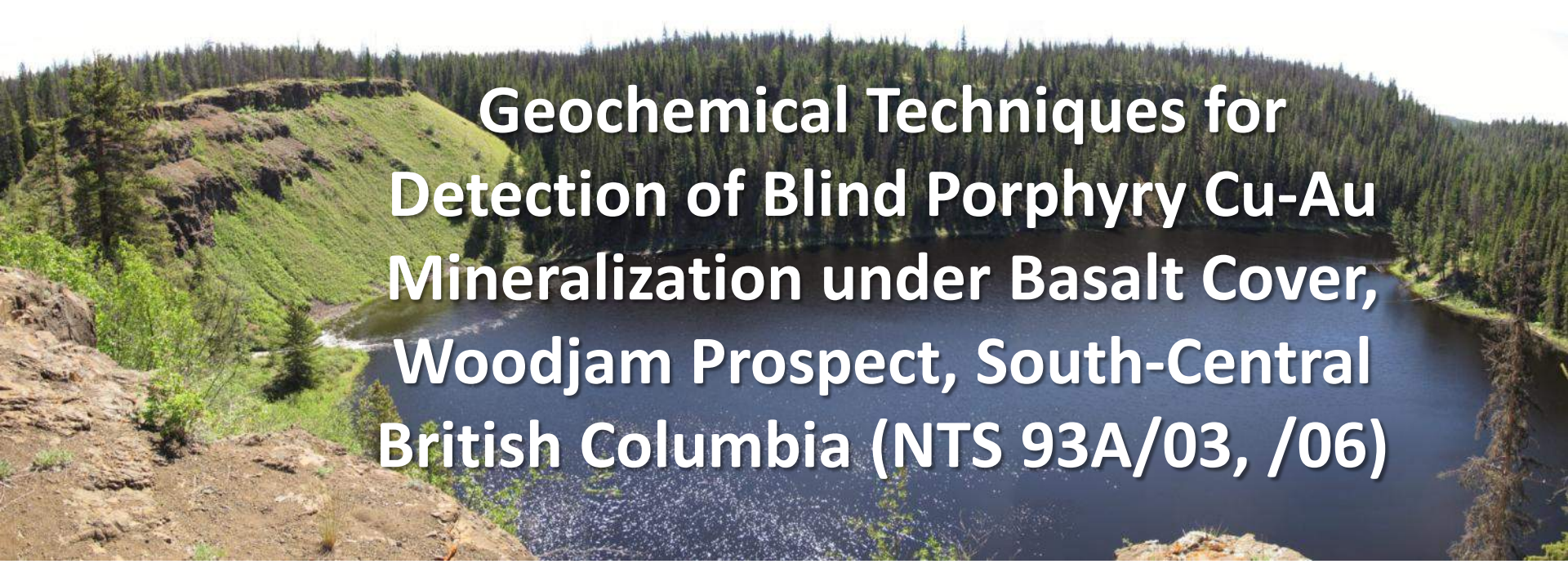


Geochemical Techniques for Detection of Blind Porphyry Cu-Au Mineralization under Basalt Cover, Woodjam Prospect, South-Central British Columbia (NTS 93A/03, /06)

Thomas Bissig, David R. Heberlein, Colin Dunn

GOLD FIELDS

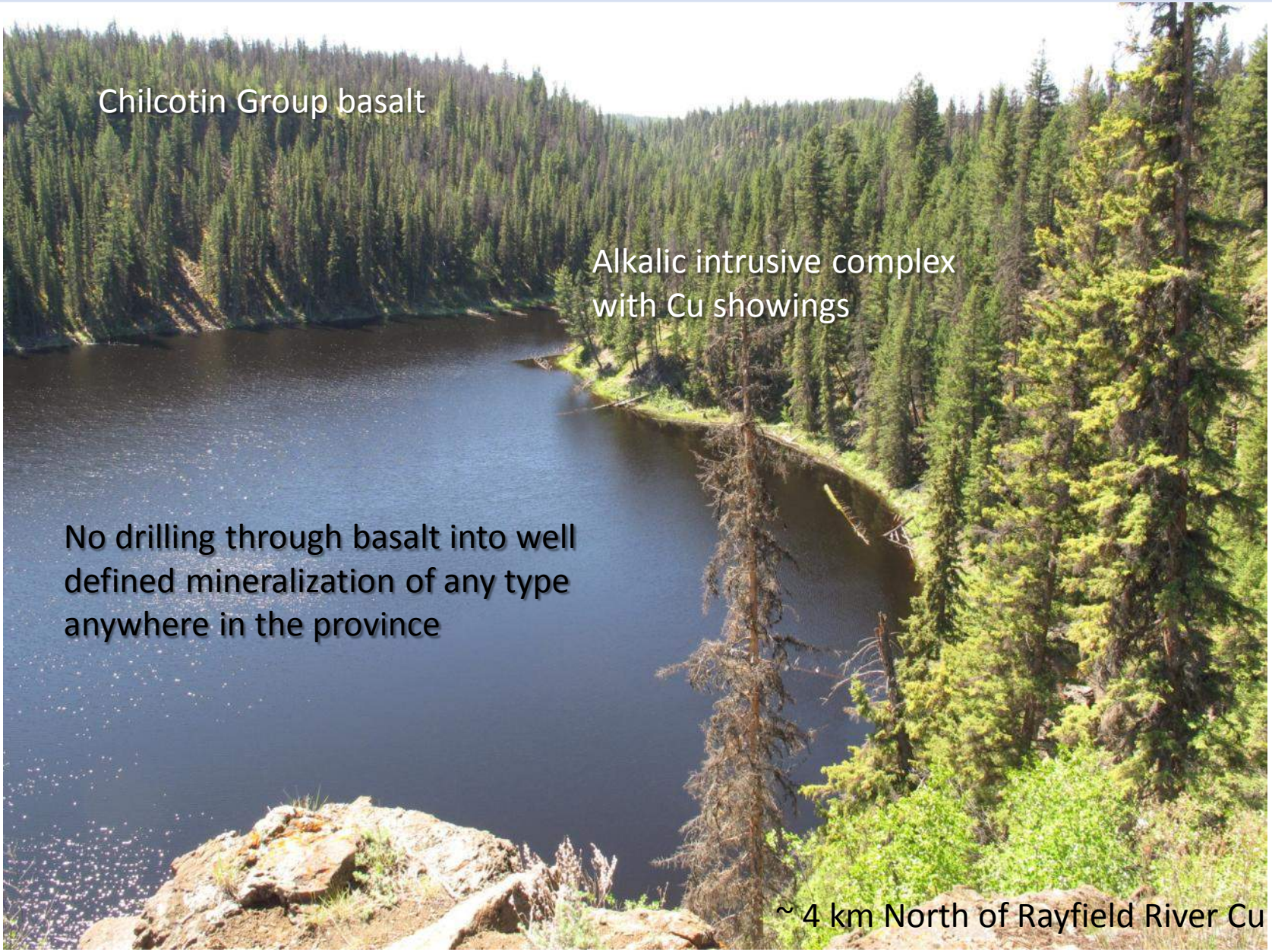
Geoscience BC

ALS Group

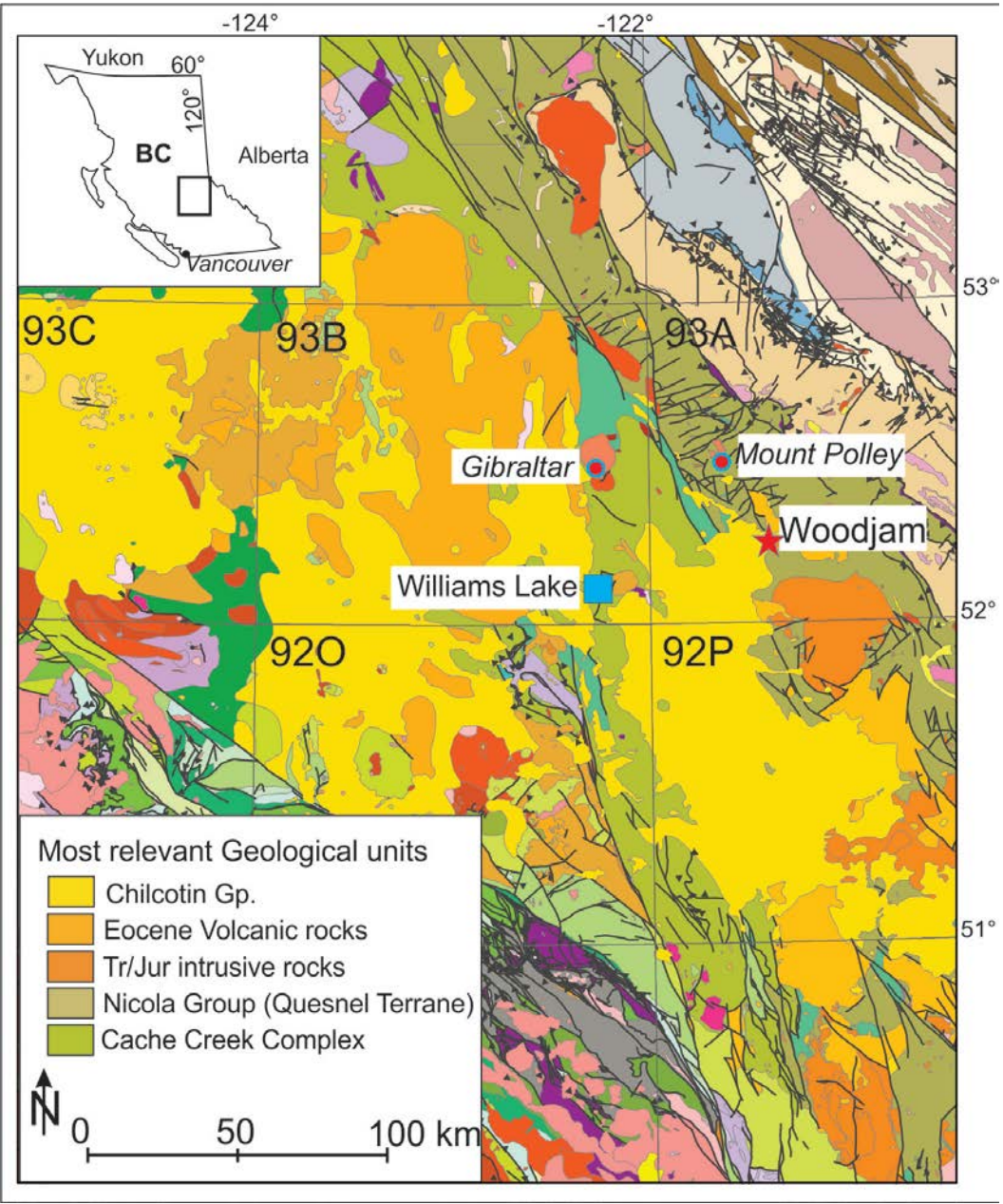
AcmeLabs™

Actlabs
Quality Analysis... Innovative Technologies

Statement of the problem



General distribution of basalt cover



Given the absence of known mineralization below basalt

Woodjam where Cu-Au-Mo mineralization is defined close (within ~ 100 m) to basalt cover

Geology from Massey et al. 2005

Try everything...

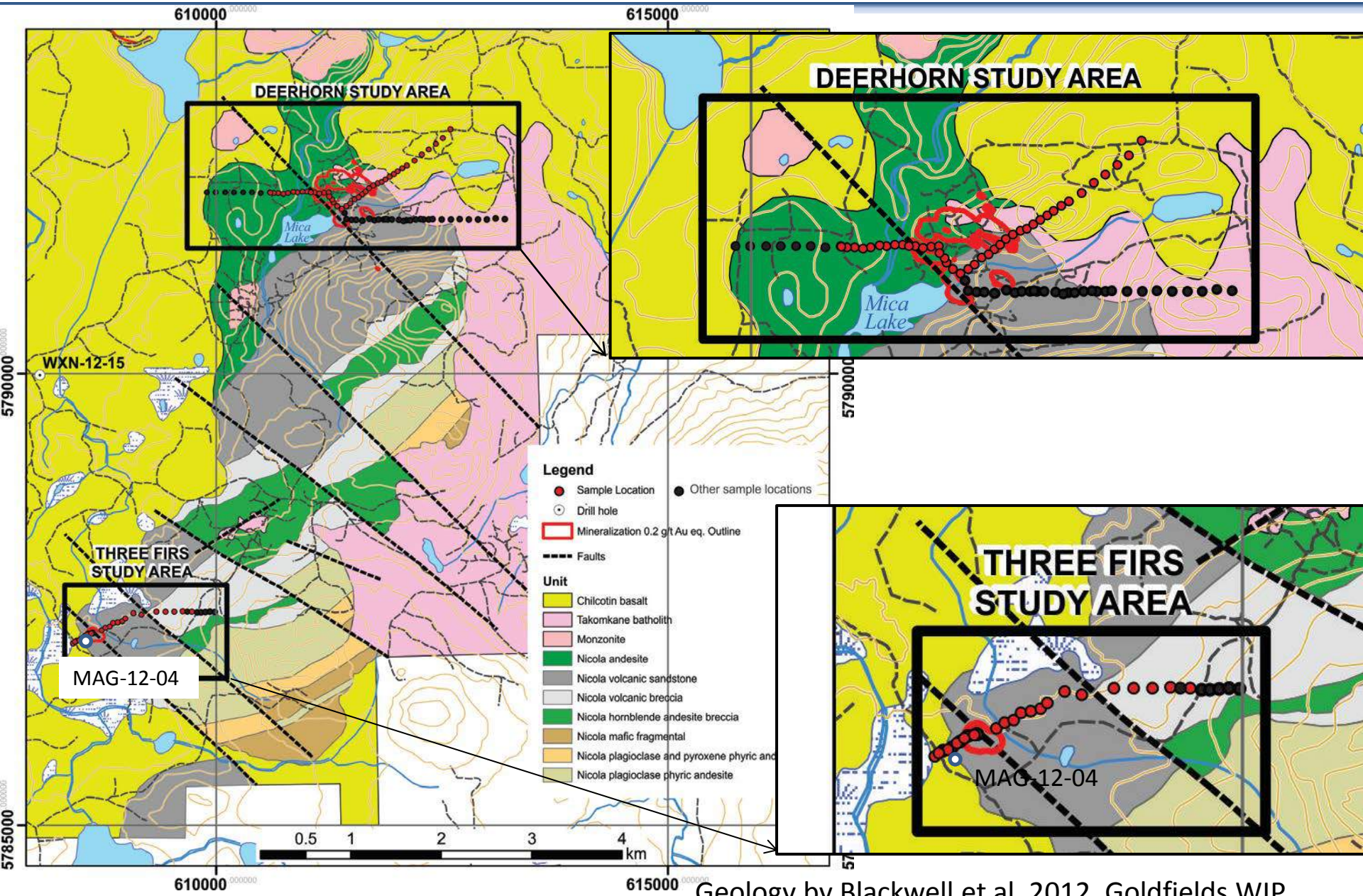
- Characterization of basalt substrate
- Amygdules in Basalt (Clay and carbonate)
- B-horizon soils 7 different leaches
- Soil pH and conductivity
- Plants (Spruce twigs and bark)
- Complemented by exudates, plants, charcoal, Ah horizon data (Heberlein et al. in progress)

