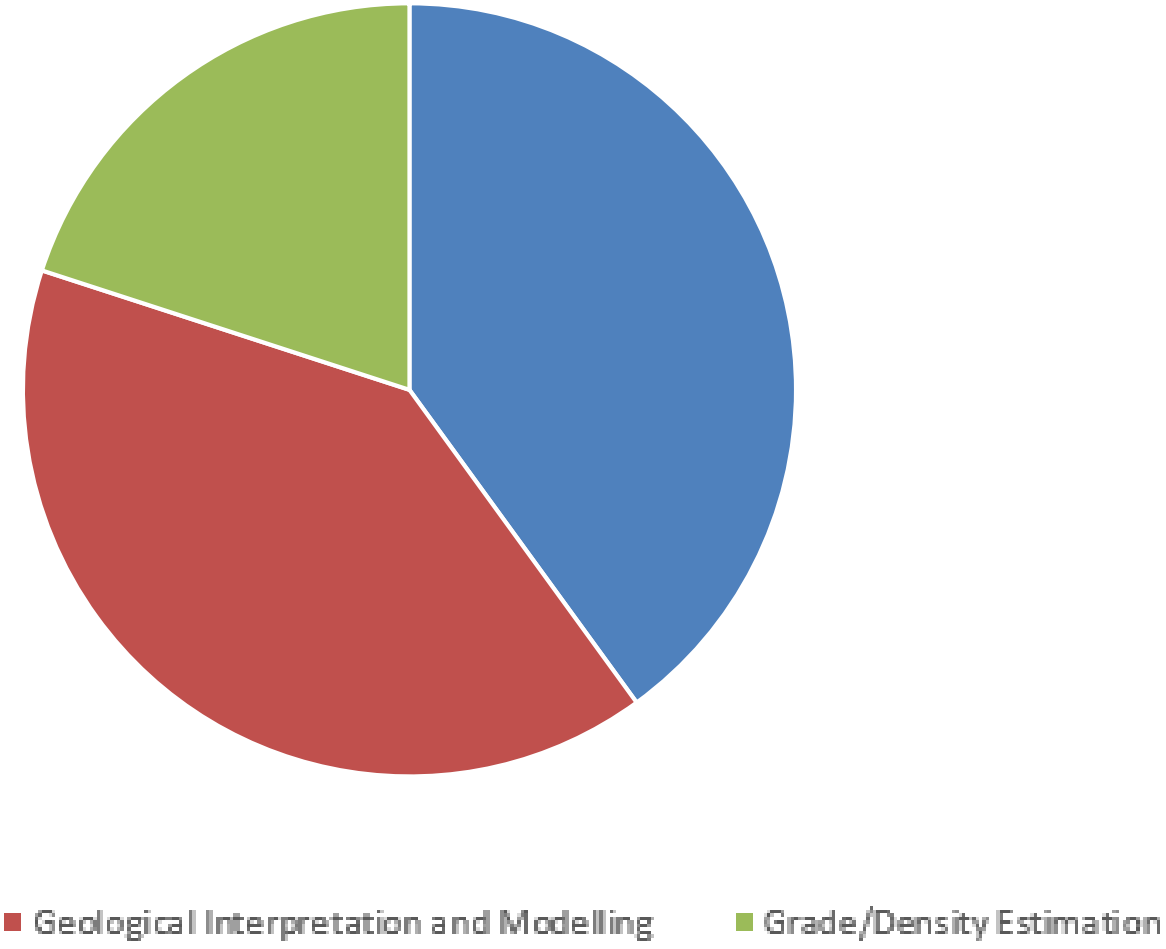
4.43Moz @0.45 g/t Au COG (151Mt @1.3 g/t Au) (indicated and Inferred)

New Resource (2016)

2.78Moz @1.5g/t Au COG (21.25Mt @4.1g/t Au – Measured, Indicated and Inferred)

So what was a large low grade resource model, amenable to open pit extraction became a higher grade resource model where its thickness and grade allowed for the consideration of both open pit, underground and a combination of both mining scenarios

Geology


Data Review
Geological Interpretation and Modelling
Grade/Density Estimation

Conclusion

Key Takeaways

- Data and geology are the key foundations of a Resource Estimate, if they are poorly understood then that uncertainty will pass on to the Resource Model and will be reflected in its Classification.
- In my experience it really can make or break a project.
- Geology is king.
- You cant escape from “bad” data!