

# Are there elephants hiding in the Jurassic of Yukon? A tectonomagmatic perspective on porphyry prospectivity

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**Abstract:** Within British Columbia, Triassic-Jurassic felsic plutonic and intrusive rocks of the Stikinia and Quesnellia terranes are very much considered “elephant country”, and are spatially and genetically associated with some of the most significant porphyry Cu-Mo deposits in North America. However, where these terranes meet and merge in central Yukon, little significant mineralization has been discovered in similarly aged felsic plutonic rocks and they host only one operating Cu mine, despite outcrop covering hundreds of square kilometres. The reasons for this discrepancy are not clear. In order to provide assessment of the tectonomagmatic setting and porphyry prospectivity of Jurassic plutonic rocks within Yukon, 65 unmineralized samples from across the district have been analyzed for their whole rock major and trace element geochemistry, and their zircon  $Ce^{4+}/Ce^{3+}$  ratios were determined by laser ablation ICP-MS. Most samples plot within calc-alkaline to high K calc-alkaline fields within a plot of  $SiO_2$  vs.  $K_2O$ , although data display significant scatter and lack any strong trend, suggestive of later disturbance of the K content. Rocks from all sampling locations show HFSE depletions and negative Nb anomalies characteristic of suprasubduction zone environments, and commonly depleted HREE patterns are suggestive of melt generated below the depth of garnet stability. Plots of Sr/Y vs. Y and La/Yb<sub>N</sub> vs. Yb<sub>N</sub> both indicate significant adakite-like and adakitic characteristics in a subset of the samples analysed. Taken together, the suprasubduction zone character and presence of adakite-like magmatism have been suggested as strong indicators of high porphyry potential in other parts of the world. Zircon  $Ce^{4+}/Ce^{3+}$  values were highly variable and ranged up to more than 2100, an order of magnitude greater than previous studies have suggested as a porphyry prospectivity threshold. However, aluminum-in-hornblende data and Cu and Mo contents well below crustal abundances suggest that Jurassic plutonic rocks may represent the mid-crustal, volatile-depleted residue of porphyry-related magmatism that has been eroded away. Future exploration for Cu-Mo-Au mineralization within Yukon will depend on understanding of tectonic uplift across the region, and better constraint on the genesis of known mineralization.

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## Are there elephants hiding in the Jurassic of Yukon? A tectonomagmatic perspective on porphyry prospectivity

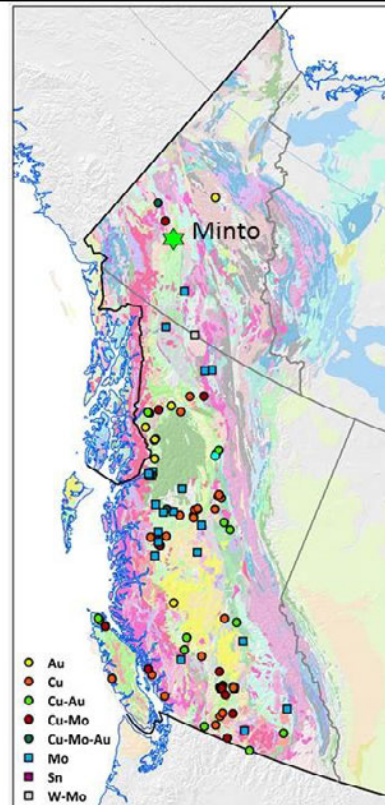
John B. Chapman  
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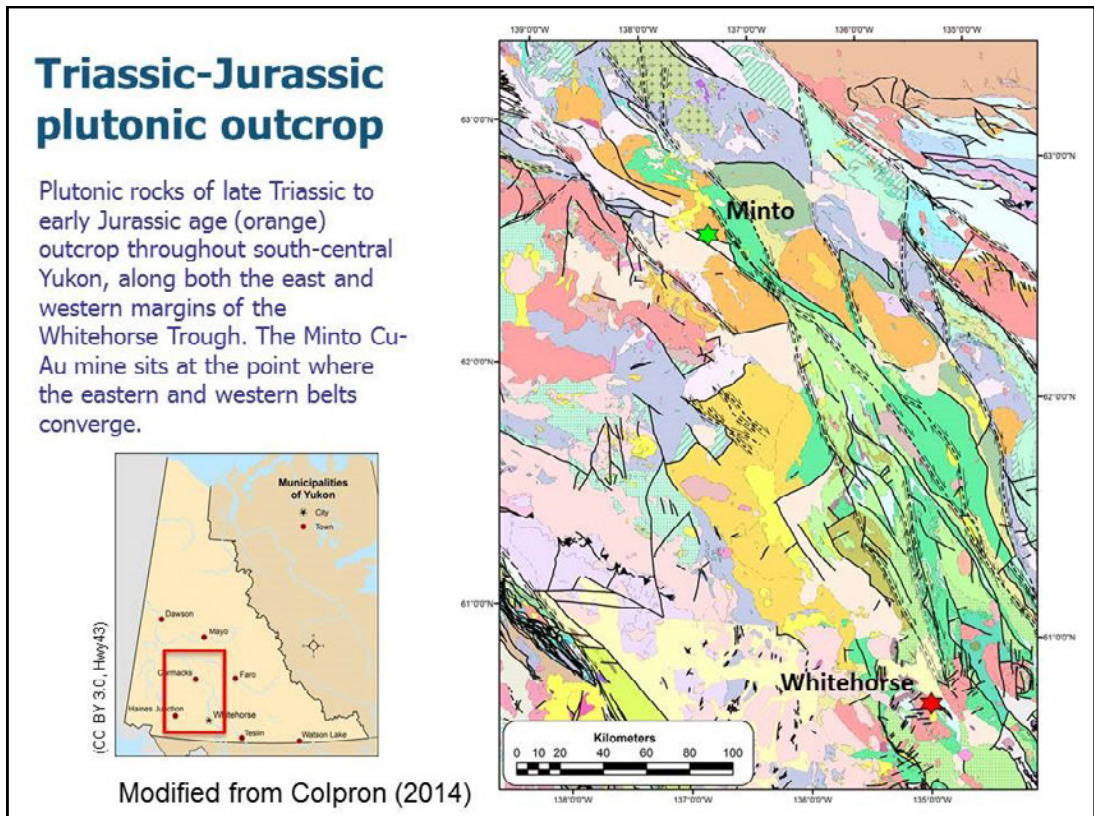
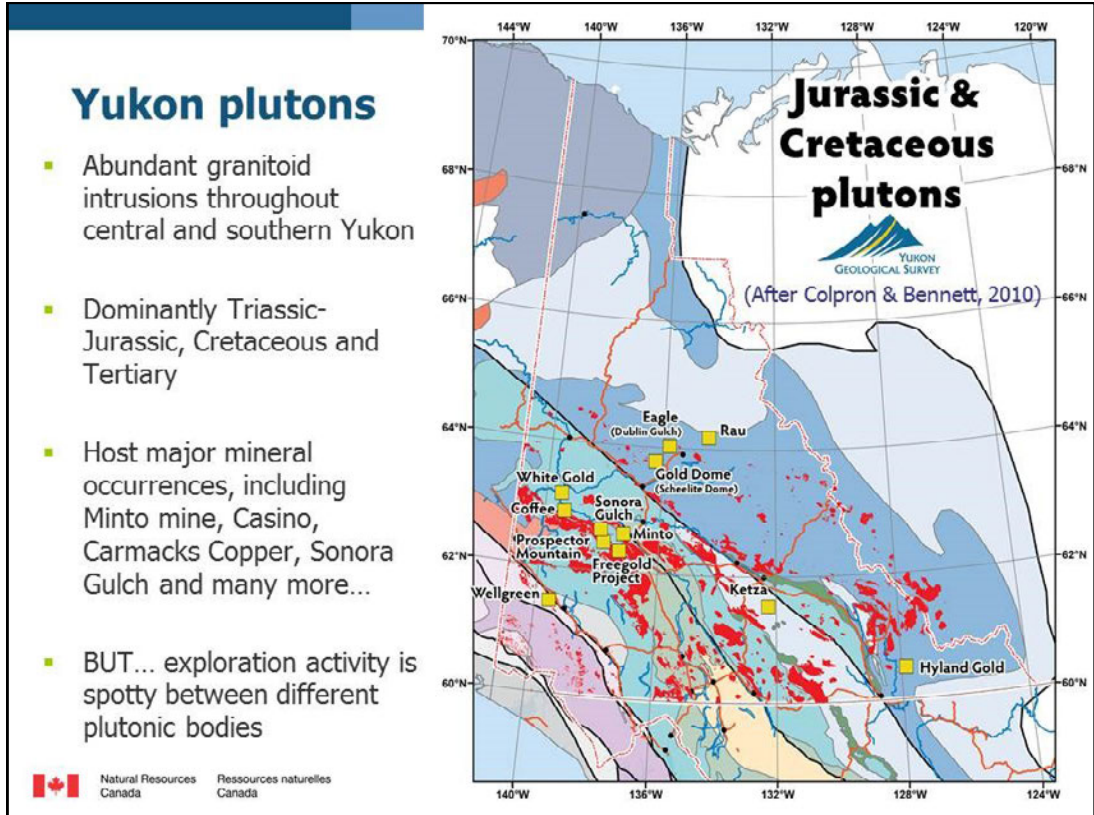
### Uneven distribution?

