When weaker is better than stronger:
Using ionic leach geochemistry in exploration

SRK Exploration Services

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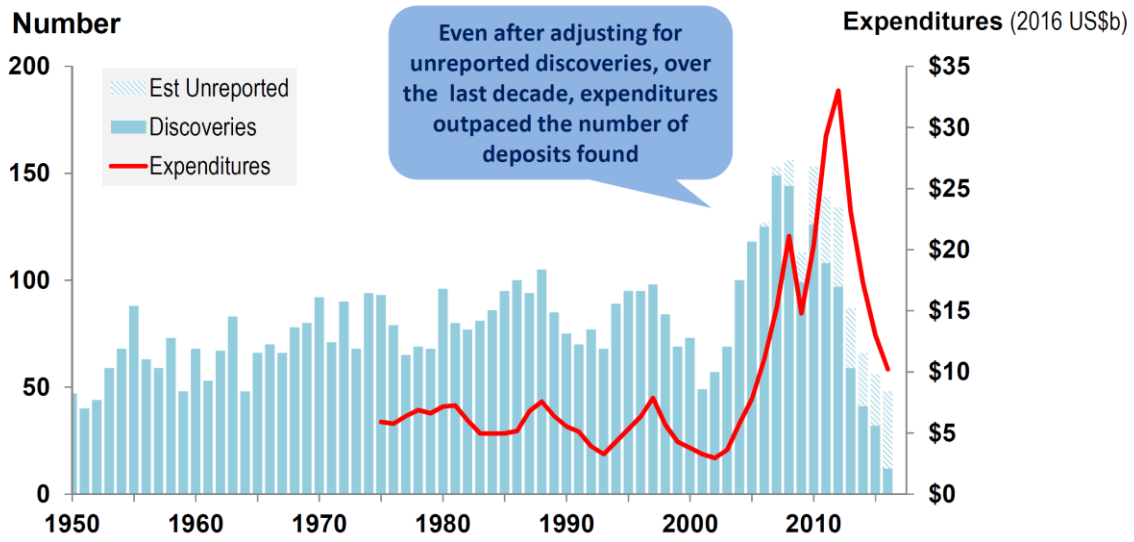
Location: MINEX Moscow, Russia

Laszlo Kupi, 2017

srk exploration

Number of discoveries versus expenditures

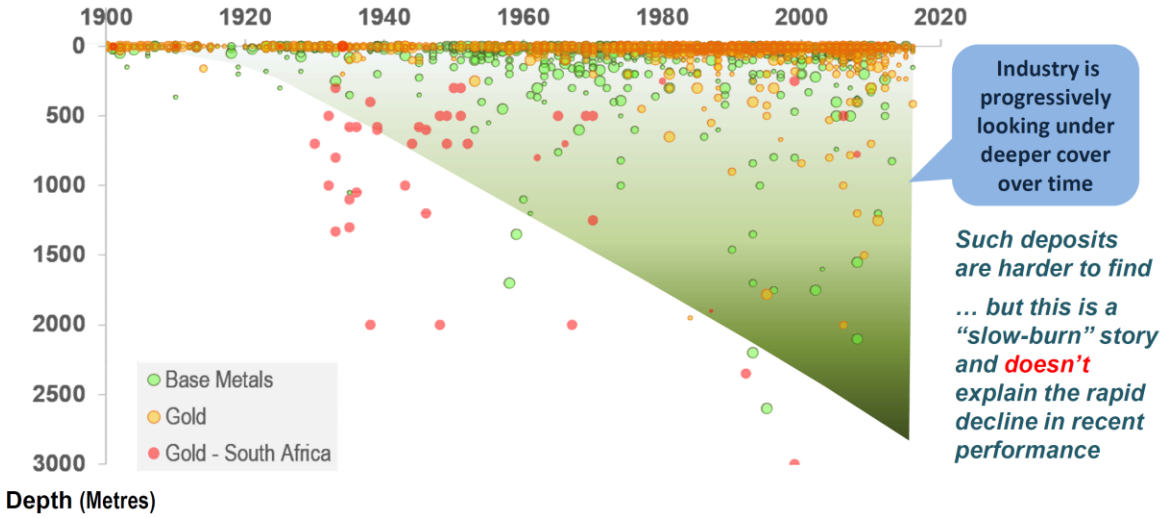
Mineral discoveries in the World : All Commodities : 1950-2016



Discoveries based on deposits >="Moderate" in size
i.e. >100koz Au, >10kt Ni, >100Kt Cu, 250kt Zn+Pb, >5kt U_3O_8 , > 10Mt Fe, >20Mt Thermal Coal

Depth of cover versus discovery year:

Gold and Base Metal discoveries in the World : 1900-2016



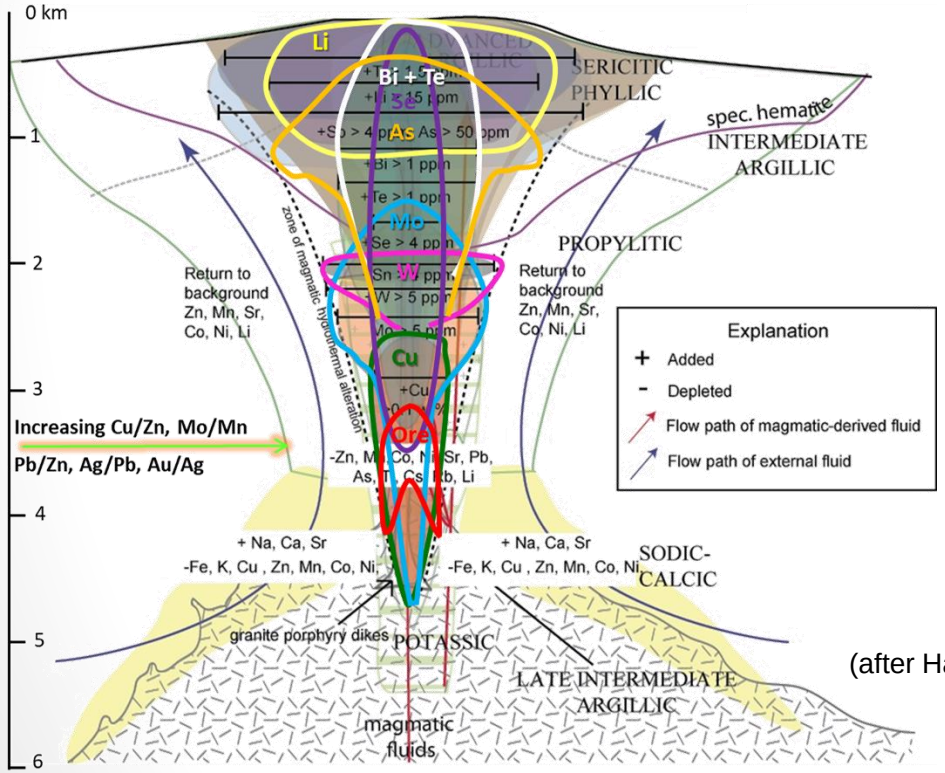
Schodde, R. (2017) Recent Trends and Outlook for Global Exploration, PDAC, 6 March 2017. http://www.minexconsulting.com/publications/

An orebody with its top located 500 to 1,000 m below surface is unlikely to exhibit an obvious sign on the surface saying "drill here"; however, it may display subtle surface and near-surface indications of ore potential if one has the *skill and good fortune to recognize these* (Wood, 2010).