Colin's vacuum system
Photo D. Heberlein

Some of the techniques Heberlein et al. applied
(which is part of the many things I am NOT going to talk about)

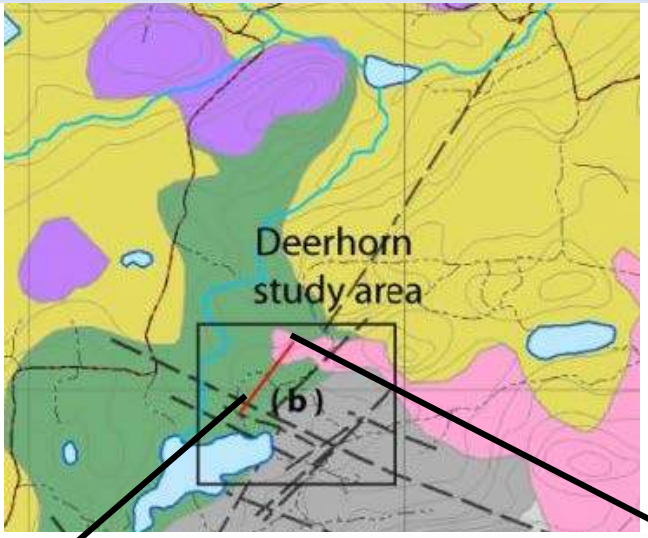
Disclaimer....

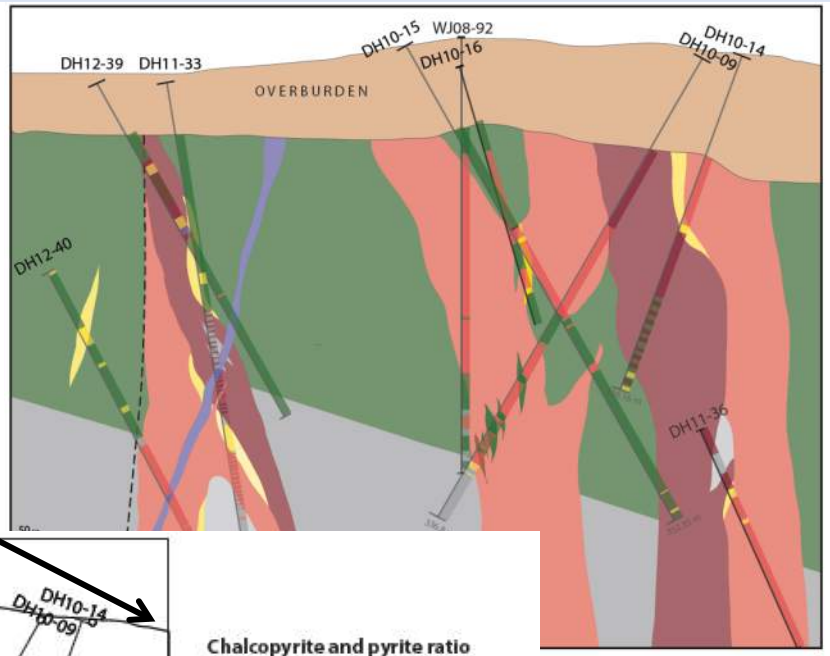
1) It could be all random
2) I really have no idea what I am talking about...



Geology by Blackwell et al. 2012, Goldfields WIP

Deerhorn section through mineralization



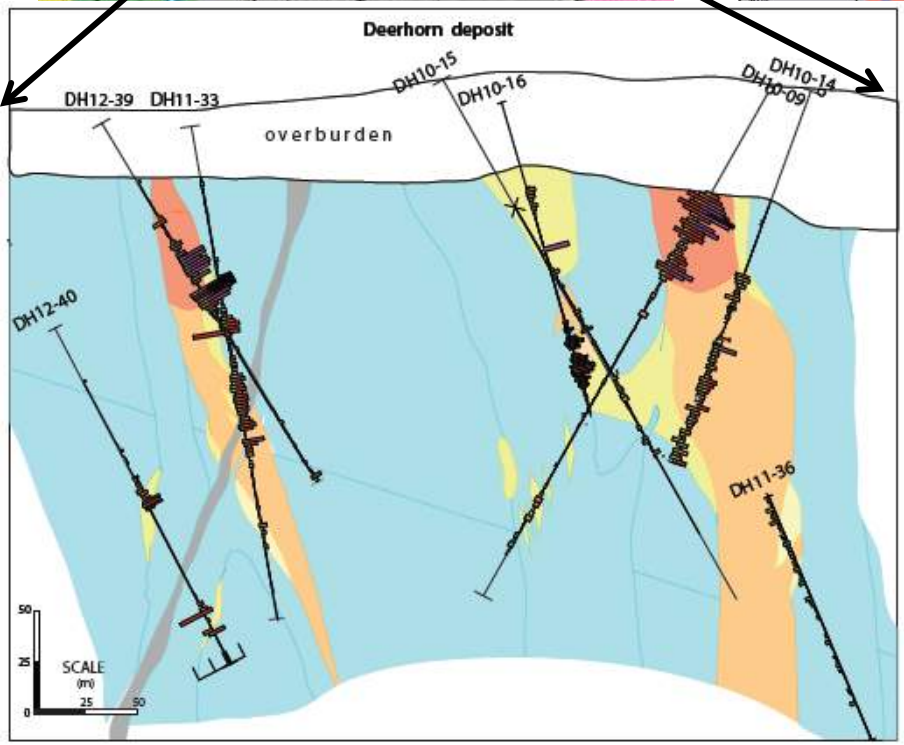


Legend

- Overburden
- Rubble
- Plagioclase porphyry dike
- Breccia
- Monzonite D interfingering volcaniclastic secuence
- Monzonite A interfingering volcaniclastic secuence
- Monzonite D
- Monzonite A
- Plagioclase-phyric andesite volcaniclastic
- Sandstone volcaniclastic
- Fault

Sections Specs:		
Ref. Pt. E, N	611230 m	579020 m
Extents	710.9 m	402.8 m
Section top, bot	940.3 m	537.5 m
Tolerance +/-	62.5 m	

Lithology from holes DH10-15, WJ08-92 and DH10-16 was logged by Gold Fields pers. comm. 2012



Chalcopyrite and pyrite ratio

- cp>>py
- cp>py
- cp=py
- py>cp
- cp=py=0
- No data

Bar graphs

Au ppm: 1.5, 1, 0.75, 0.25, 0.1

Cu%: 0.75, 0.5, 0.4, 0.3, 0.2, 0.1

Cpy ratios of hole DH10-16 and DH11-36 and Cu-Au grades of all holes where given by Gold Fields pers. comm. 2012

Sections Specs:		
Ref. Pt. E, N	611230 m	579020 m
Extents	710.9 m	402.8 m
Section top, bot	940.3 m	537.5 m
Tolerance +/-	62.5 m	

Del Real et al. 2013

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One of the only places where drilled through basalt into mineralization: Three Firs zone

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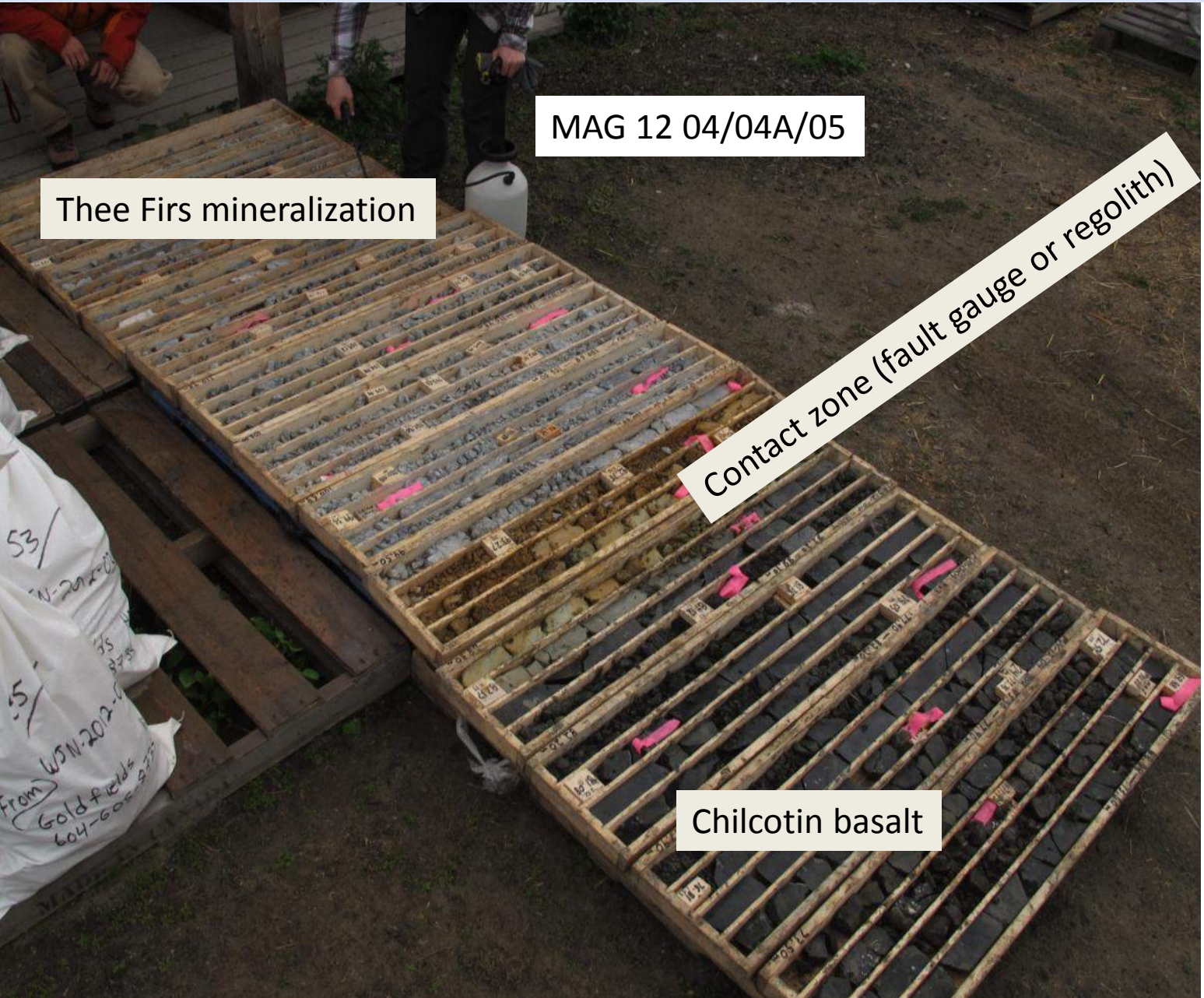
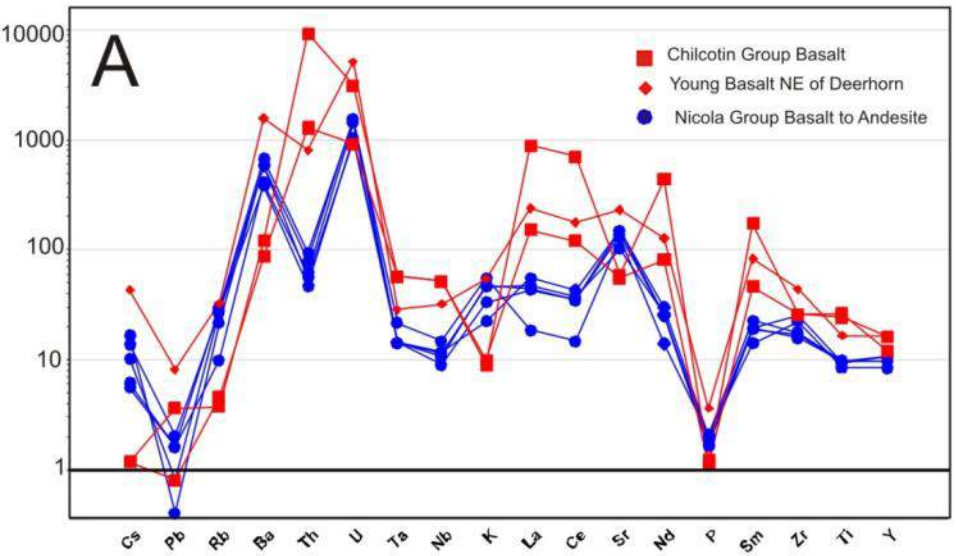
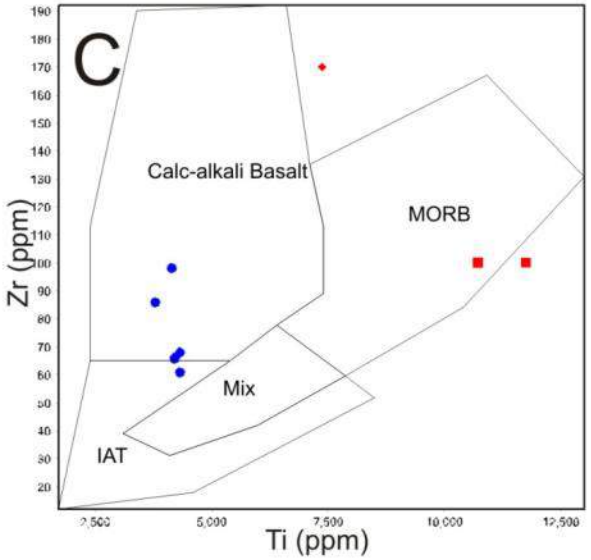
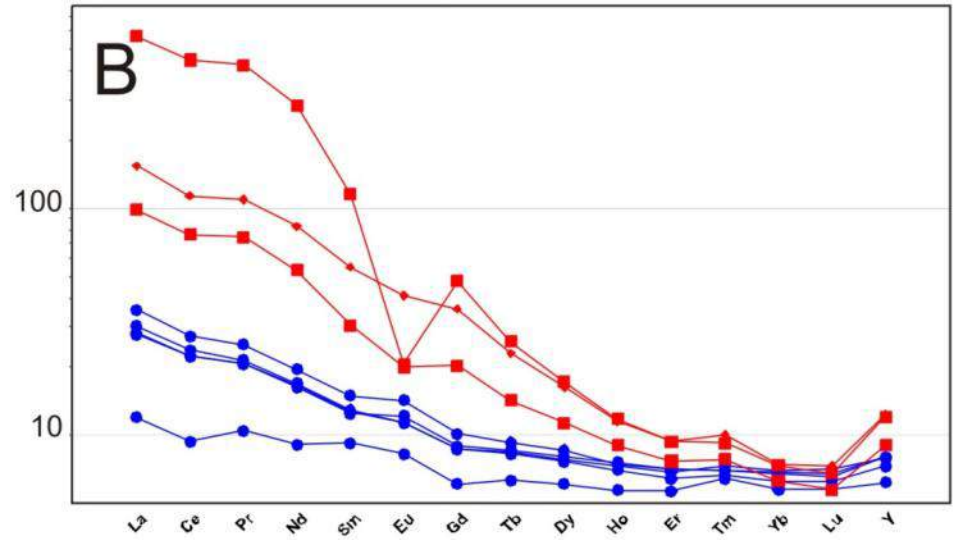