- Triassic-Jurassic granitoids host or are linked to most of British Columbia's largest and economically significant porphyry Cu-Mo and Cu-Au ore bodies
- To date, only one operating Cu-Au mine in the Yukon: Minto
- However, the Intermontane Superterrane, including Stikine and Quesnel terranes, has significant outcrop in Yukon.



Data from  
Sinclair (2007)

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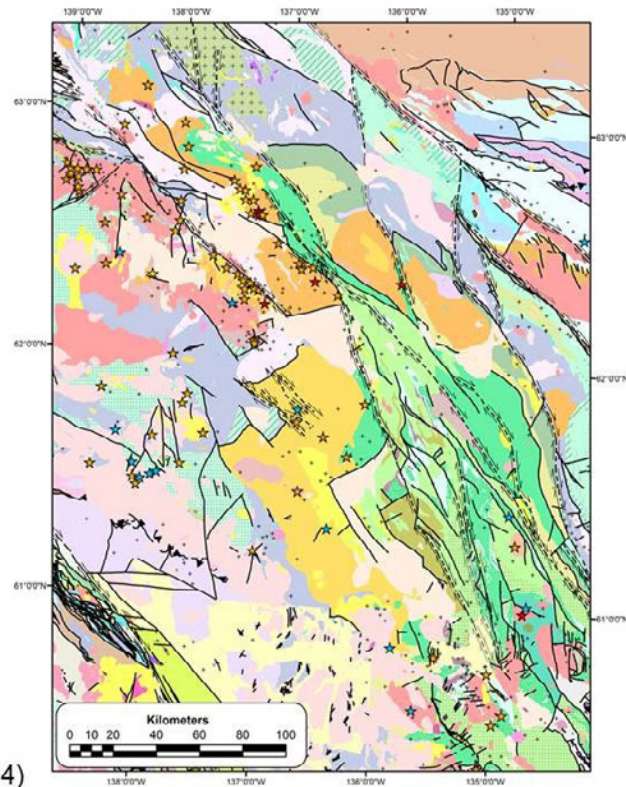


## MINFILE occurrences

While plutonic rocks Cretaceous age (dark pink) west of the Big Creek Fault contain abundant porphyry occurrences listed in the MINFILE database, occurrences recorded for the Triassic-Jurassic suite are sparse, and dominantly located in the Granite Mountain and Minto plutons, in the vicinity of known economic mineralization at the Minto deposit itself and the Carmacks deposit (formerly Williams Creek).

Most occurrences are of the normal calc-alkalic porphyry Cu type (orange stars), but some instances of alkalic Cu (red stars) and porphyry Mo (blue stars) have been reported.