Soil Sampling

Geochemical Metal Zonation

- Proximal to distal zonation pattern Cu-Mo-W-Sn-Se-Te-Bi-So-As-Li-Tl
- Increasing Cu/Zn, Mo/Mn, Pb/Zn, Ag/Pb, Au/Ag ratios with proximity to porphyry centre

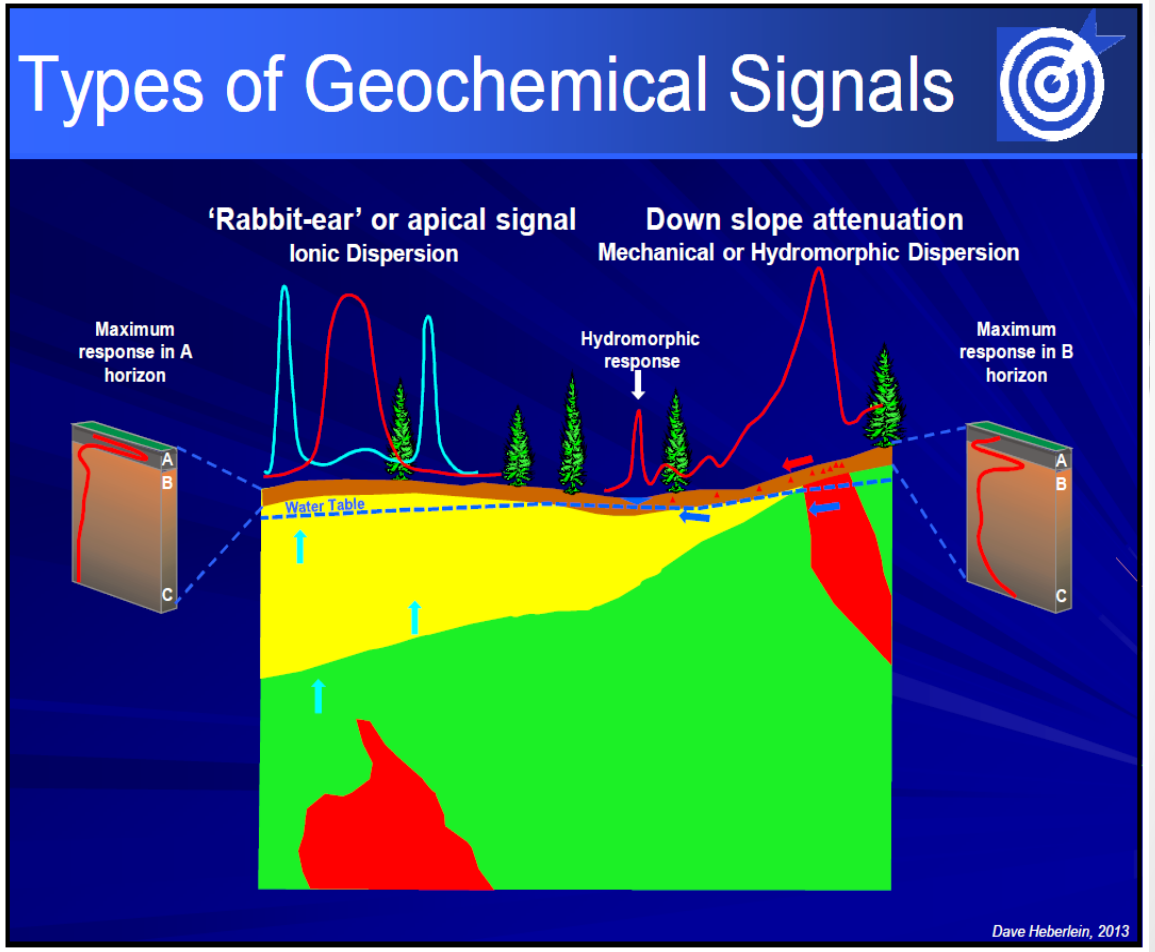


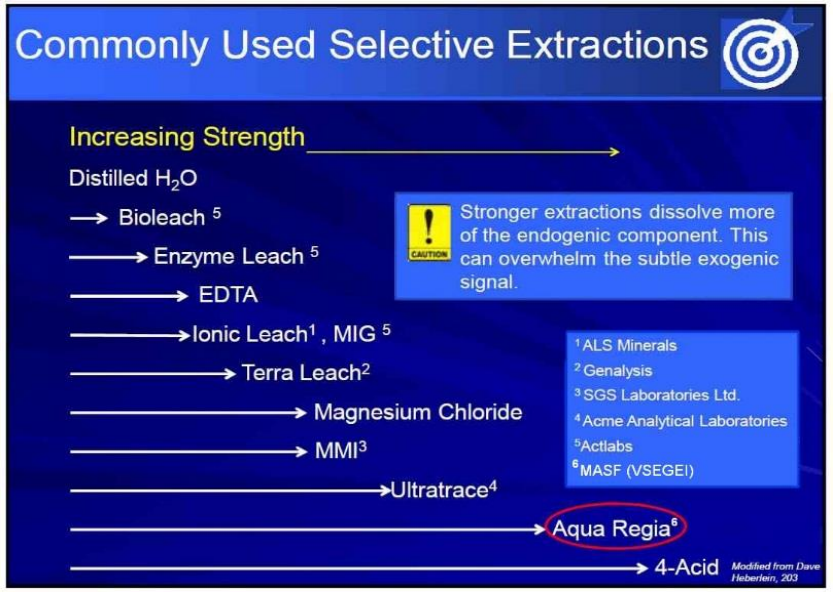
(after Halley et al., 2015)