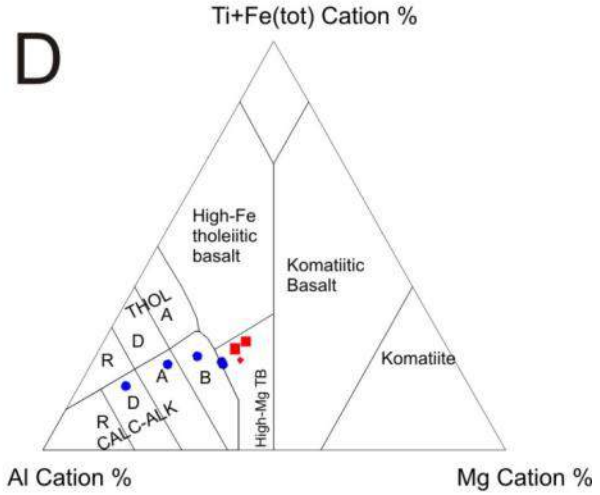
~ 65 m of till
~ 25 m of basalt
~ mineralization

Chilcotin vs. Nicola Group basalt



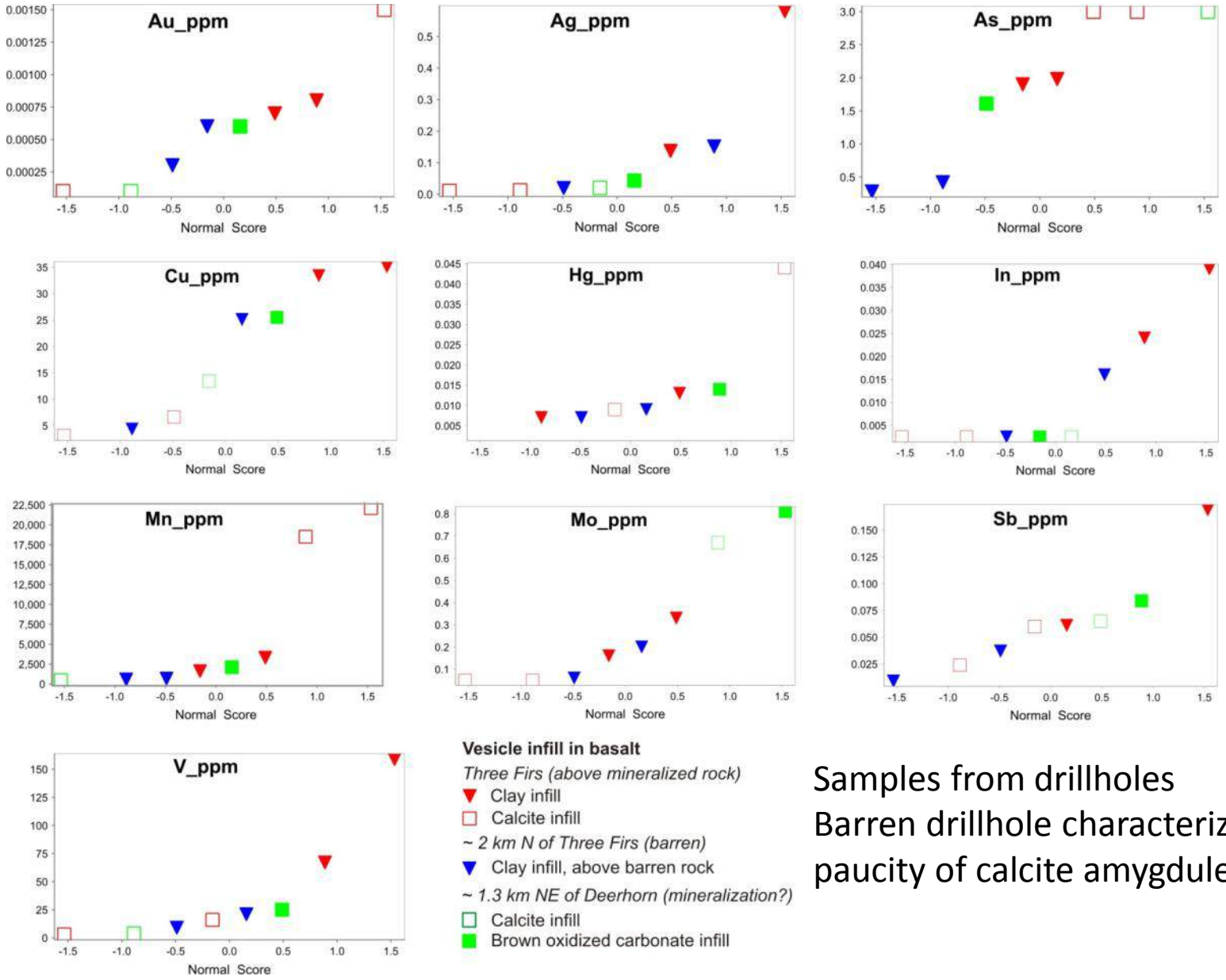






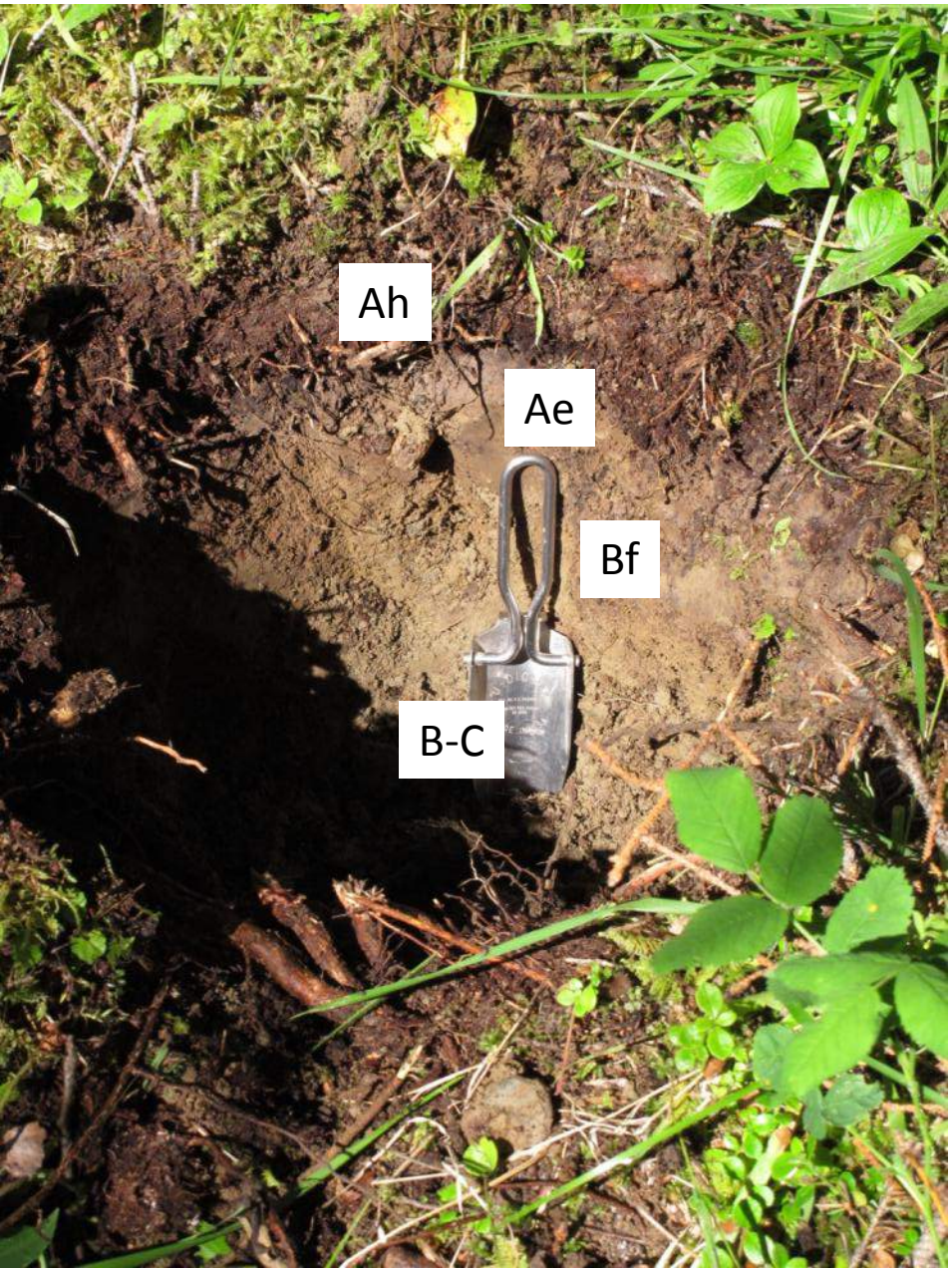

clay
calcite

Amygdule chemistry (Aqua Regia)

