Sizing up the Footprint: Concepts in Regional Scale Undercover Geochemistry.

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Opportunities

• Discover the next round of mineral deposits:
  • Lacking outcropping mineralisation,
  • Lacking significant outcropping alteration,
  • Extremely weathered,
  • Extremely leached,
  • Buried under younger formations,
  • Buried under transported overburden,

• Combinations of the above.
Spence Cu-Porphyry, Chile
Cu, Aqua-regia ICP-MS
Cameron et al 2006
Ore Footprints.

• Majority of commercial selective geochemical techniques are for target discrimination
  • Enzyme leach
  • Ionic Leach
  • BioLeach\(^{(BB)}\)
  • Regoleach\(^{(BB)}\)
  • MMI\(^{(BB)}\)
  • SGH\(^{(BB)}\)
  • Distilled water
  • Weak aqua-regia
  • Hyroxylamine

\( (BB) = \text{Black Box} \)
Cu ppm – aqua-regia ICP-MS
The “other” 100m
“By using the raw data and selecting seven unknown compounds (out of 162) that showed anomalous responses anywhere towards the centre of the traverse, we created an index (the 7 compounds were multiplied together). The result of this index is quite similar to the Actlabs reported results. Thus we were able to simulate the Actlabs report without knowledge of the reported organic compounds. A successful result was generated just by guessing roughly where the mineralisation occurs – typically towards the middle of an orientation traverse.”

Challenges

- None-robust signals
- Poor reproducibility
- Poor signal : noise distinction
- High Sampling Density
Challenges

- None-robust signals
- Poor reproducibility
- Poor signal : noise distinction
- High Sampling Density
- Poor knowledge of processes
- Poor knowledge of response residency
- Poor understanding of chemistry
  - Soil Chemistry
  - Leach chemistry
Regional Scale

• Required sampling density to high for regional scale exploration.

• Methods not sufficiently robust enough.
  • False positives
  • False negatives

• Environmental and background variability – much more unforgiving.
  • Regolith,
  • Topography
  • Geology
Residual terrains
Organics/inorganics/electrical/biological/isotopes
Porphyry alteration

BAJO DE LA ALUMBRERA (1975, pre-mine)

Qz-ser

Propylitic

Bi-ksp

Bi-ksp + Cu

[3km]

Ver Ulrich and Heinrich, 2002)
IOCG alteration model

Emmie Bluff 3D Model

Alteration Voxet

10x vertical exaggeration

500 m x 500 m x 10 m cell size
Kimberlite

Anomalous Hamilton, 2006

Highly Anomalous

SDP “sum”

Background

Anomalous

Highly Anomalous
Spontaneous Potential

Lithology

- Pegmatite
- Gneiss
- Tertiary cover
- Probable boundaries of pegmatitic gneiss
Lithological Changes undercover

- Geological boundaries produce redox boundaries
- Reflected at the surface:
  - Spontaneous Potential
  - Eh, Ph
  - Inorganic
  - Organic
  - Bacteria
  - Isotopic
- Thickness of overburden?
The challenge

• Can we map the alteration through cover.

• Back to basics

• Identify and characterise the processes
  • Generation
  • Preservation

• Develop environment specific techniques and practises specifically for the responses.
Thank You