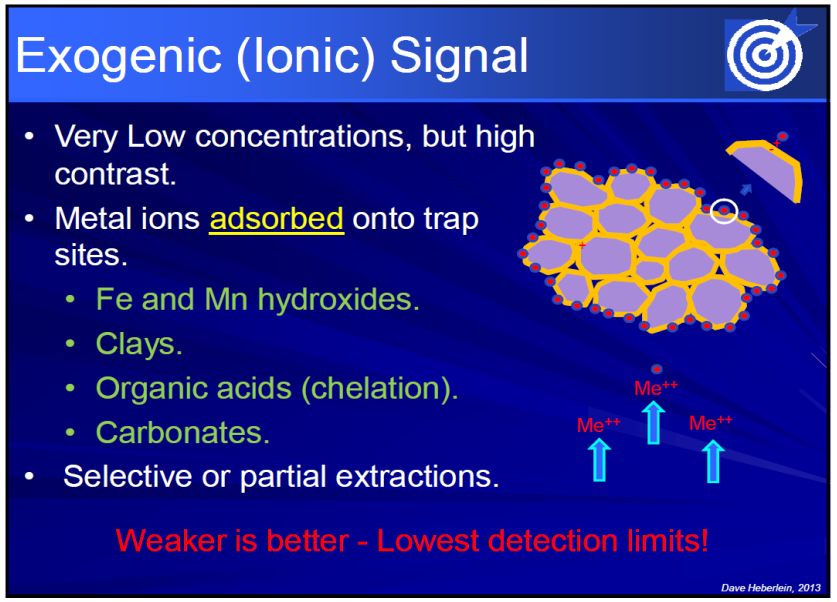
Soil and Rock Sampling

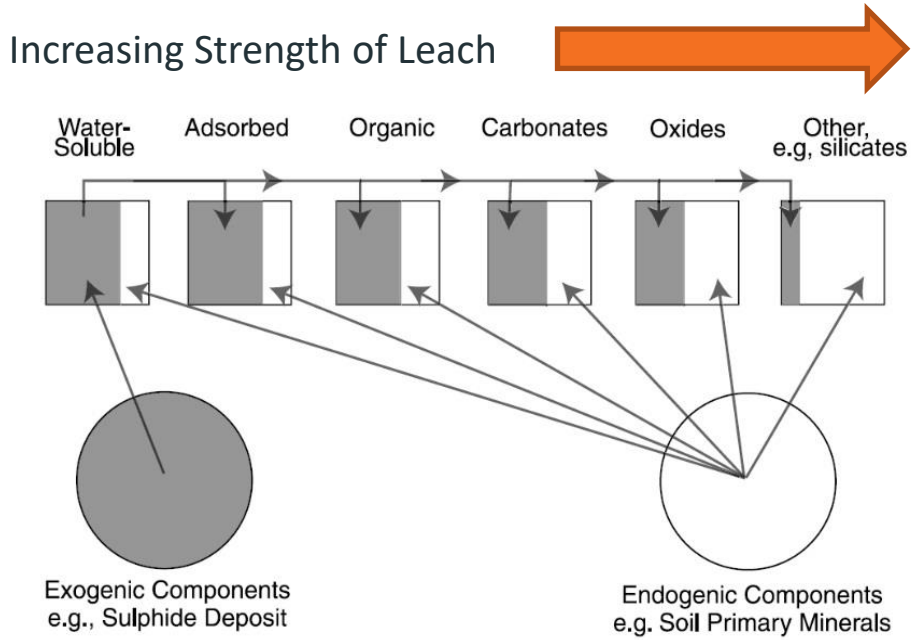
Alteration Mapping - Spectroscopy

- Spectral reflectance (wavelength) variation of micas









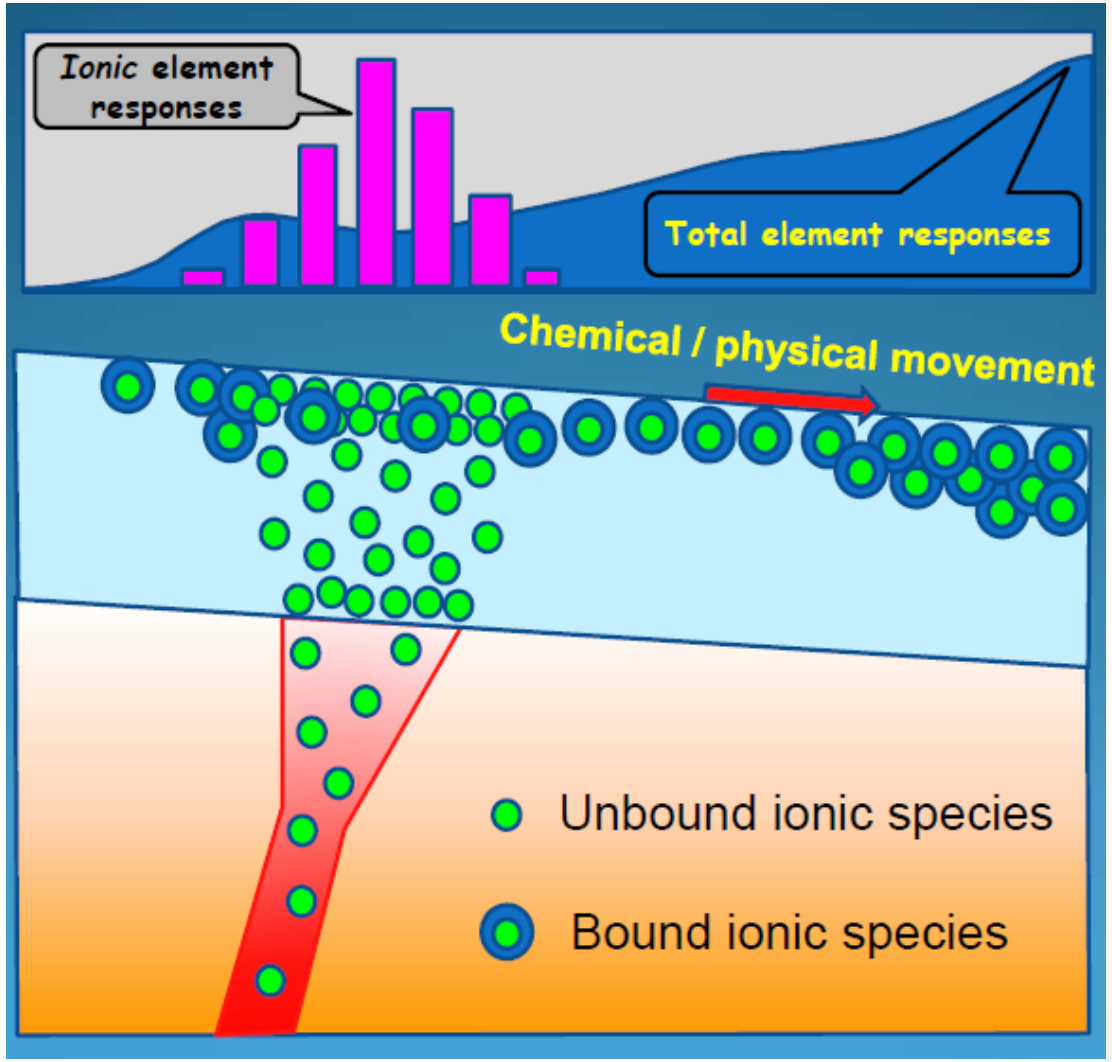
Aqua Regia versus selective leaches:

- Weak Leaches would possibly better in younger deposits (<1 Ma.);
- Strong partial Leaches more effective in older environment (>1 Ma.).