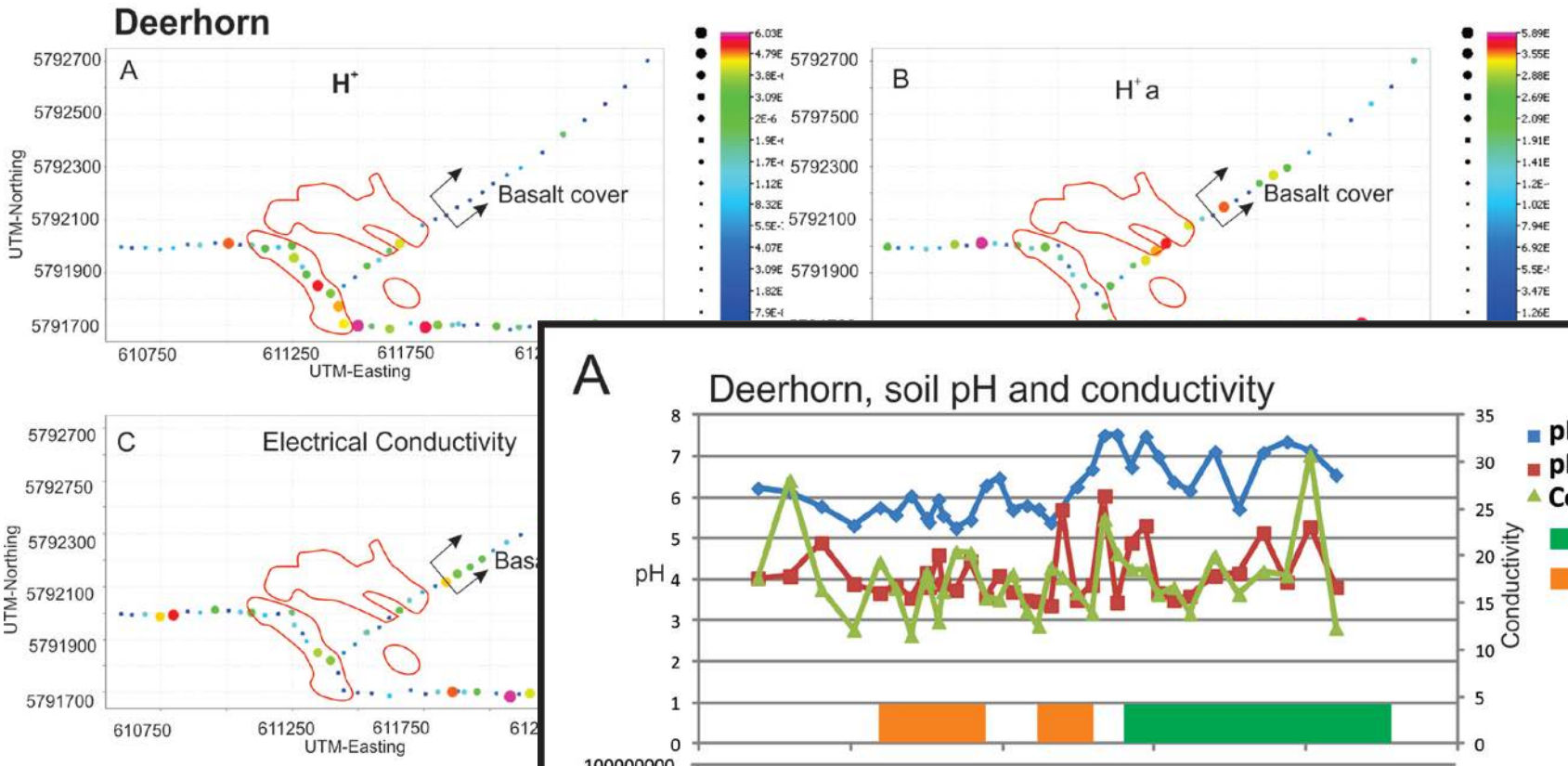


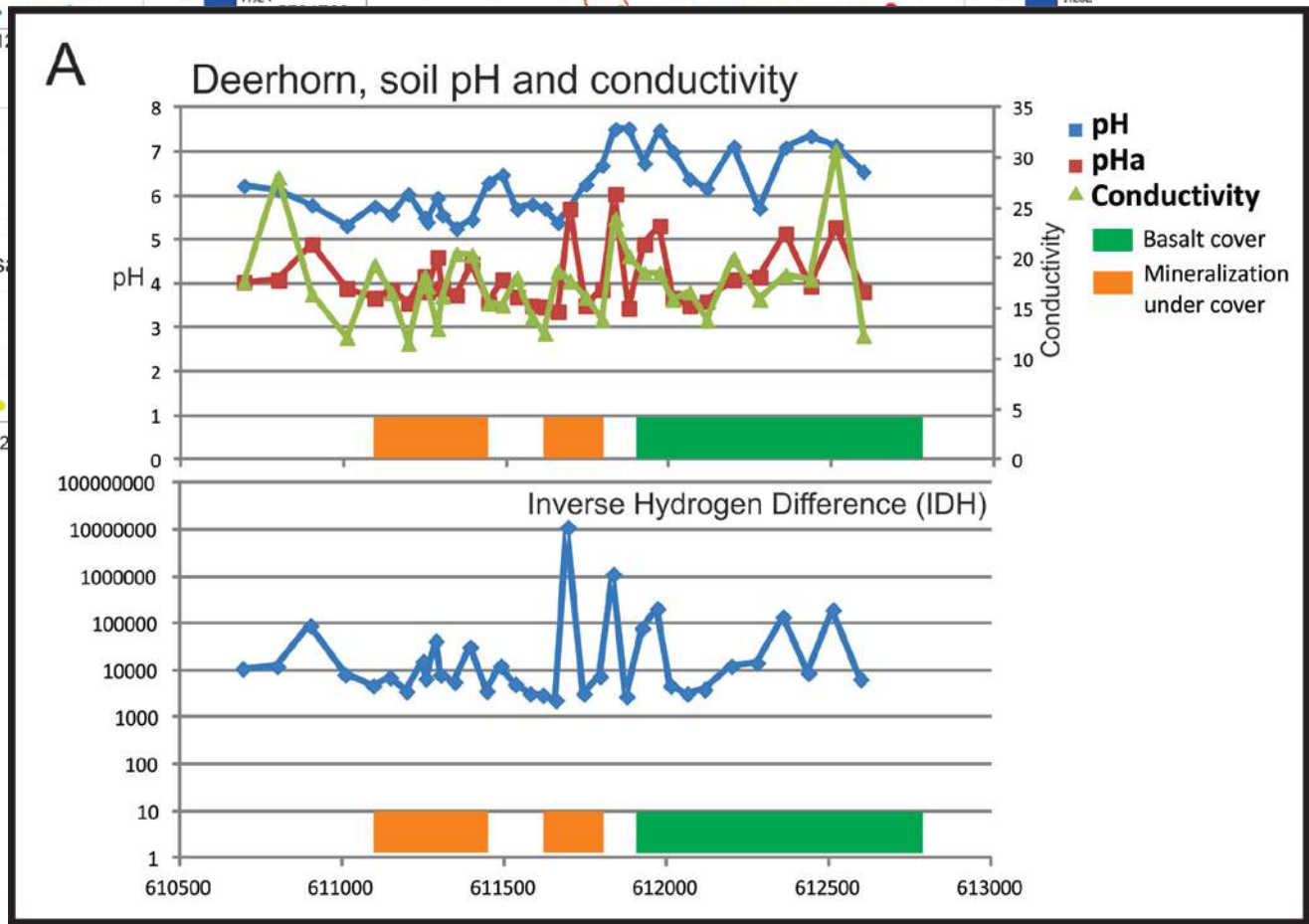
Samples from drillholes
Barren drillhole characterized by paucity of calcite amygdules