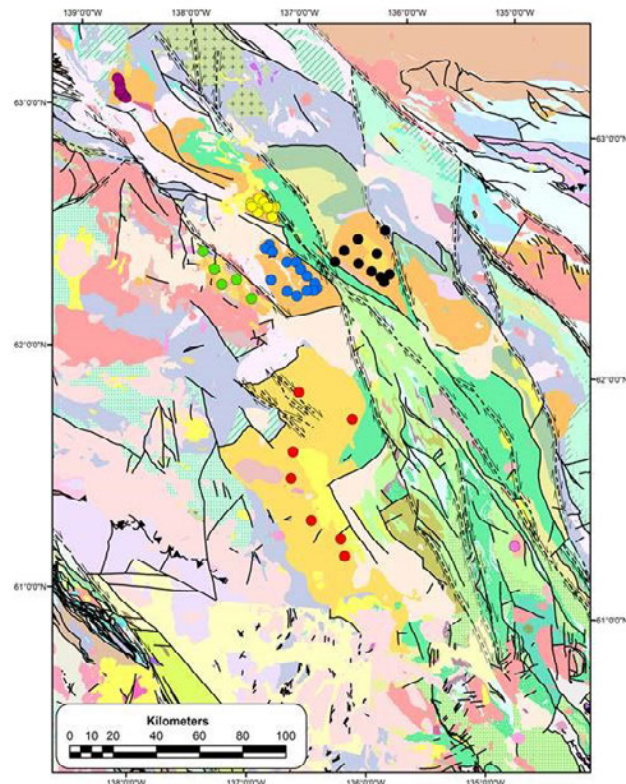
Modified from Colpron (2014)



## Sampling distribution

In order to examine the tectonomagmatic setting of Triassic-Jurassic plutonic rocks in central Yukon, 65 samples were taken from the surface outcrop locations shown.

Individual pluton and batholith names are used to distinguish sampling locations (below).




## Fieldwork and sampling



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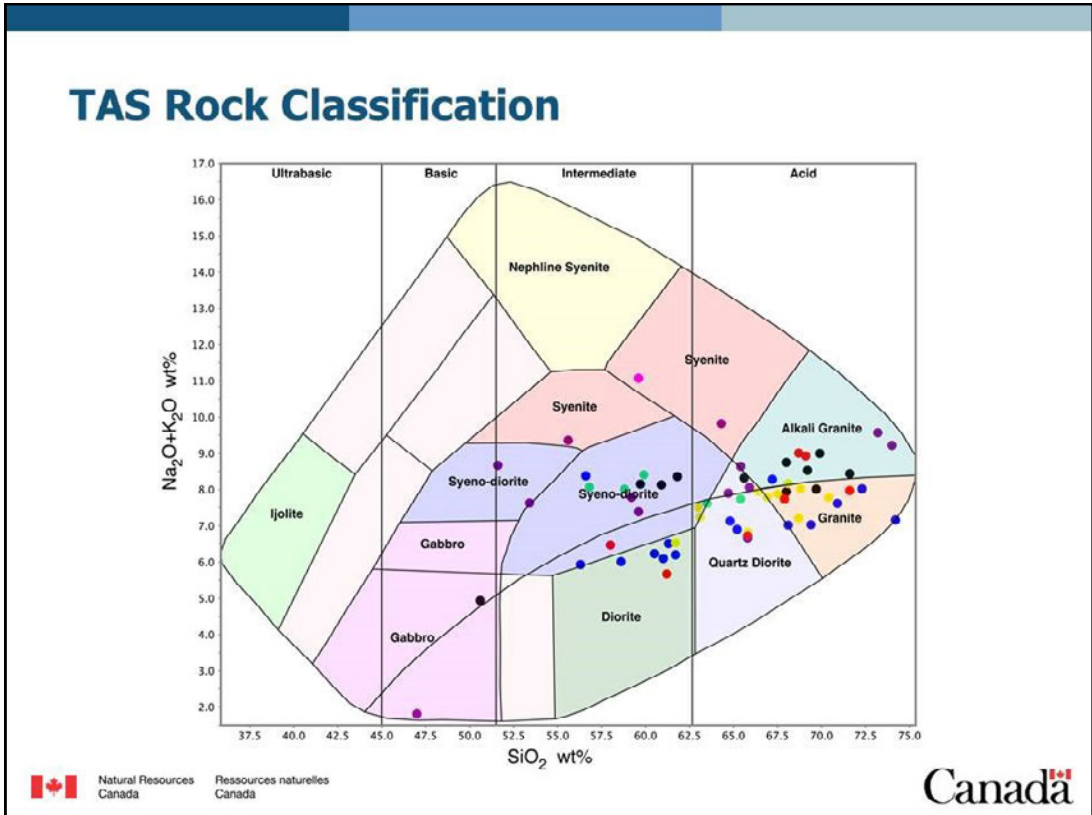