Source: Cameron et al., 2004, Hoffman, 2013, Heberlein, 2013

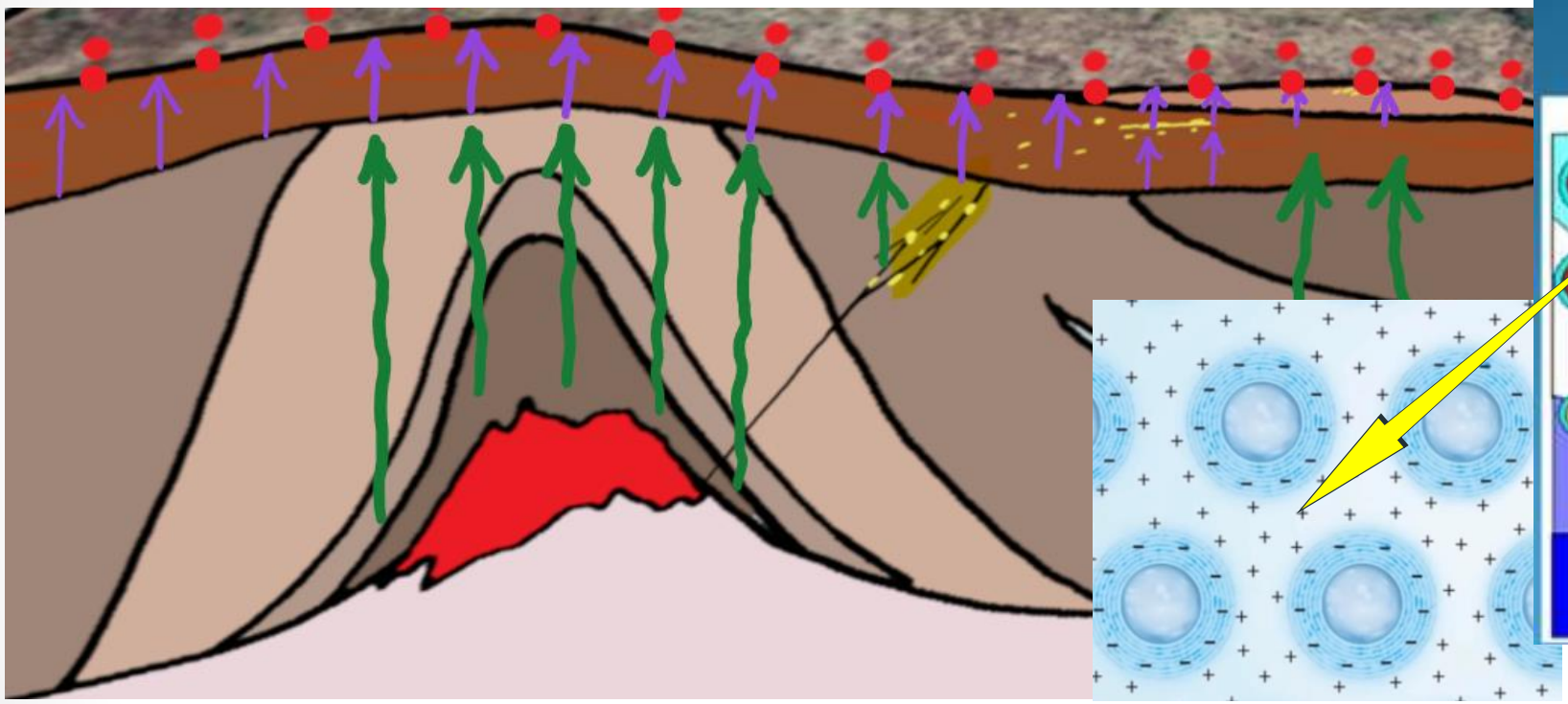
- Ionic analysis measures precursor ion species, it does not assay elements that have combined into surface products
- The procedure selectively dissolves metal ions that have been leached from the primary source, migrated, and then concentrated near the surface
- 61 element package plus isotopes, detection below crustal abundance natural background not detection limit – excellent signal to noise ratio

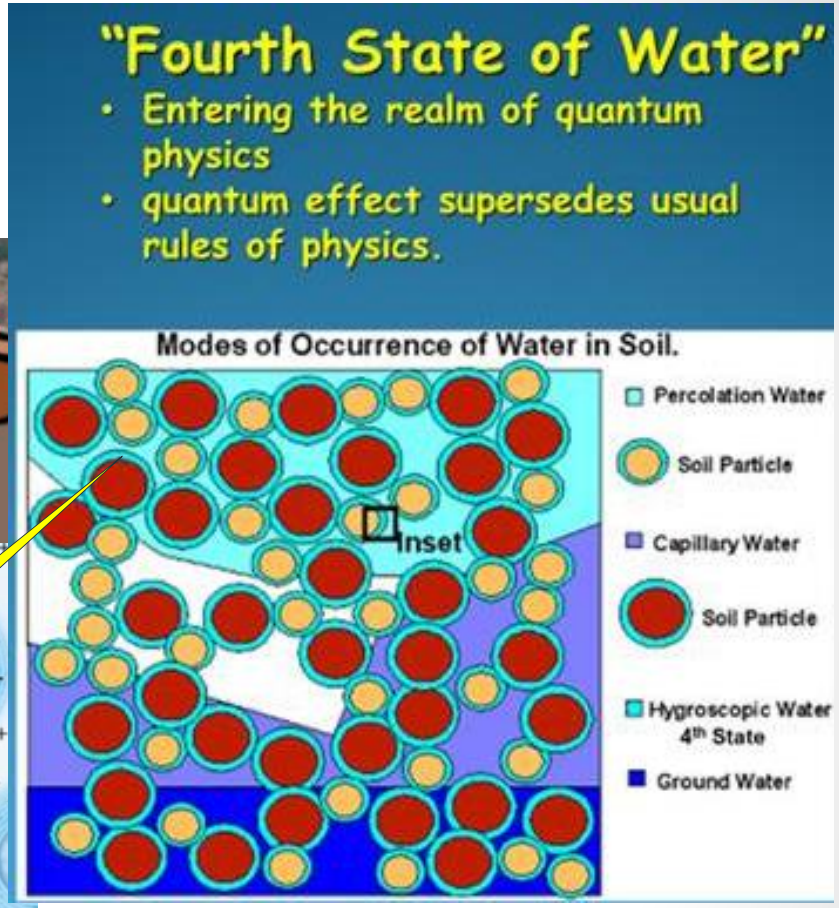
Ionic Analysis – only measures 'free ions', identifies the source.