B-horizon soils. Weakly developed Podzol, Brunisol, locally Gleysol

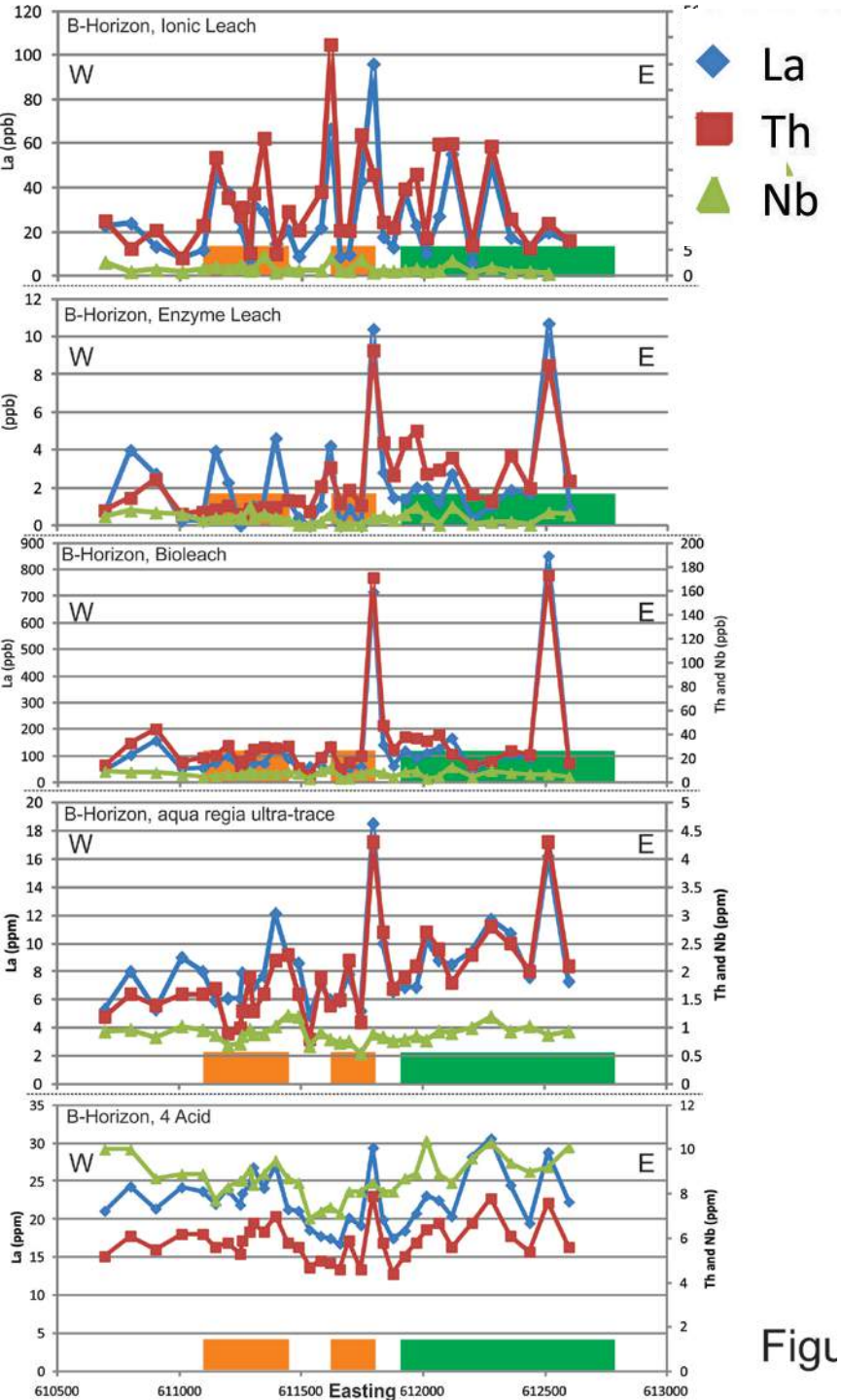


Soil pH and conductivity

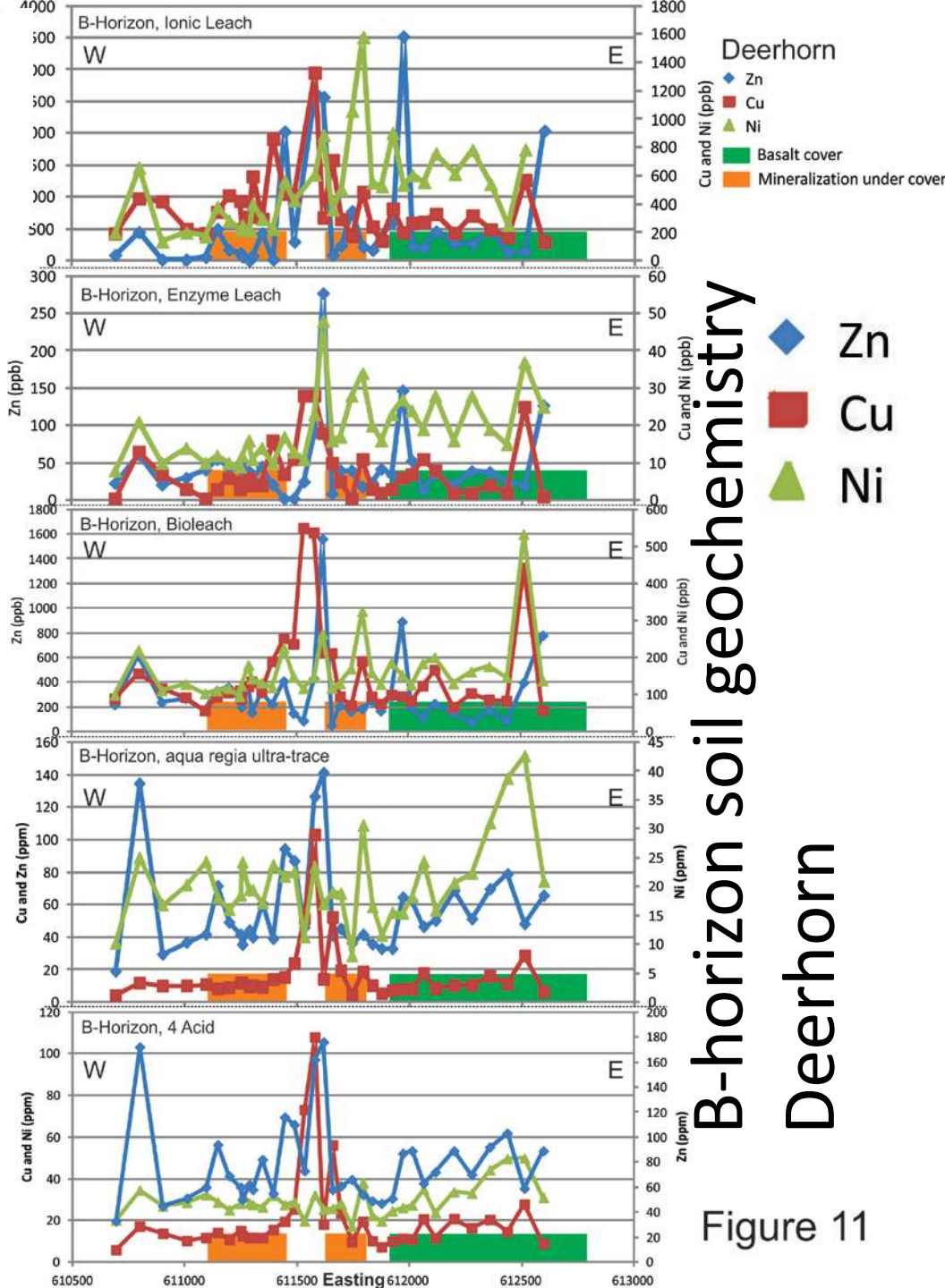




Deerhorn



Figu

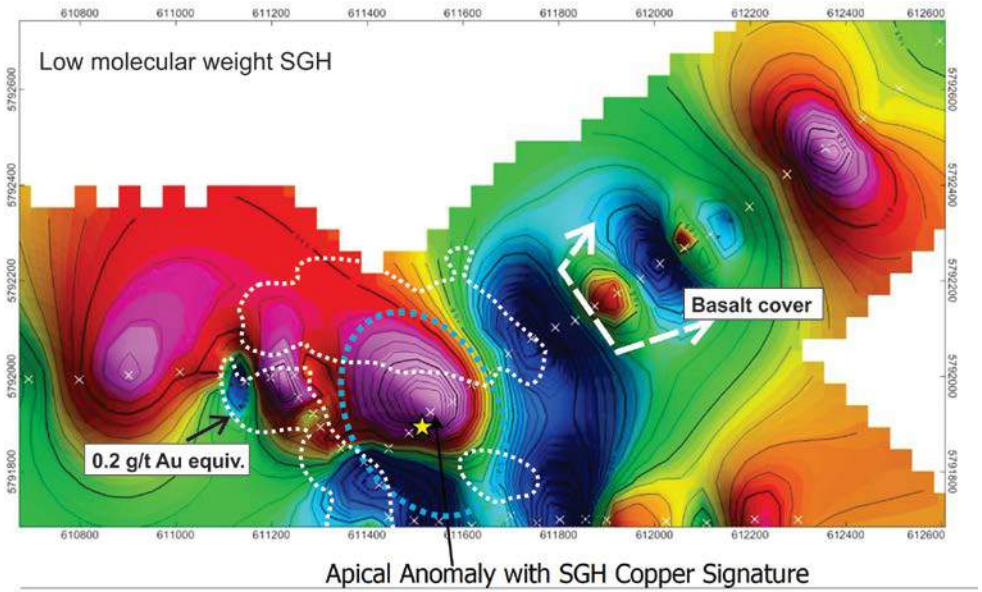


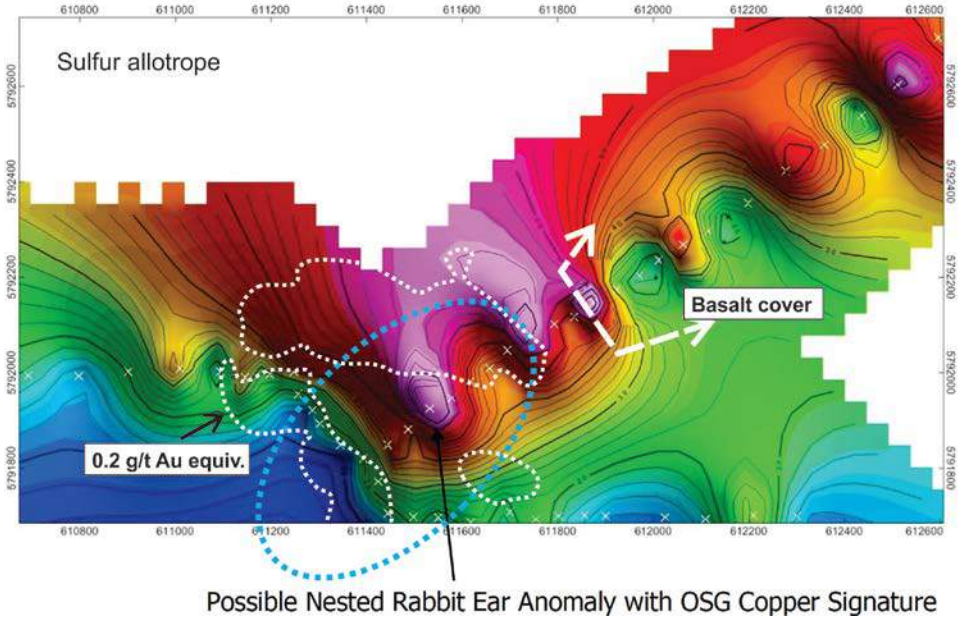
B-horizon soil geochemistry

Deerhorn

Figure 11

Soil Gas Hydrocarbons and Organo Sulfur Geochemistry

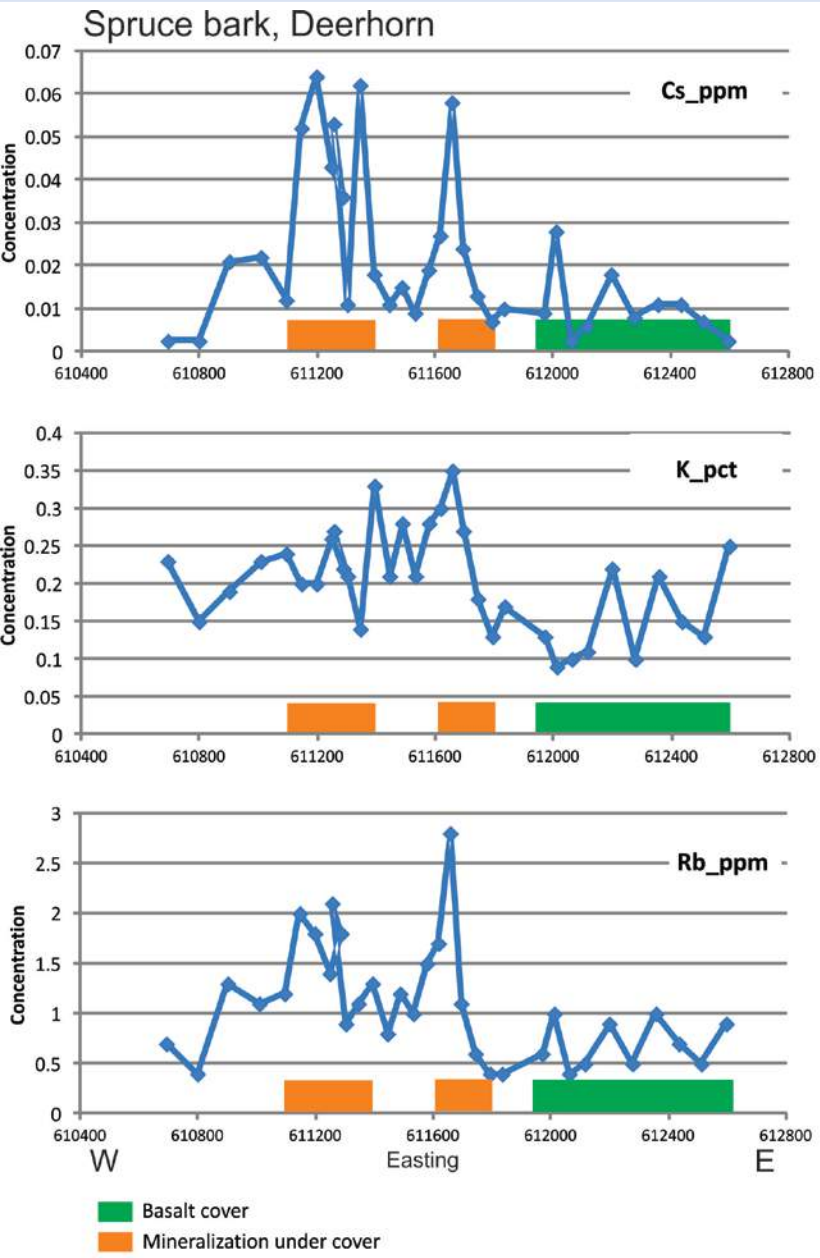


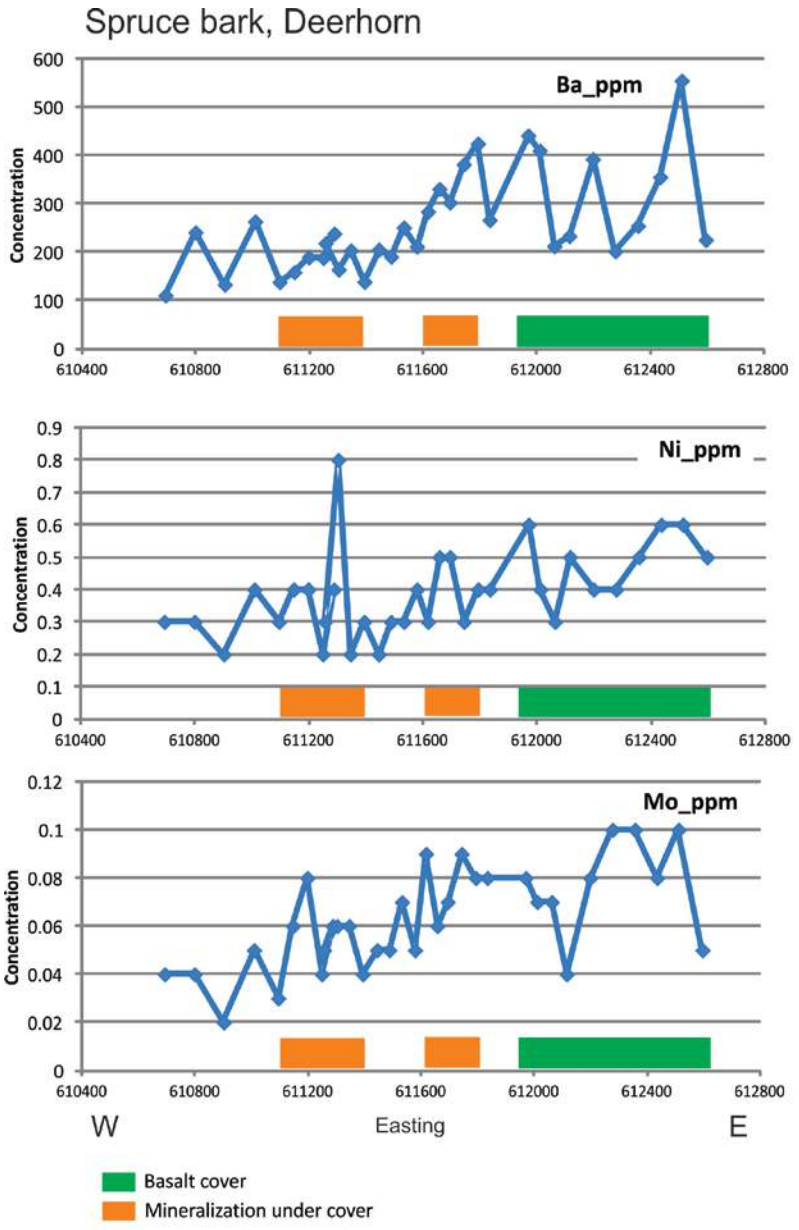


Copied from standard report provided by Actlabs Sutherland 2012a,b)