Tatchun

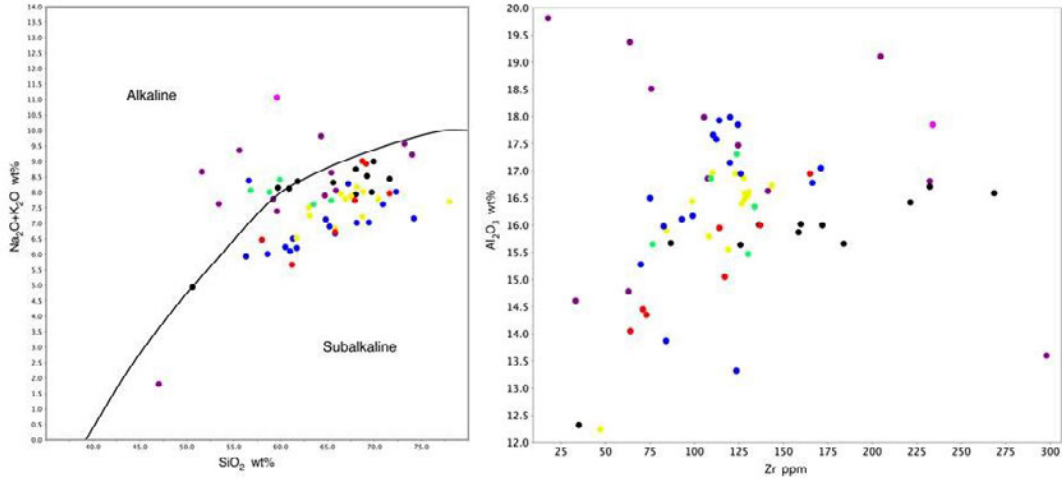
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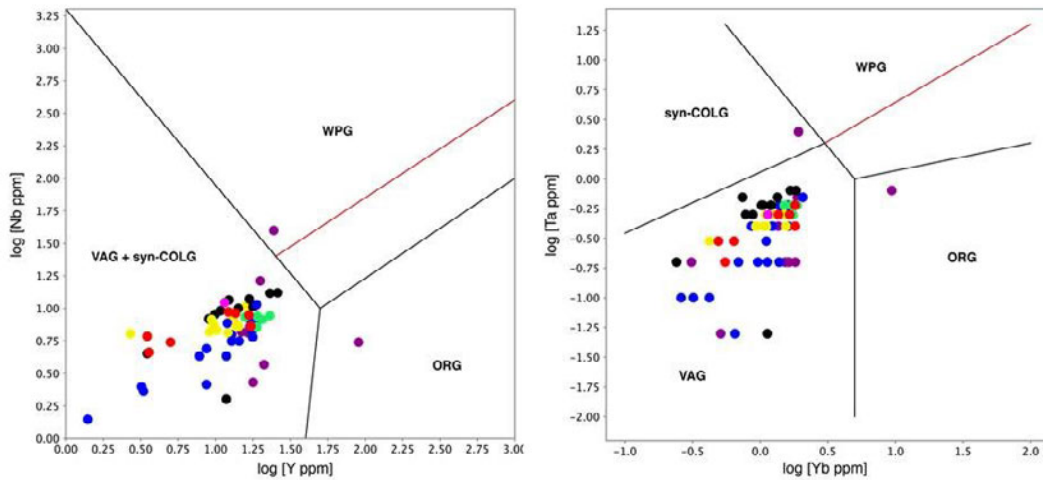