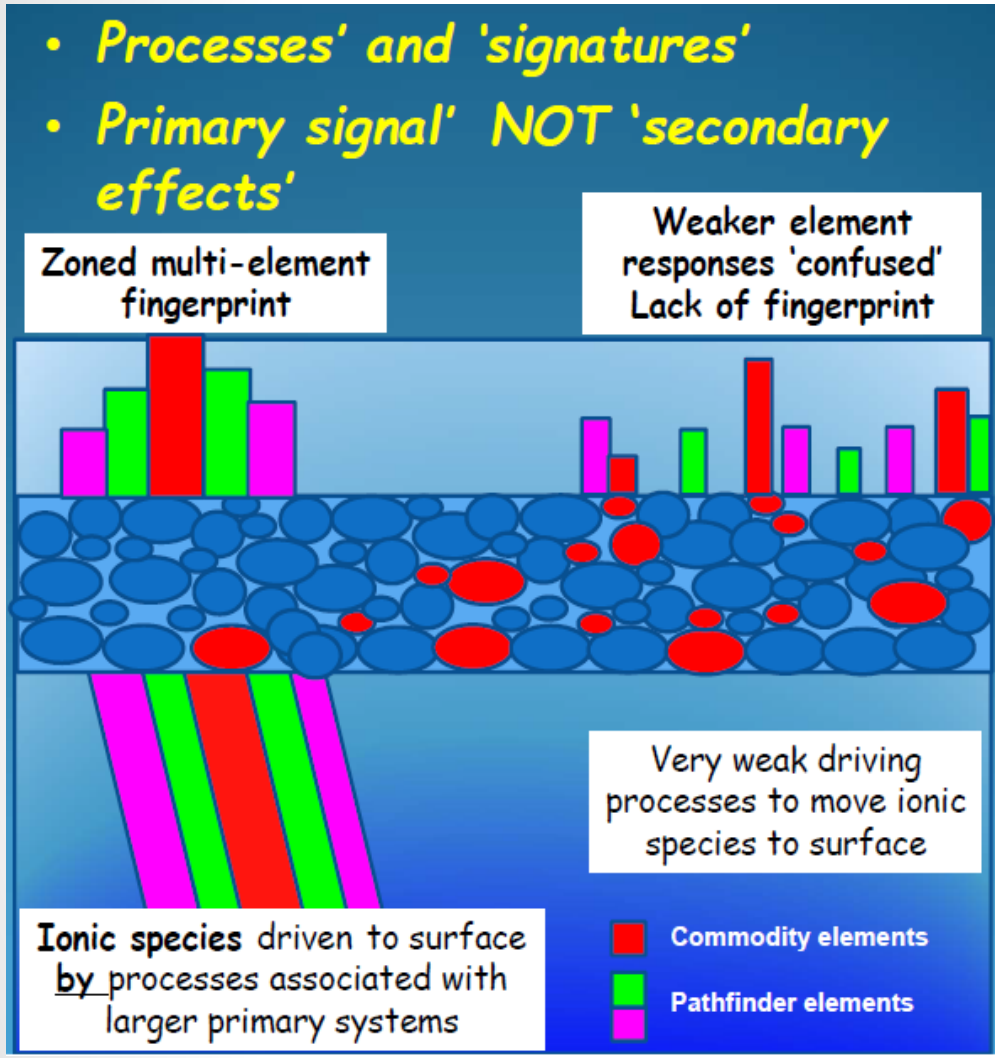
Ion Transport

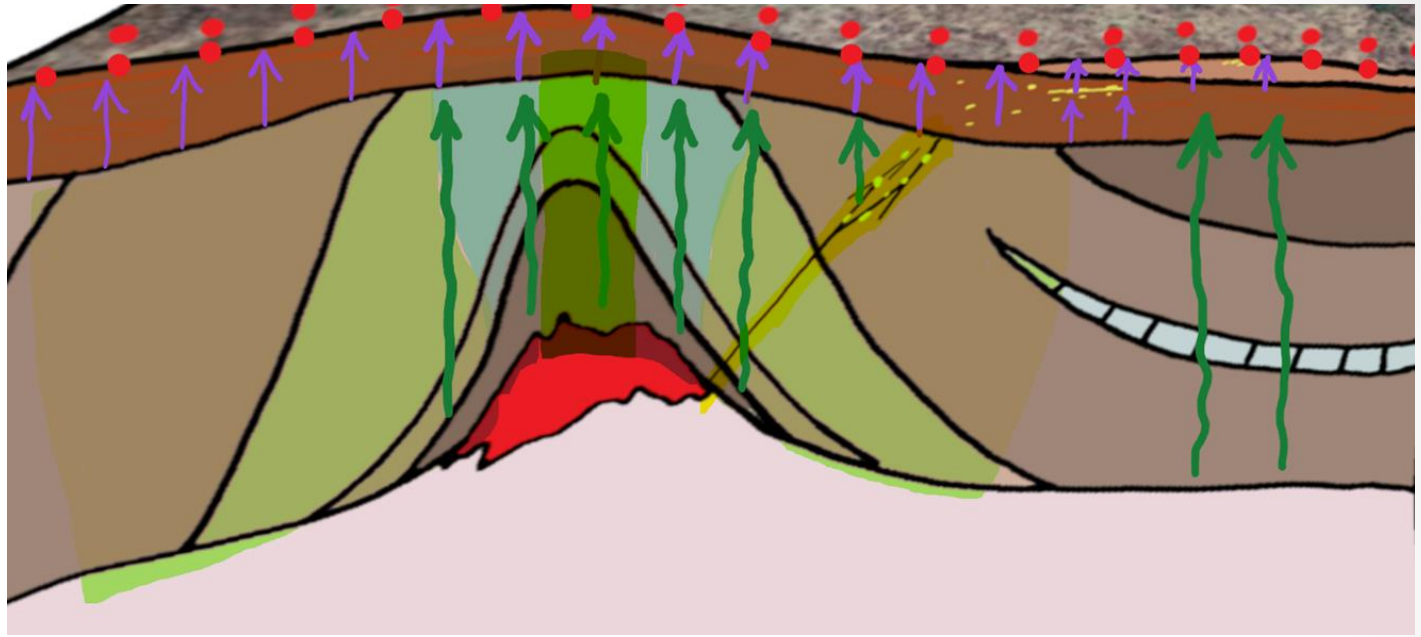
Generation of temperature gradient – convection, capillary action and ion transfer - 4th state of water.