Roughly coinciding interpretation for anomaly and known mineralization

Vegetation results Deerhorn





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Three Firs/ Magalloy

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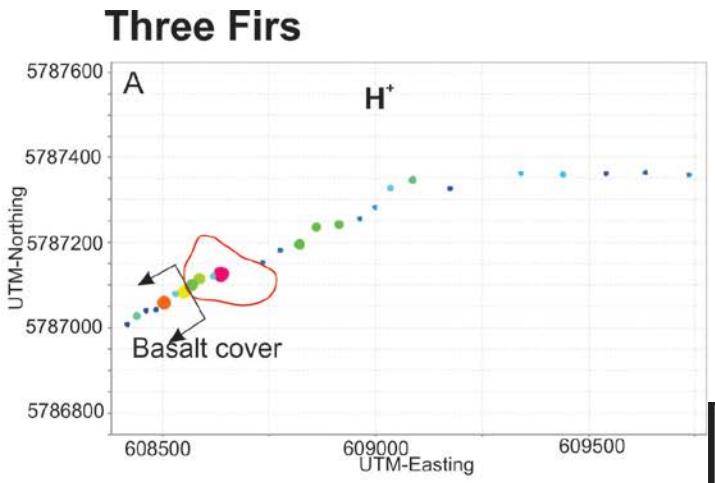
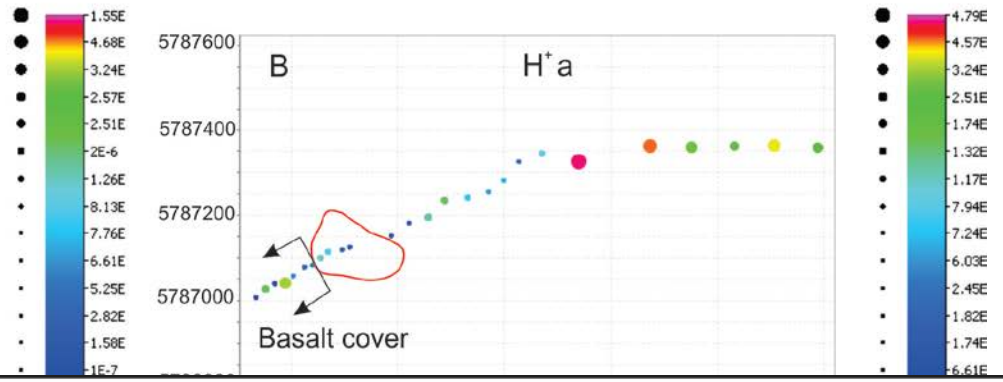
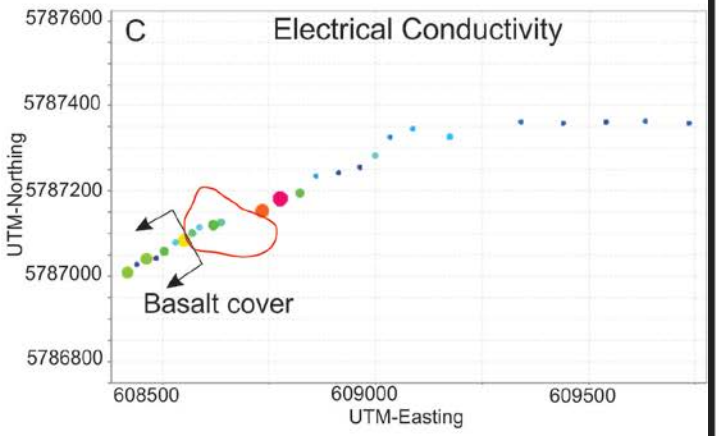
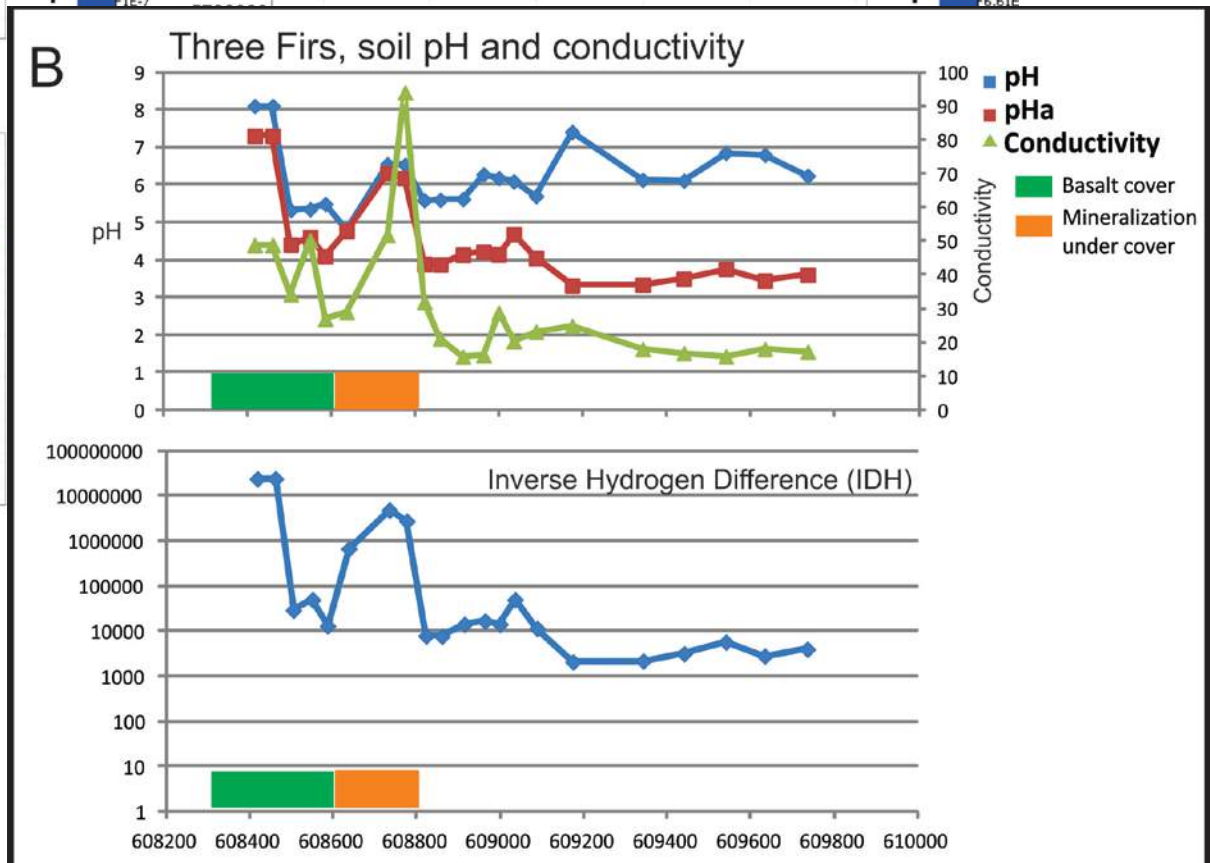
Soil pH and conductivity

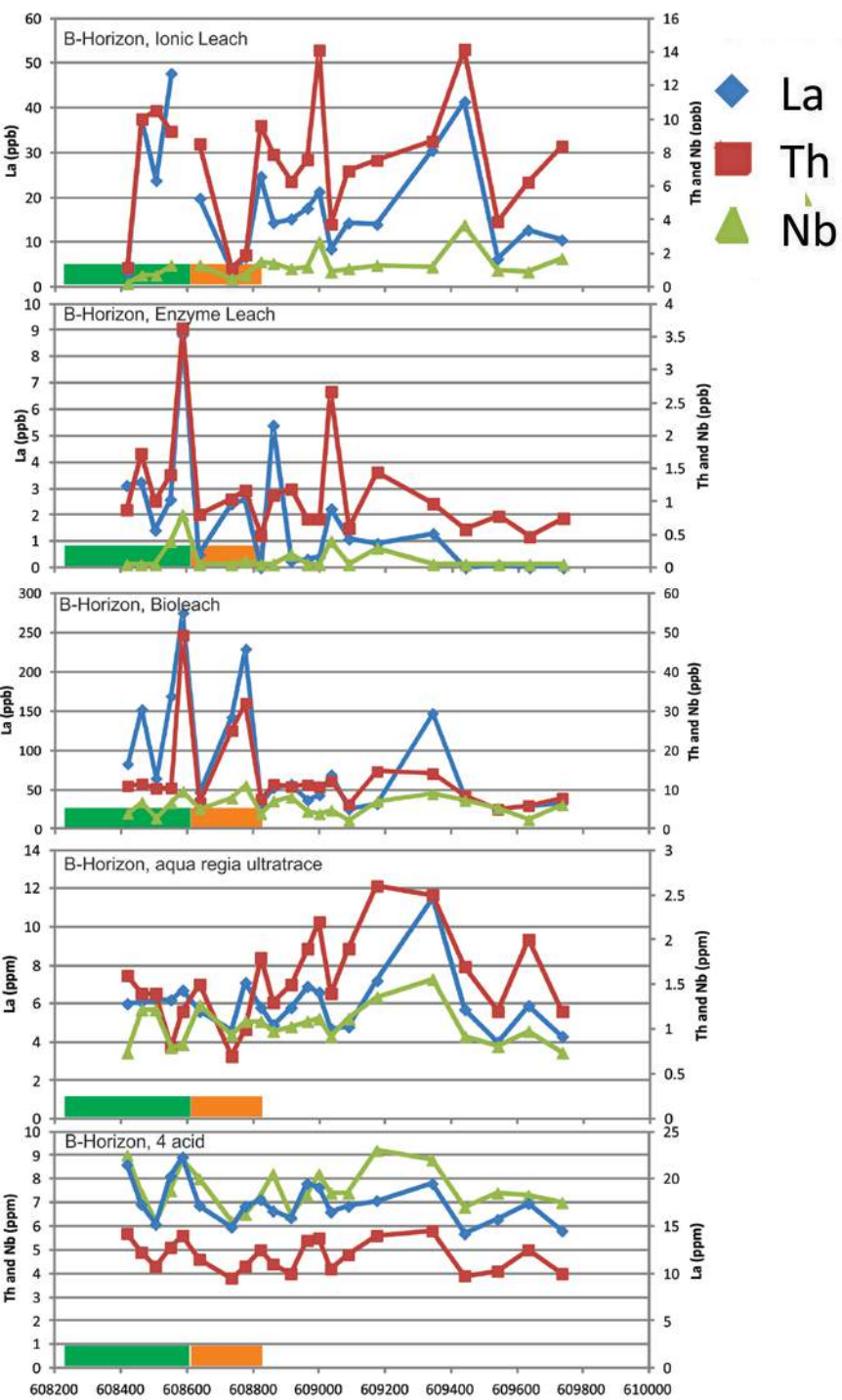


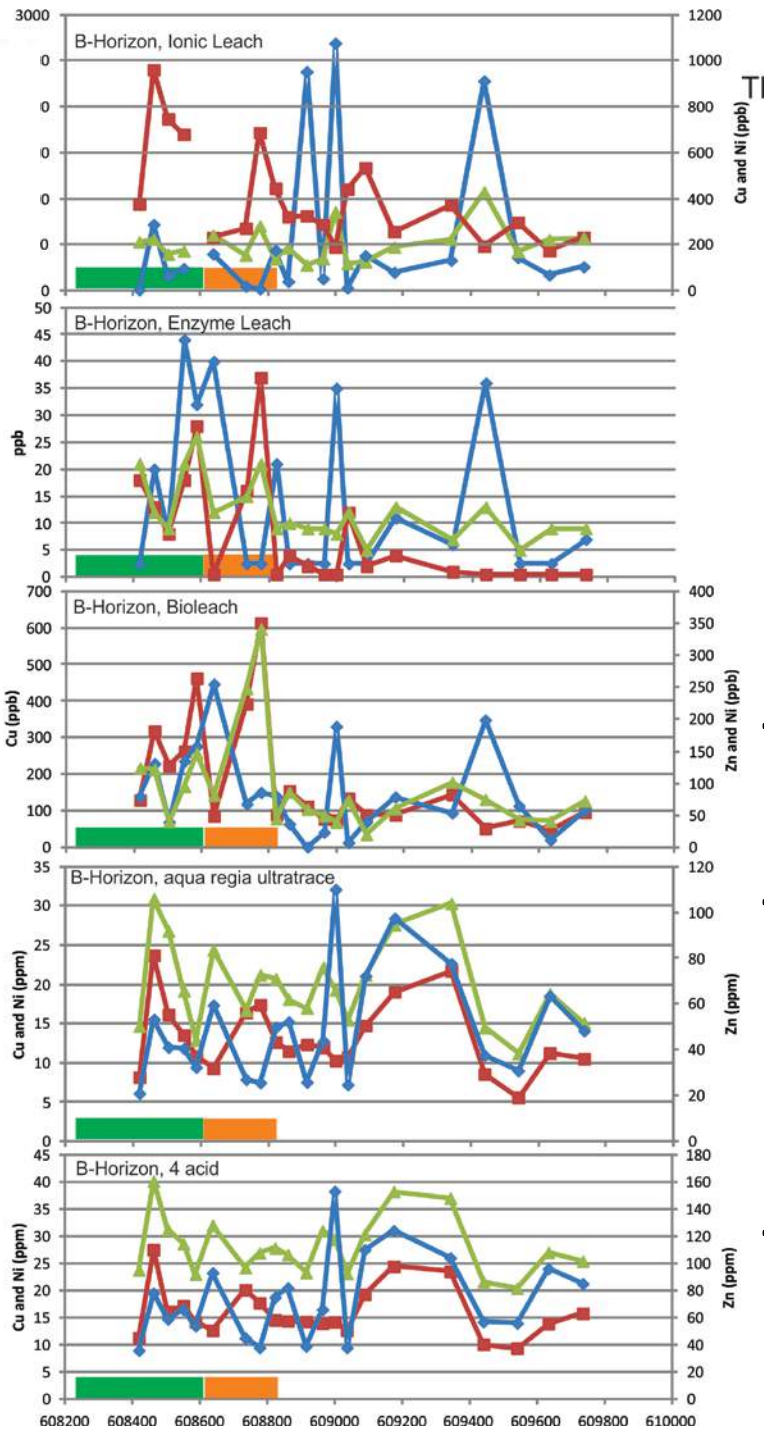






Three Firs



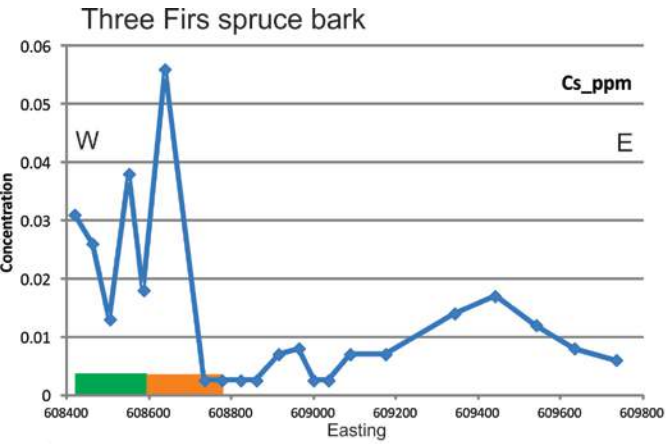


B-horizon soil geochemistry

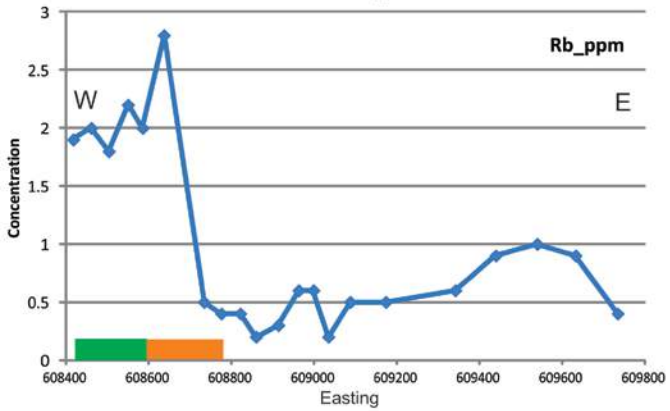
3 Firs

Vegetation results Three Firs

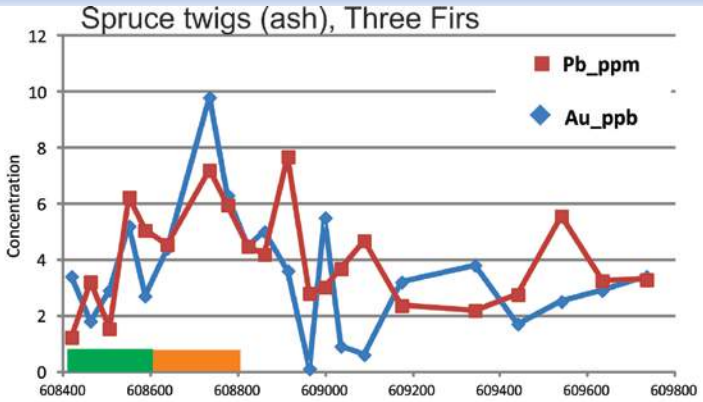
Spruce Bark Spruce Twigs (Ashed)