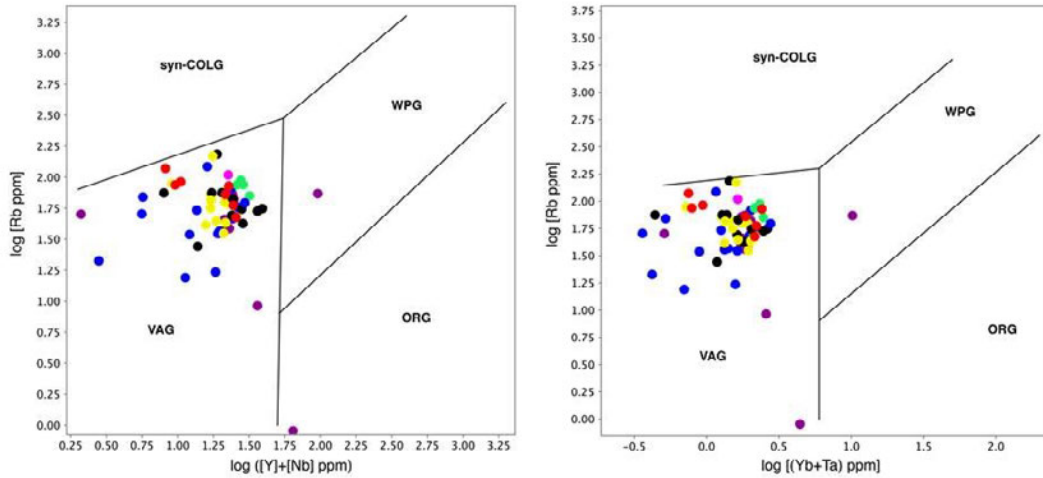
## Classification



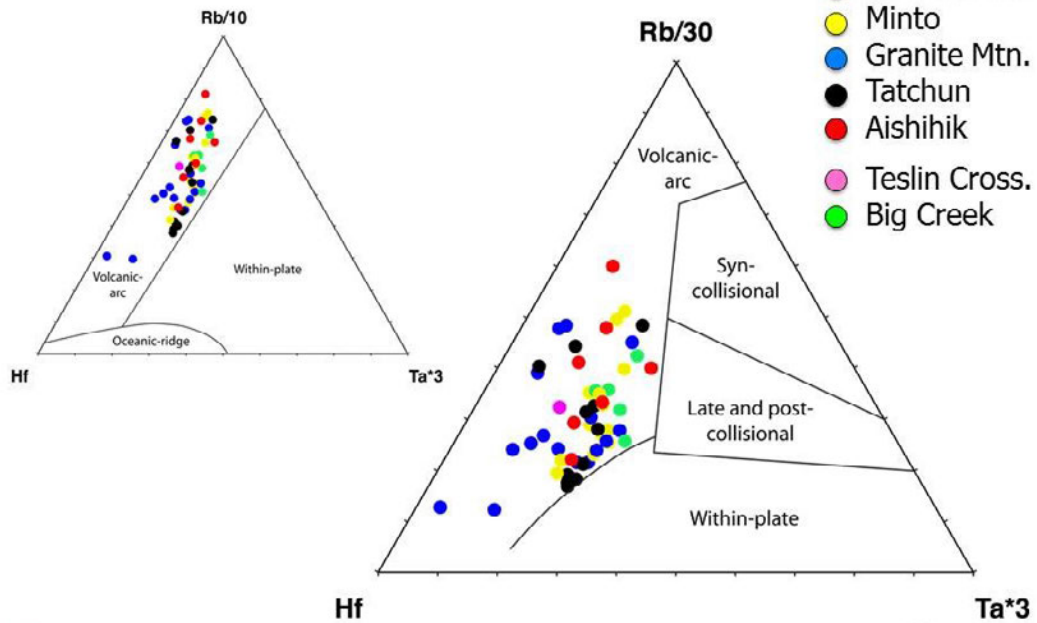
## Pearce tectonic discrimination



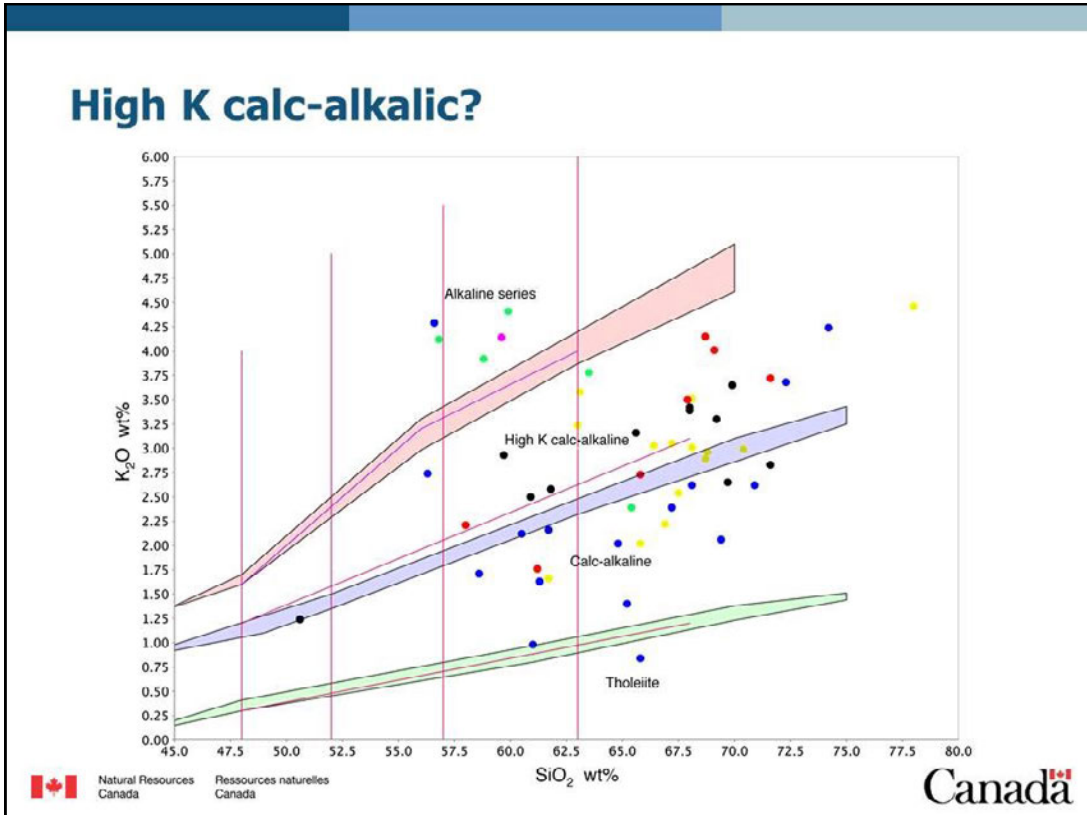
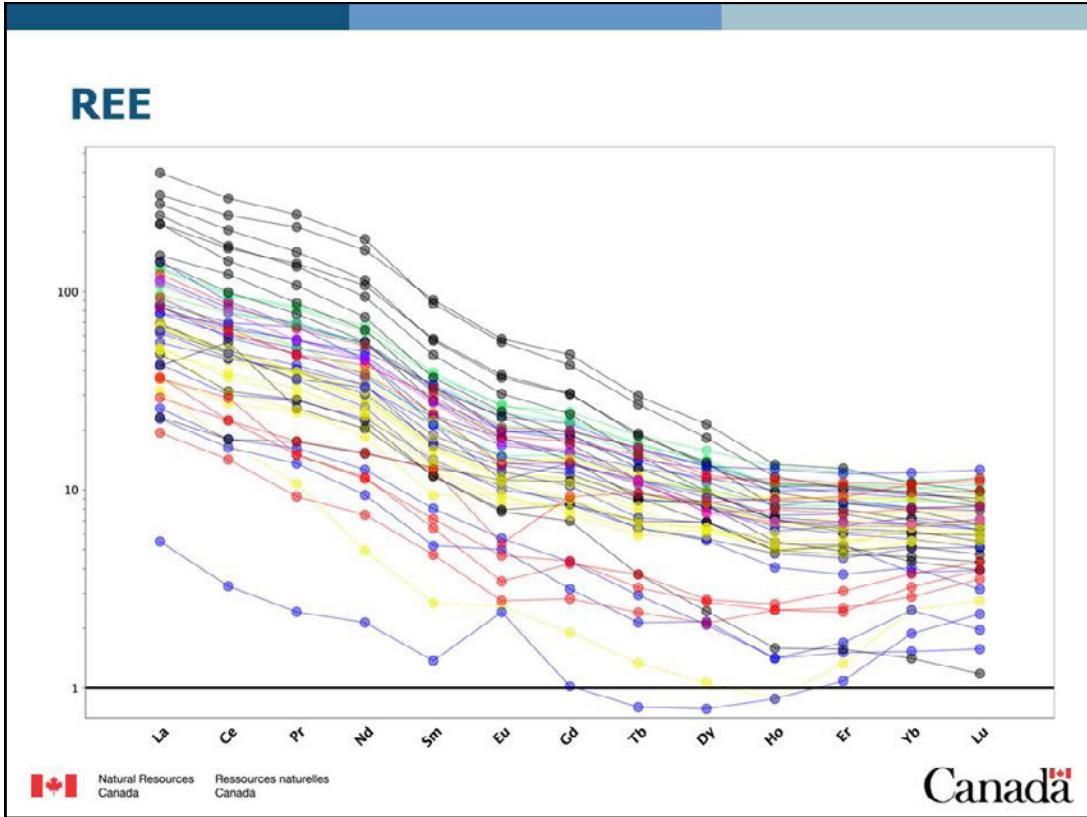
## Pearce tectonic discrimination