Surface anomalies have been recorded through 500m of overlying rocks

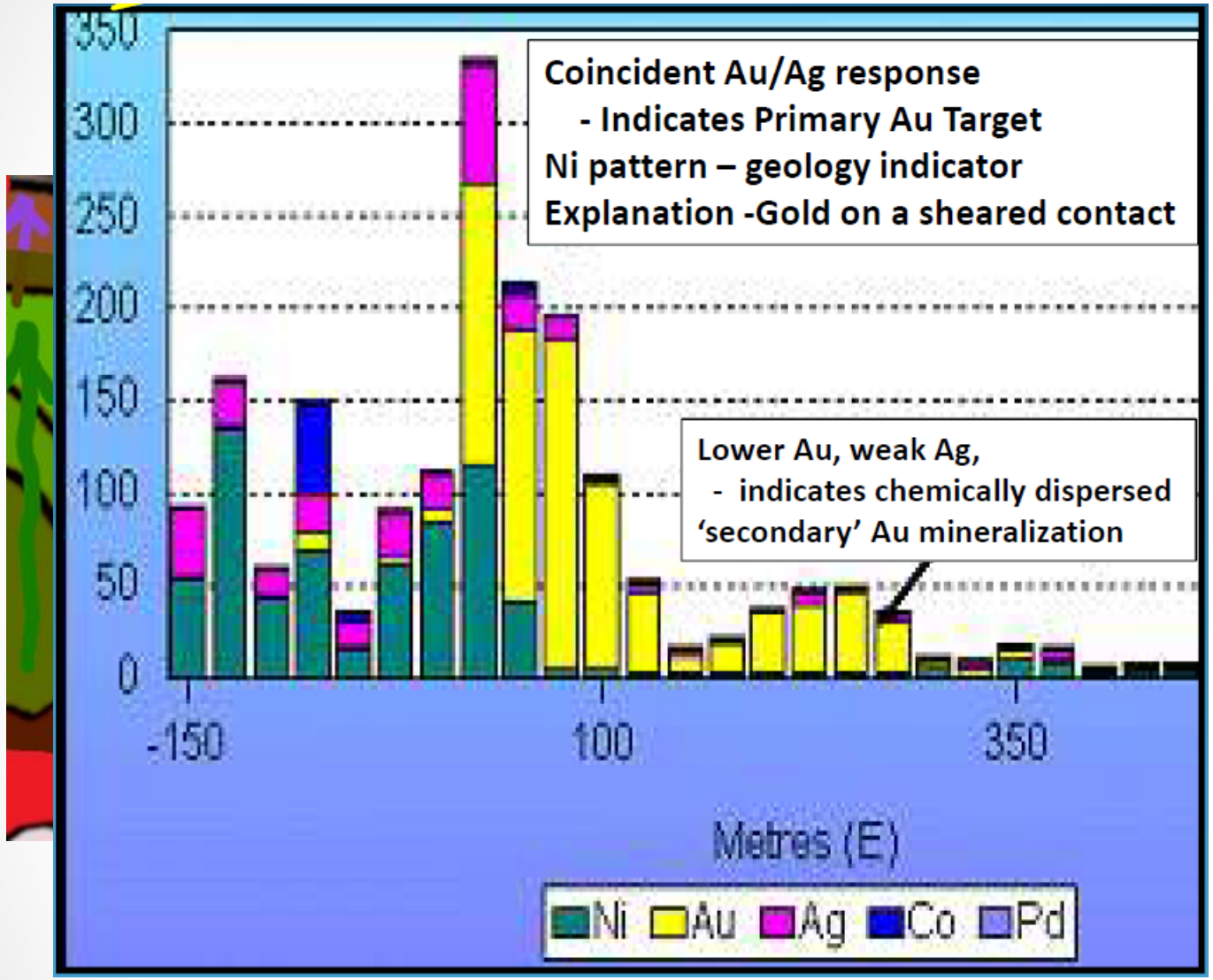


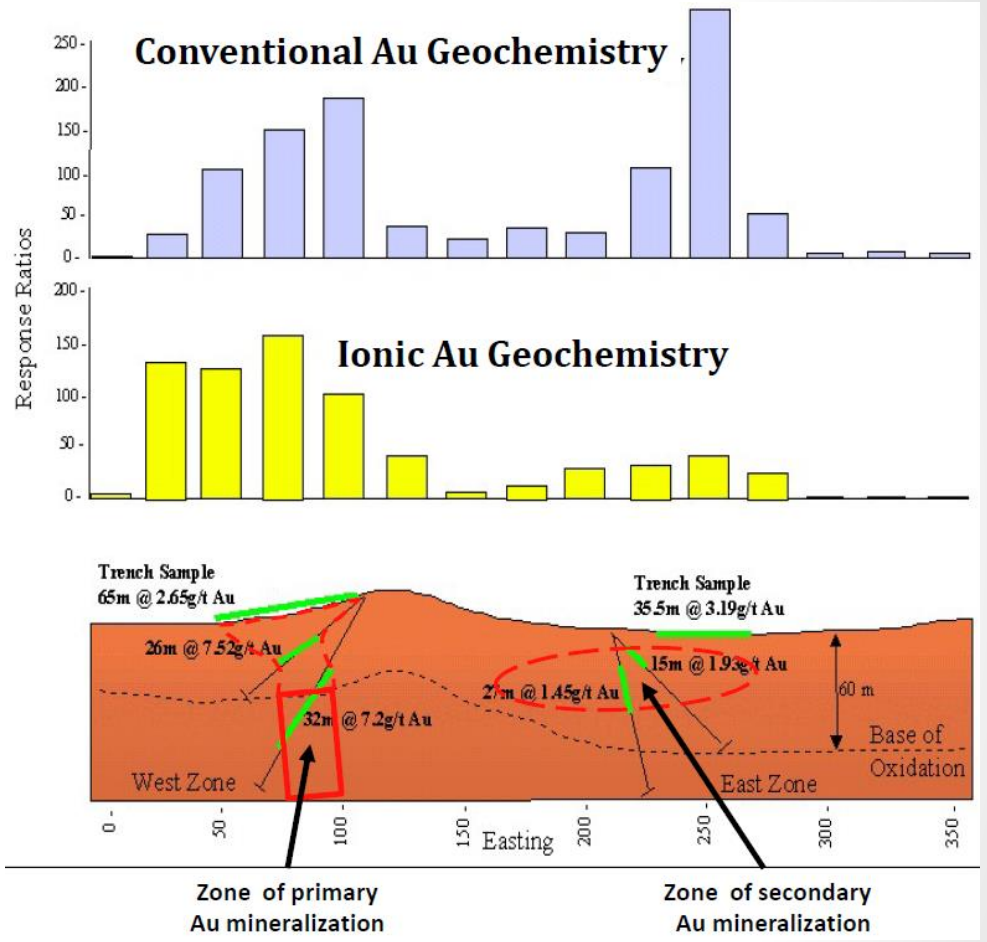


Looking for fingerprints, ore systems

Acknowledgement, Russell Birrell, 2018

Example - La Salle Gold Project Venezuela





Looking for fingerprints, ore systems

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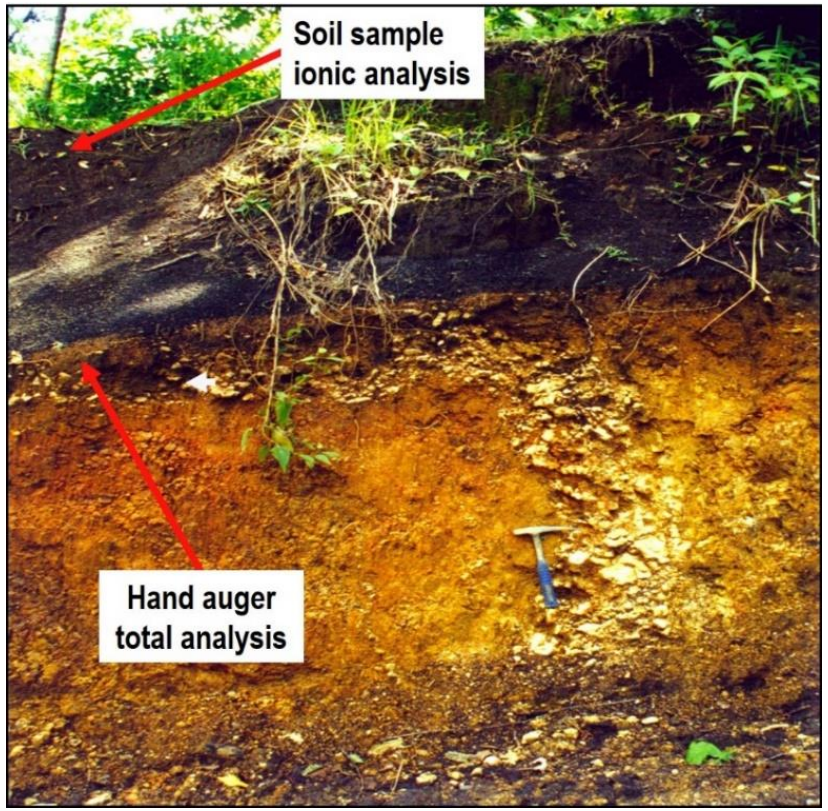
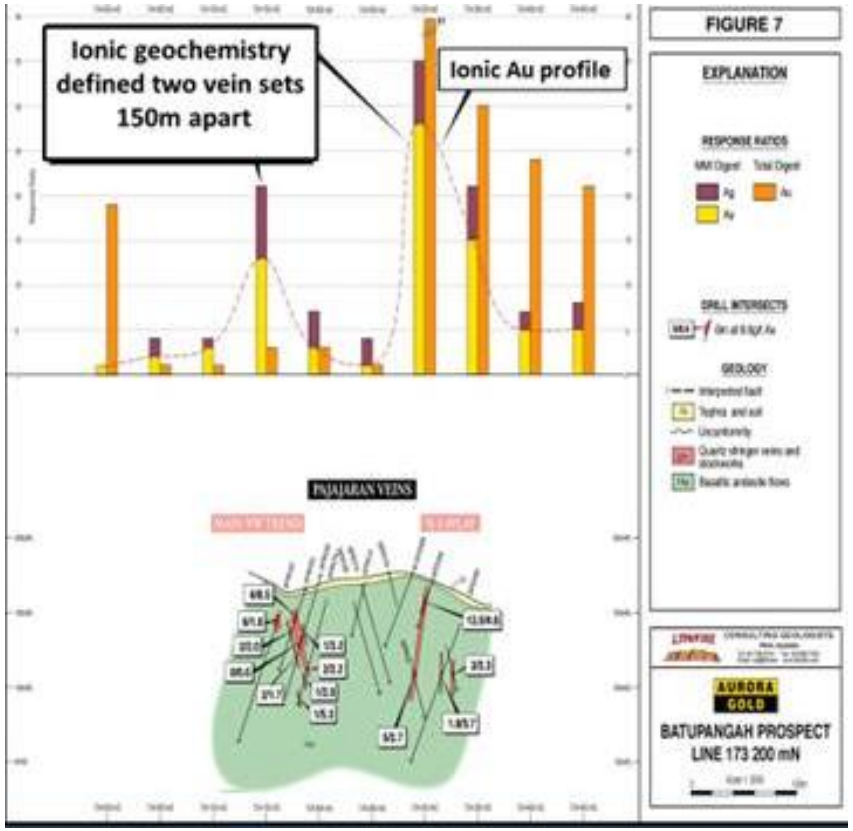
Time for ions to be transported

- Estimated at 200-300 years, but dependant upon depth, water availability and temperature