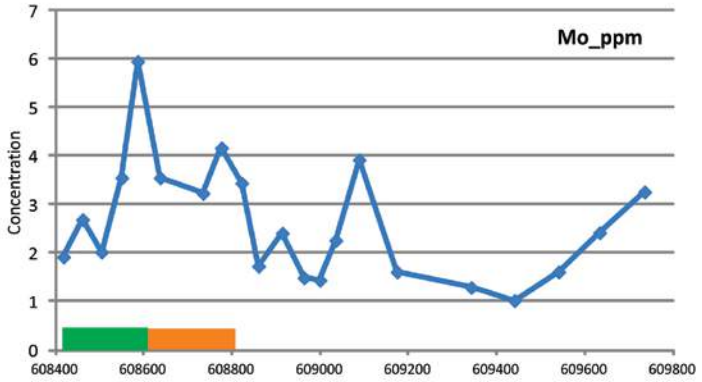
Cs



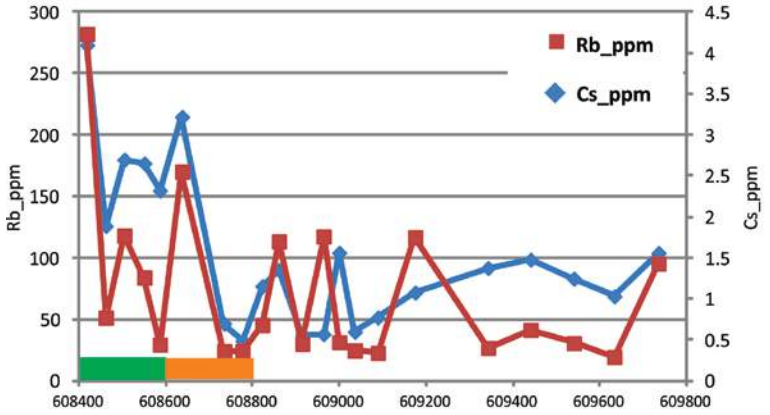
Rb



Pb
Au

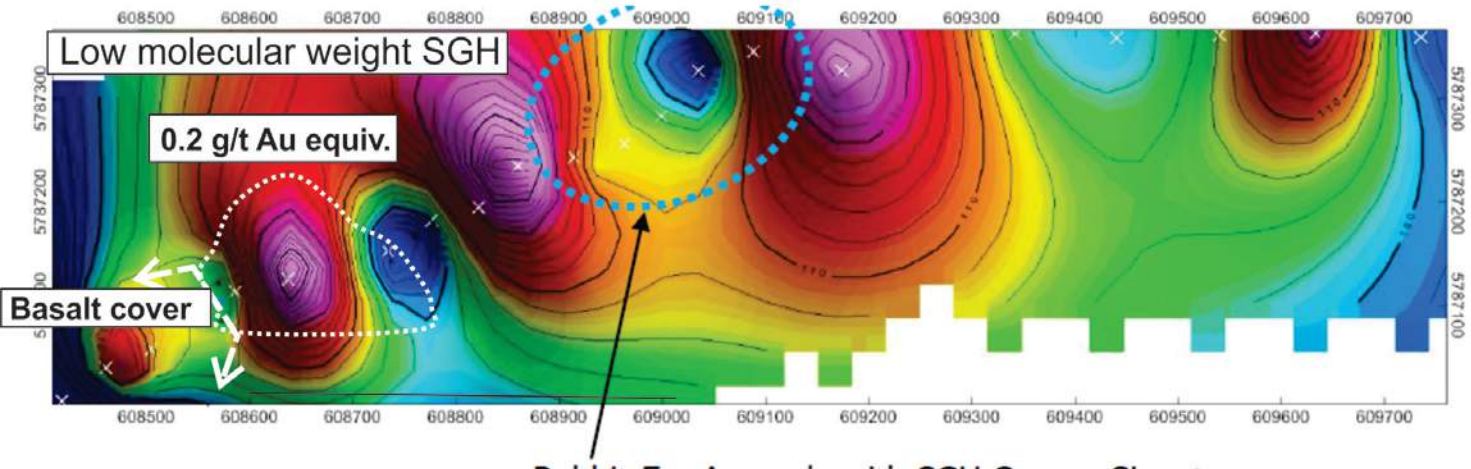


Mo

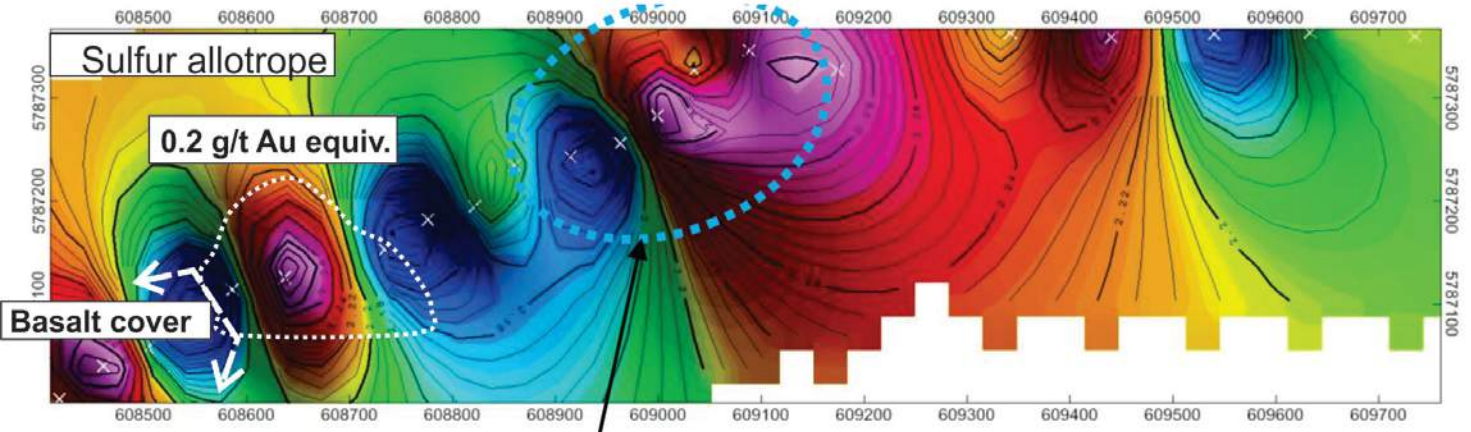


Rb
Cs

Three firs SGH and OGS response



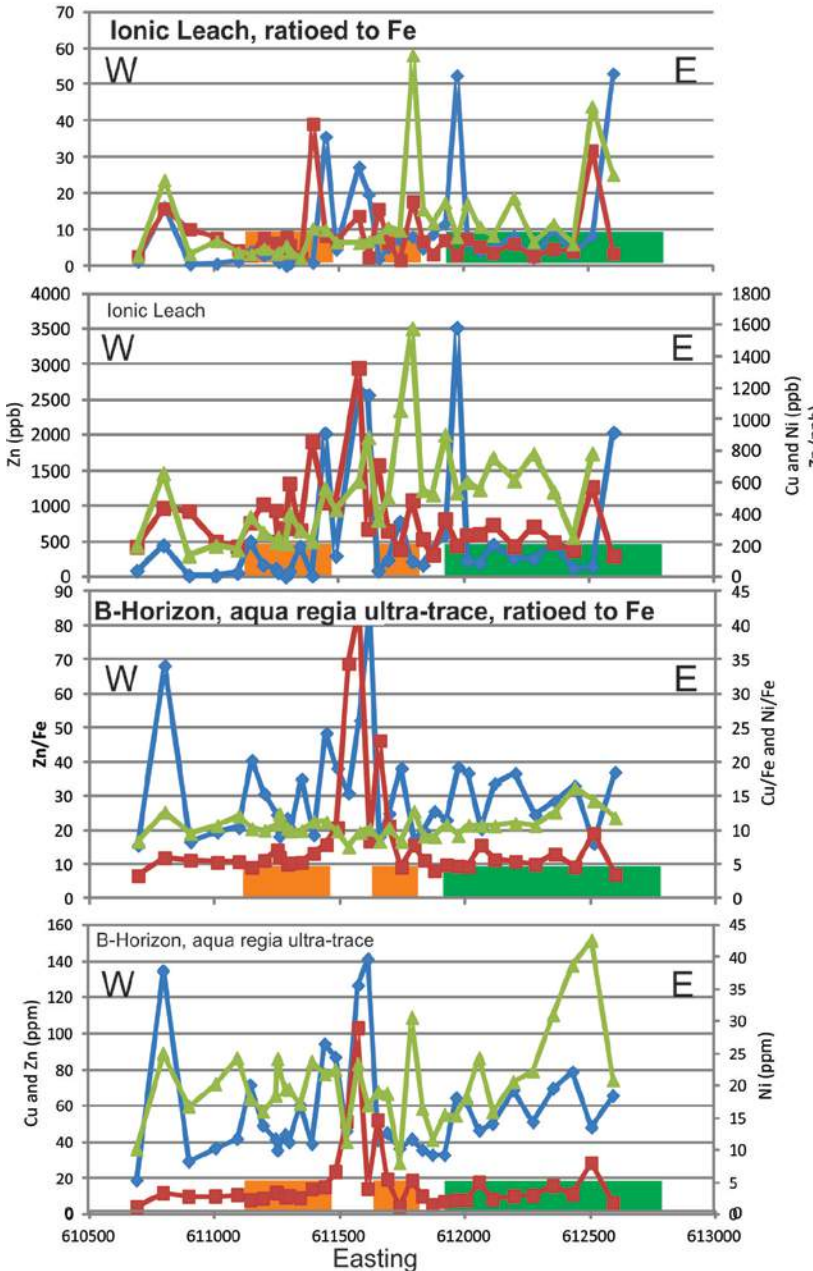
Rabbit-Ear Anomaly with SGH Copper Signature



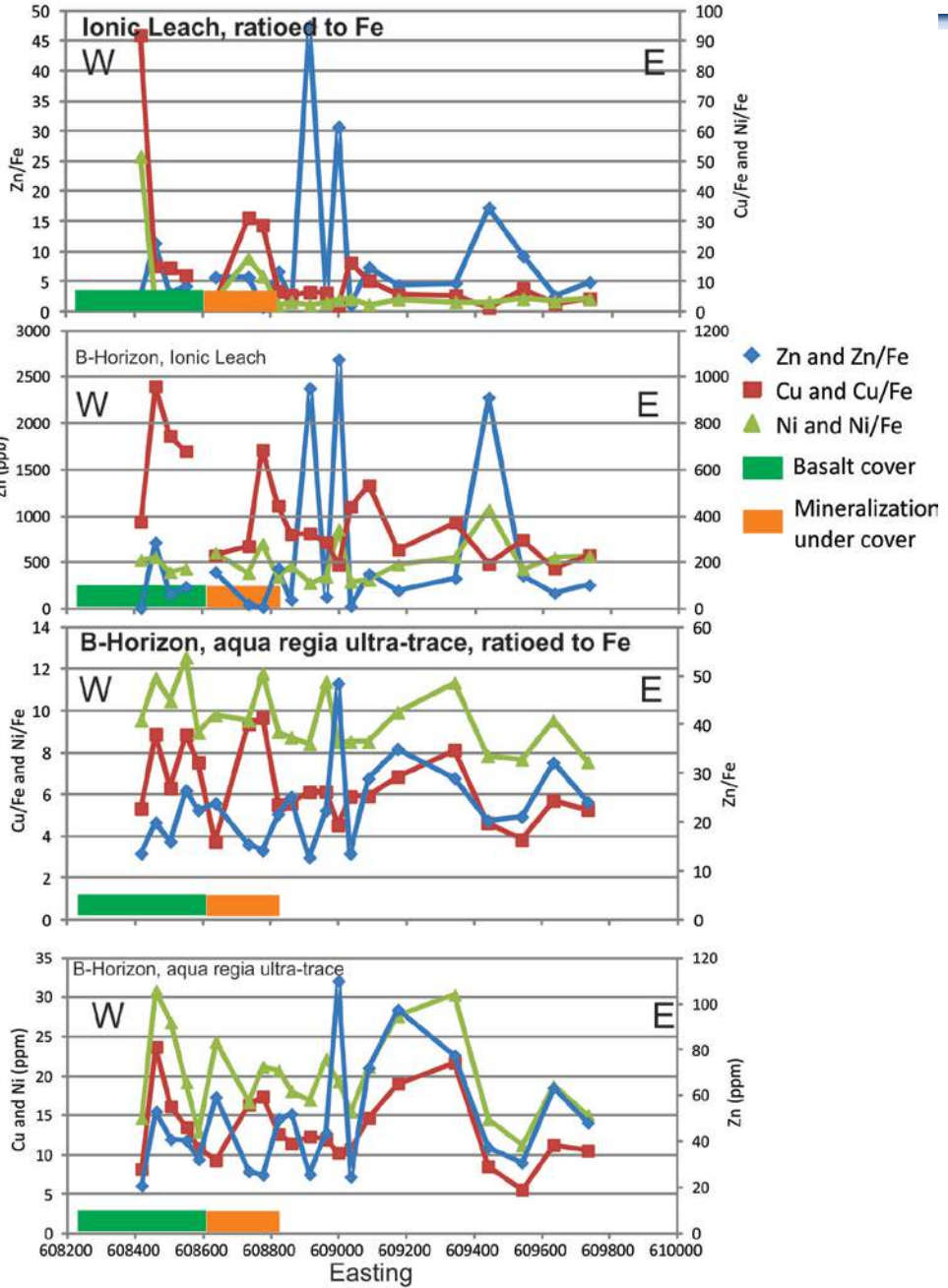
Narrow Rabbit-Ear Anomaly with OSG Copper Signature

Interpretation for anomaly and known mineralization not in the same spot.
Sample set too small?