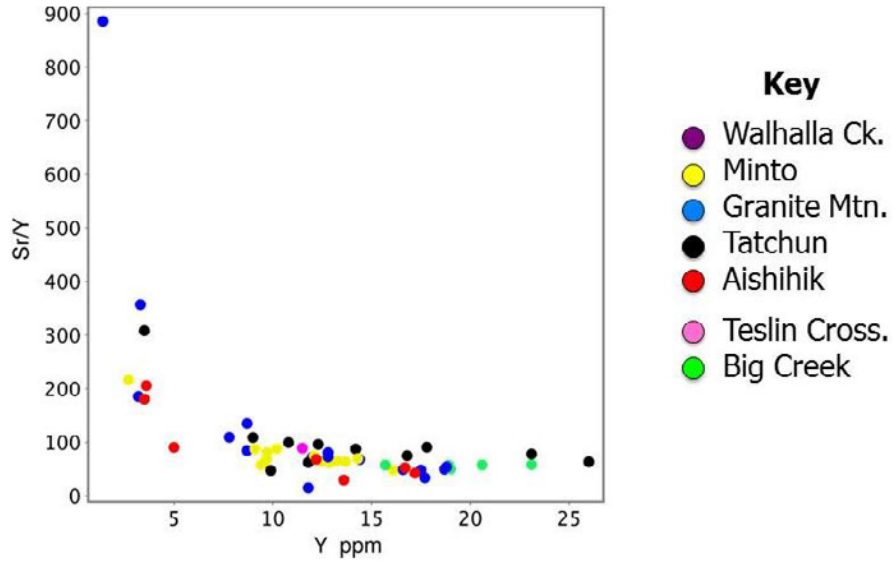
## Harris tectonic discrimination



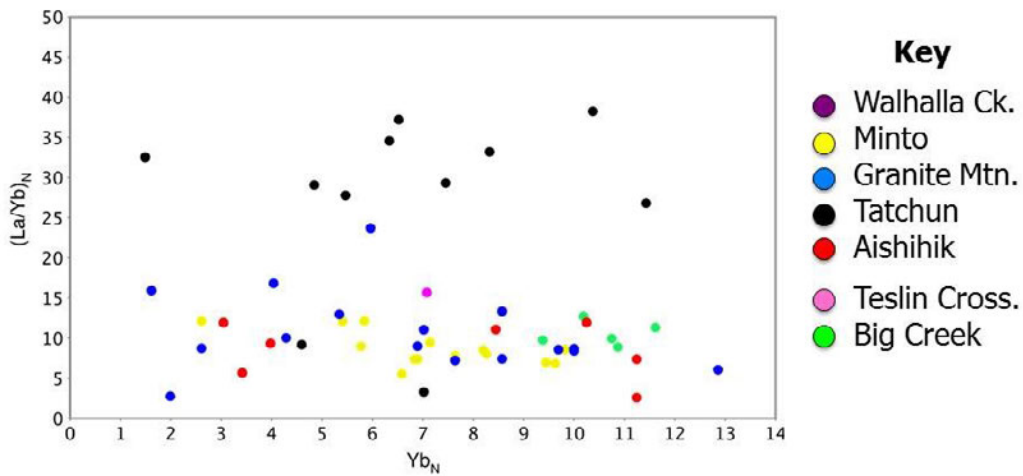


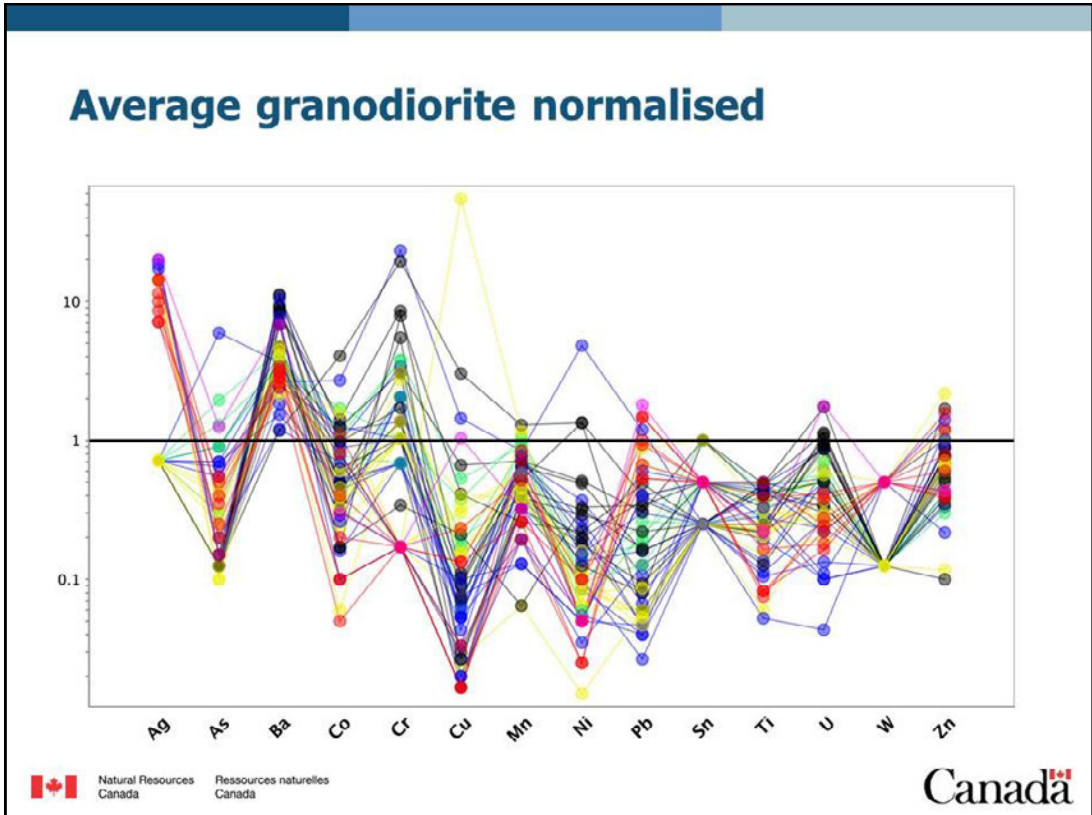
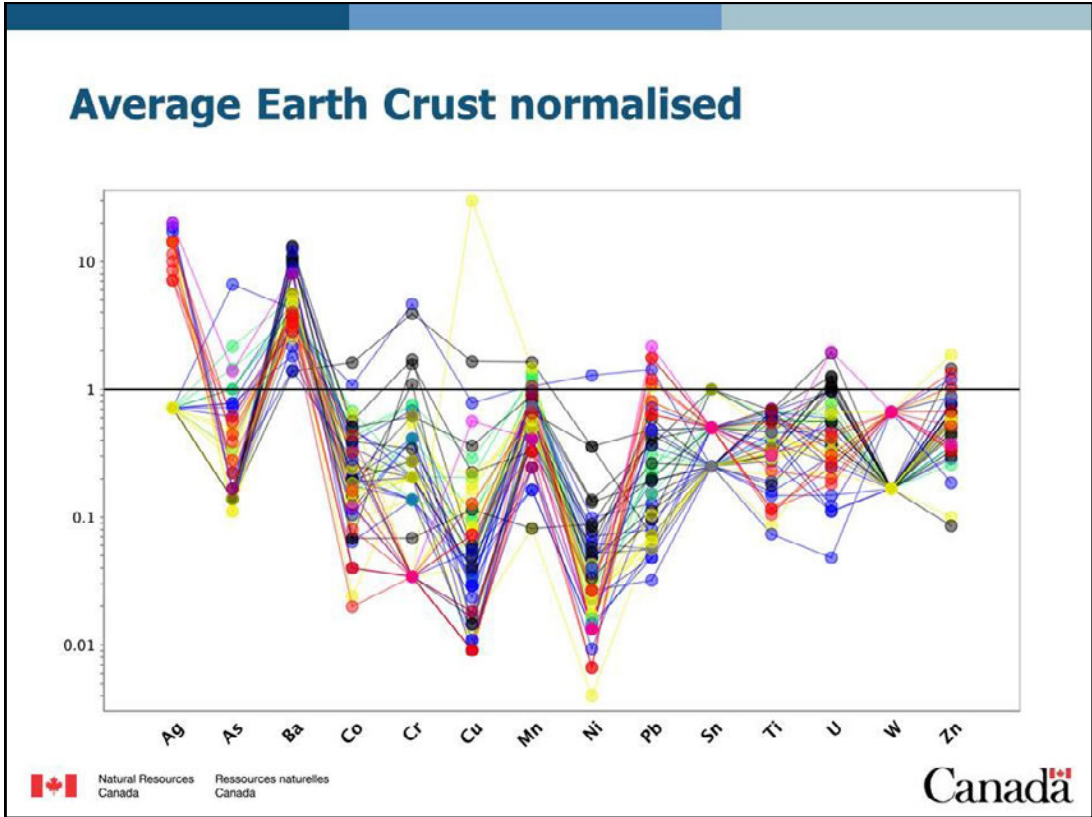