- Example from Indonesia sampling through tephra reportedly from Krakatoa 1883 - 1 to 1.5 m thick
- Auger and surface ionic sampling
- Both techniques very successful, ionic chemistry identified two veins 150 m apart

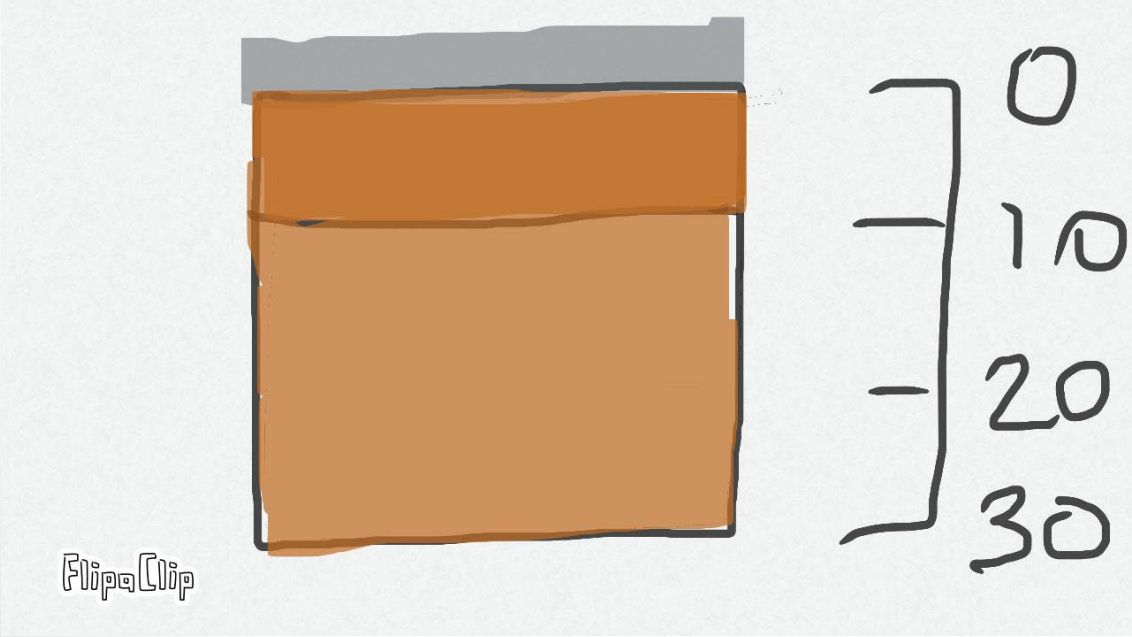




Russell Birrell, 2018

Ionic Soil Sampling - Methodology

- Sample between 10-25 cm below base of vegetation, **consistent depth** is key
- Take 100-150 g sample, pick out large roots, rocks
- Contamination
  - jewellery, smoking, sunscreen etc
  - remove residue and flush equipment in soil from next sample site
- Remove excess air, double bag - ziplock plastic, sample number.