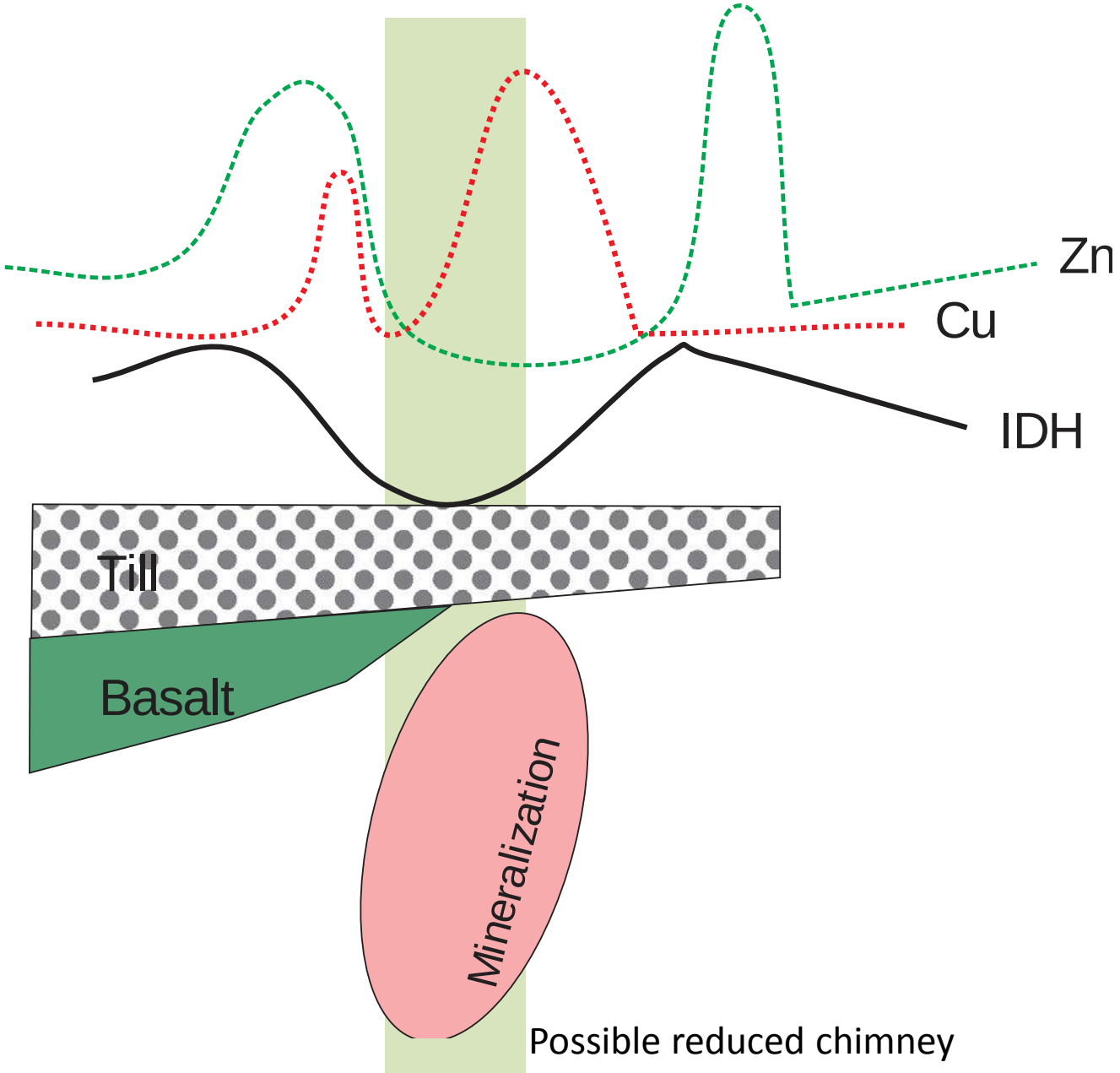
Effect of Fe



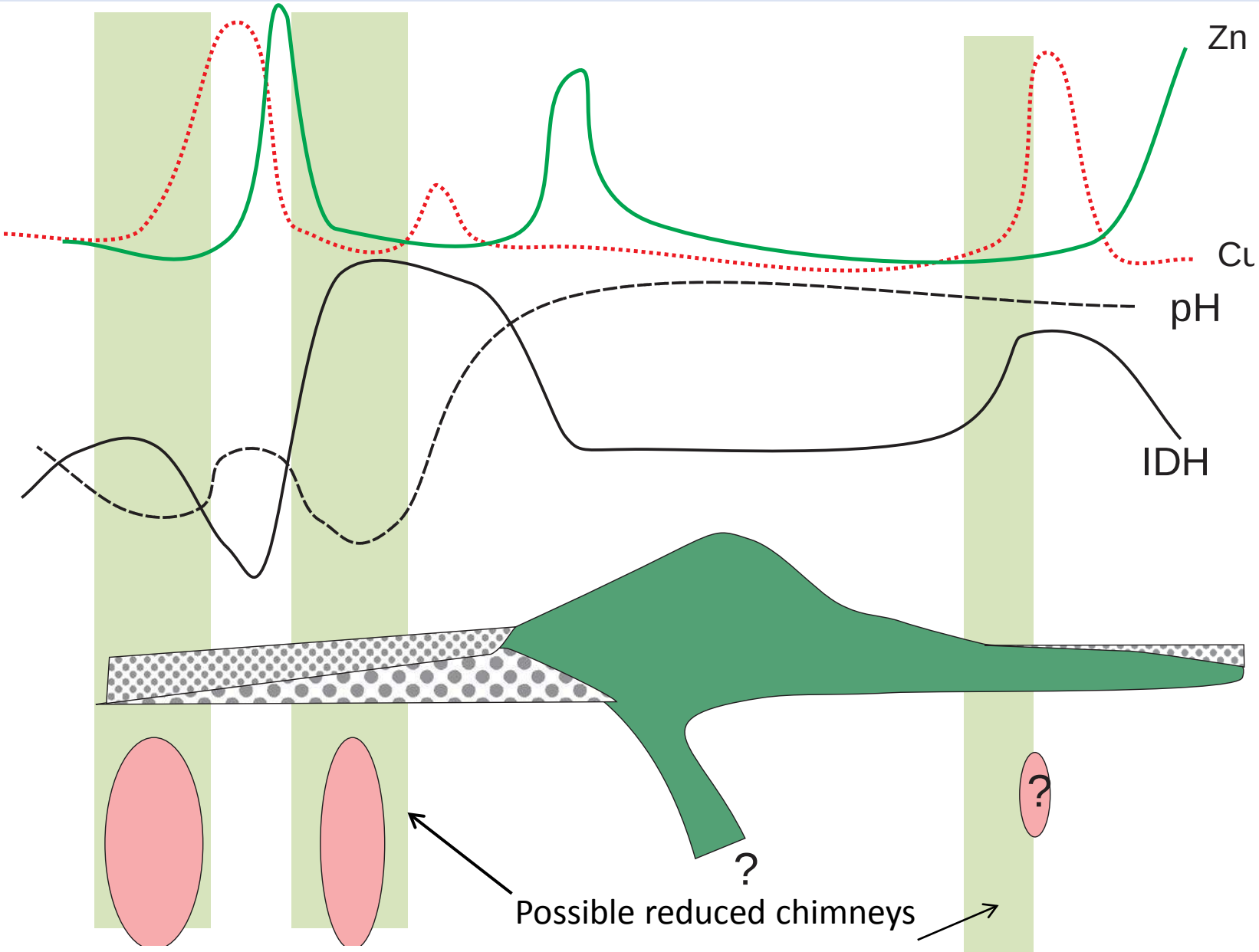
Three Firs



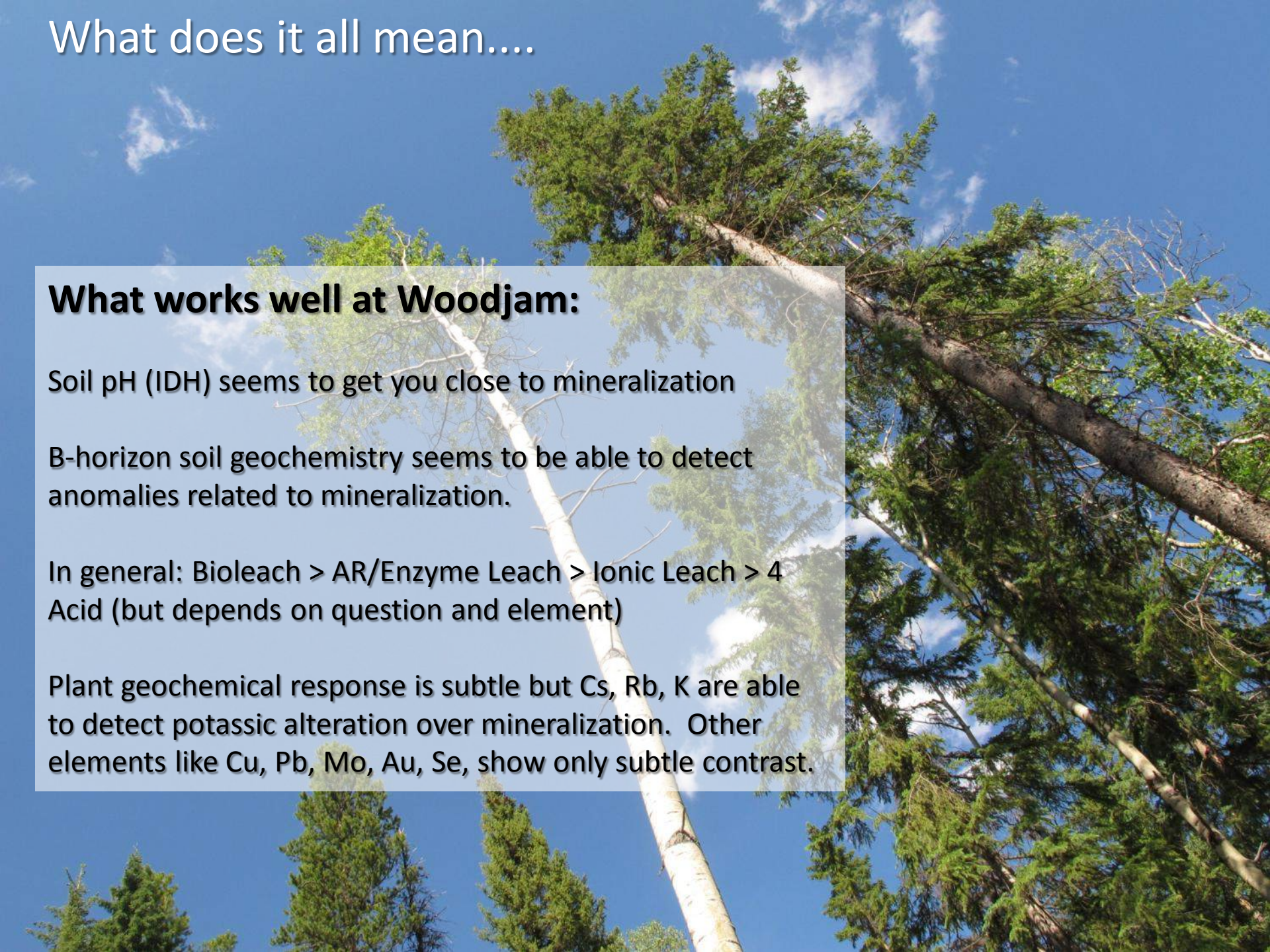
The situation simplified/interpreted at Three Firs



The situation simplified/interpreted at Deerhorn



What does it all mean....



What works well at Woodjam:

Soil pH (IDH) seems to get you close to mineralization

B-horizon soil geochemistry seems to be able to detect anomalies related to mineralization.

In general: Bioleach > AR/Enzyme Leach > Ionic Leach > 4 Acid (but depends on question and element)

Plant geochemical response is subtle but Cs, Rb, K are able to detect potassic alteration over mineralization. Other elements like Cu, Pb, Mo, Au, Se, show only subtle contrast.

What does it all mean....

Basalt is not impermeable to geochemical signal:

One “ear of the rabbit” over basalt, the other over till at both Three Firs (several elements) and Deerhorn (Zn)

Why should it be anyway? Columnar jointing, porosity....

Ideas and further work (but not planned specifically):
Amygdule chemistry expanded
Does the presence of calcite amygdules by itself indicate location at the edge of reduced chimney?

Constructive comments are appreciated...

Spruce exudate field tasting for anomalies

Hop tea tasting far beyond anomalies