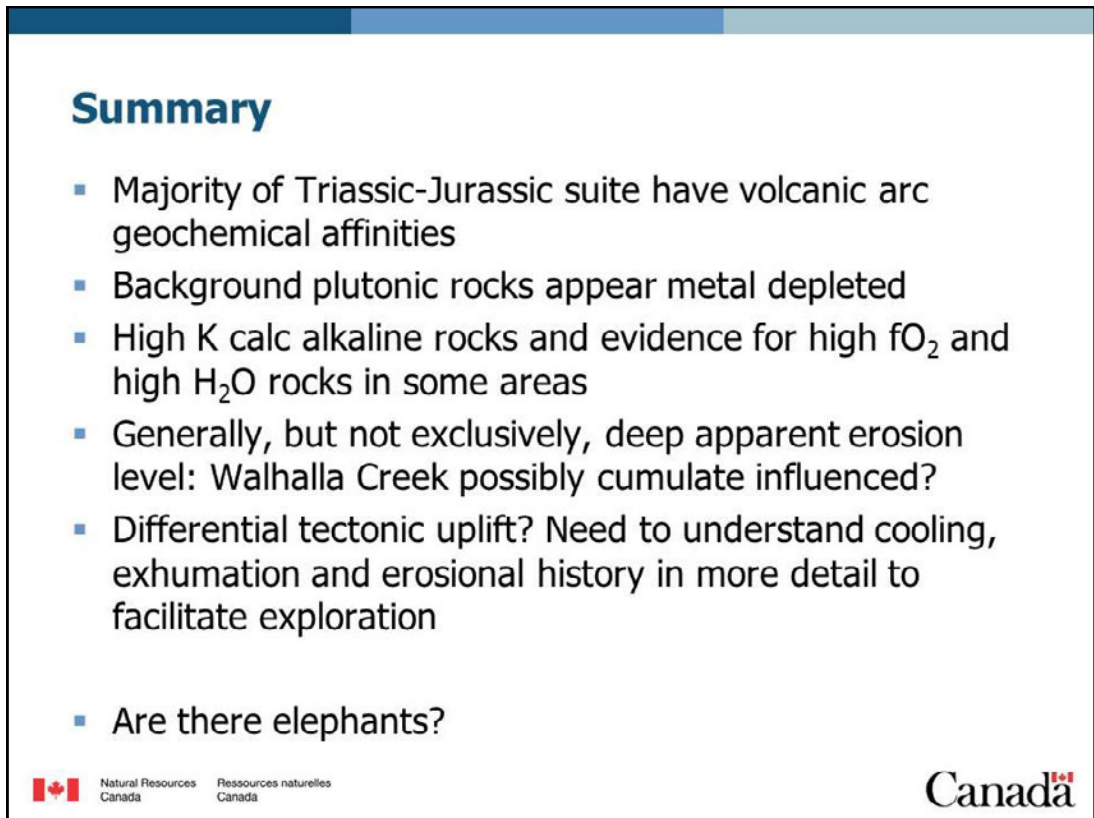
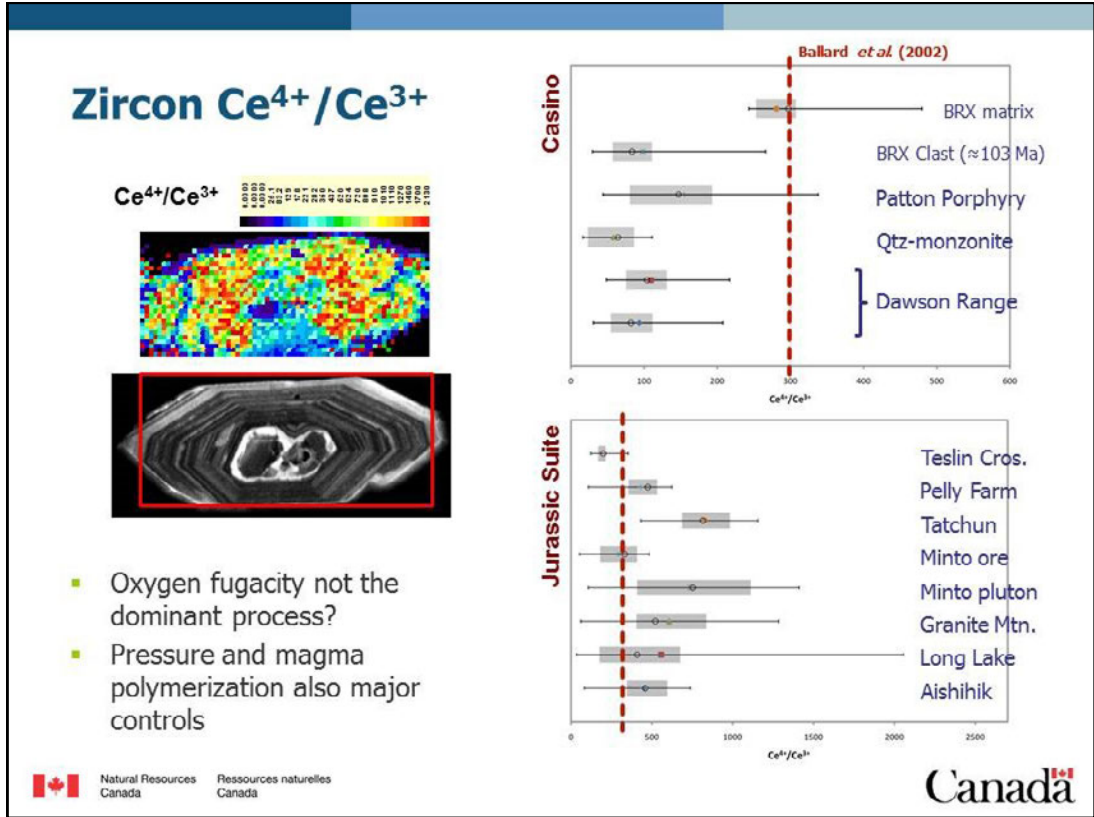
### Other genetic indicators...