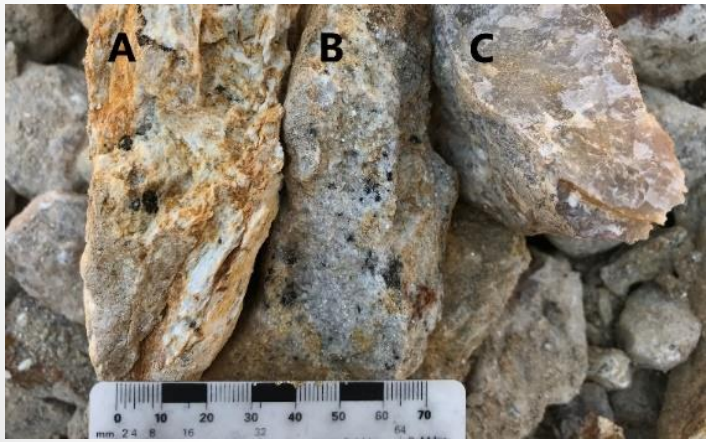


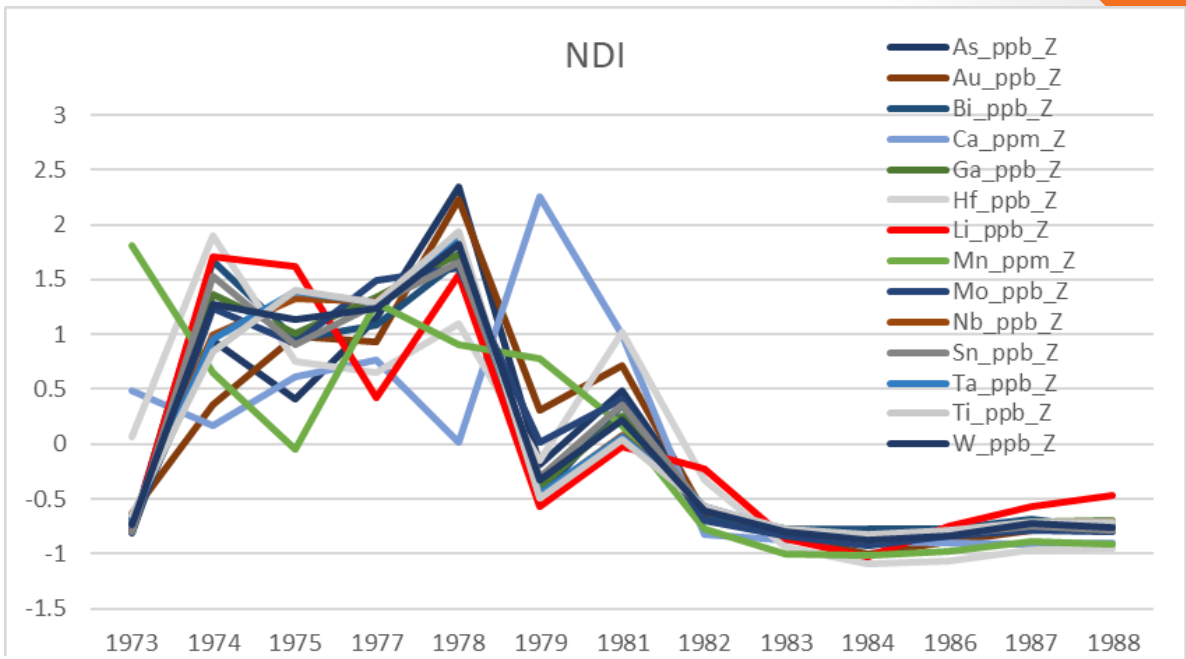
Project example - Rwanda

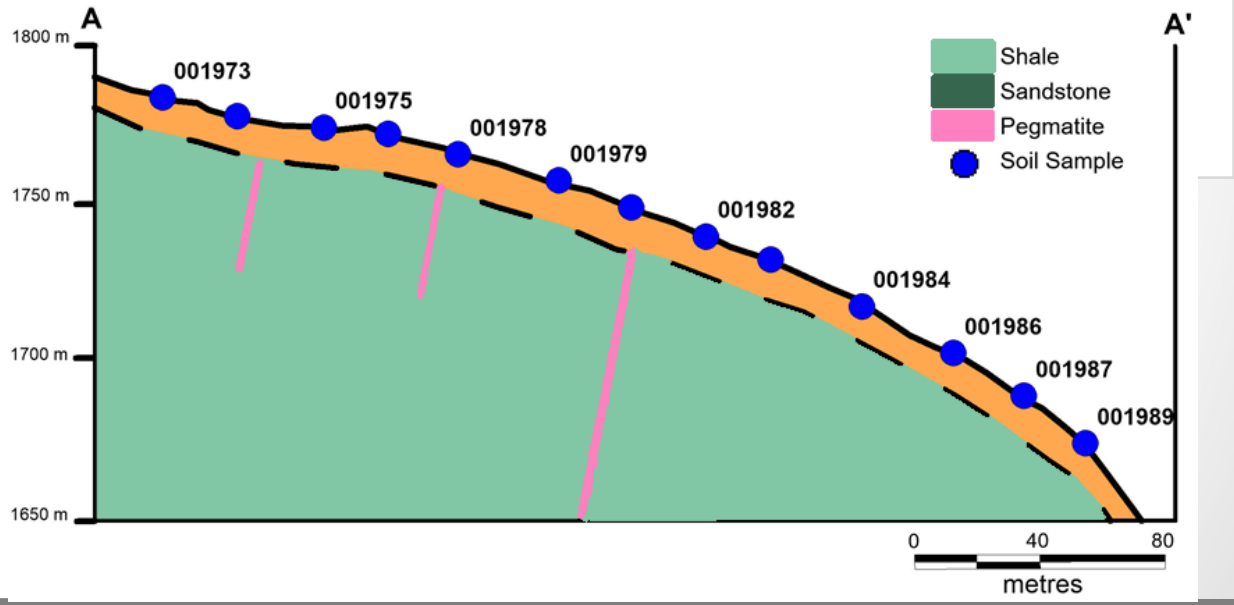
5-9 times background	10-19 times background	≥20 times background
Br, Ge, **Hf**, **Li**, **Mn**, Sb, Sc, Se, Tb, Th, Zr	Au, Ca, Ce, Cr, Eu, Fe, **Ga**, Gd, I, La, Nd, Pr, Sm, Te, **W**	As, Bi, Mo, **Nb**, **Sn**, **Ta**, Ti

Anomalous elements over known pegmatites, from ionic leach soil sampling, SRK 2018

Orange elements enriched in LCT pegmatites (London, 2008).







On Rwanda project

- Works well in deep cover
- Strong anomalies identified over pegmatites and base metal sulphides
- Positive tests over weak Au mineralisation and basalt units

- Orientation sampling is strongly recommended prior to regional campaign

- Assay costs higher than traditional geochemical sampling - but offset by ability to collect more samples per day, no preparation required, low shipping costs

- Represents good way of identifying primary anomalies rather than secondary (transported) anomalies

SRK - КОНСАЛТИНГ ДЛЯ ГОРНОДОБЫВАЮЩИХ КОМПАНИЙ

- SRK Global основана в 1974
- Более 1400 сотрудников
- 47 офиса
- 22 страны

100% компании принадлежит ее сотрудникам

Большое количество проектов в России и Центральной Азии, в настоящее время ведутся крупные проекты в Узбекистане и Казахстане.

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Спасибо за внимание!

Thanks for your attention!

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