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## Minto and Carmacks Copper?

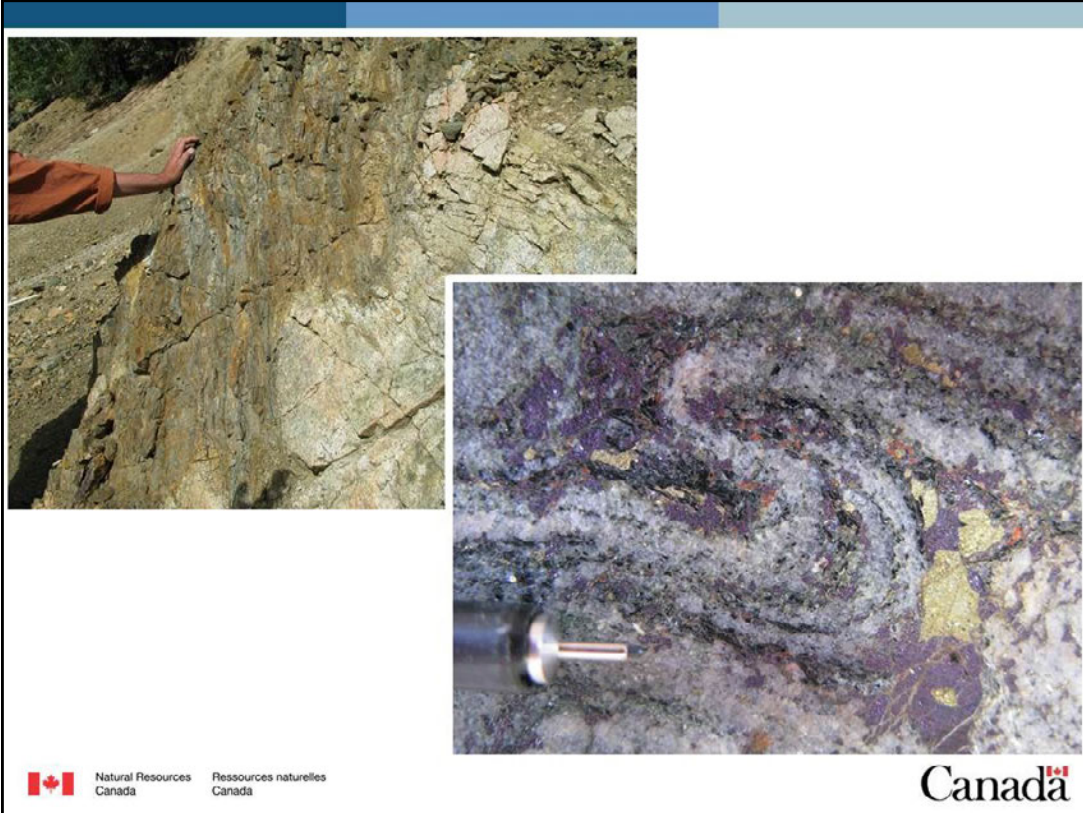


Measured & Indicated Resources:  
~49.3 Mt @ 1.10% Cu, 0.40 g/t Au, 3.85 g/t Ag  
(Capstone Mining Corp., Dec. 2013)

Photo taken July 2011

## Minto and Carmacks Copper?





## References

- Colpron, M. 2014. Update of the Yukon Bedrock Geology Map – Updated Bedrock Geology Polygons. Yukon Geological Survey.
- Sinclair, W.D. 2007. Porphyry deposits. *In*: Goodfellow, W.D. (ed.) *Mineral Deposits of Canada: A Synthesis of Major Deposit-types, District Metallogeny, the Evolution of Geological Provinces, and Exploration Methods*. Mineral Deposits Division, Geological Association of Canada, Special Publication 5. Supplementary GIS data.