

## **Insights into Exploration Geochemistry (4): The importance and value of regional geochemical datasets**

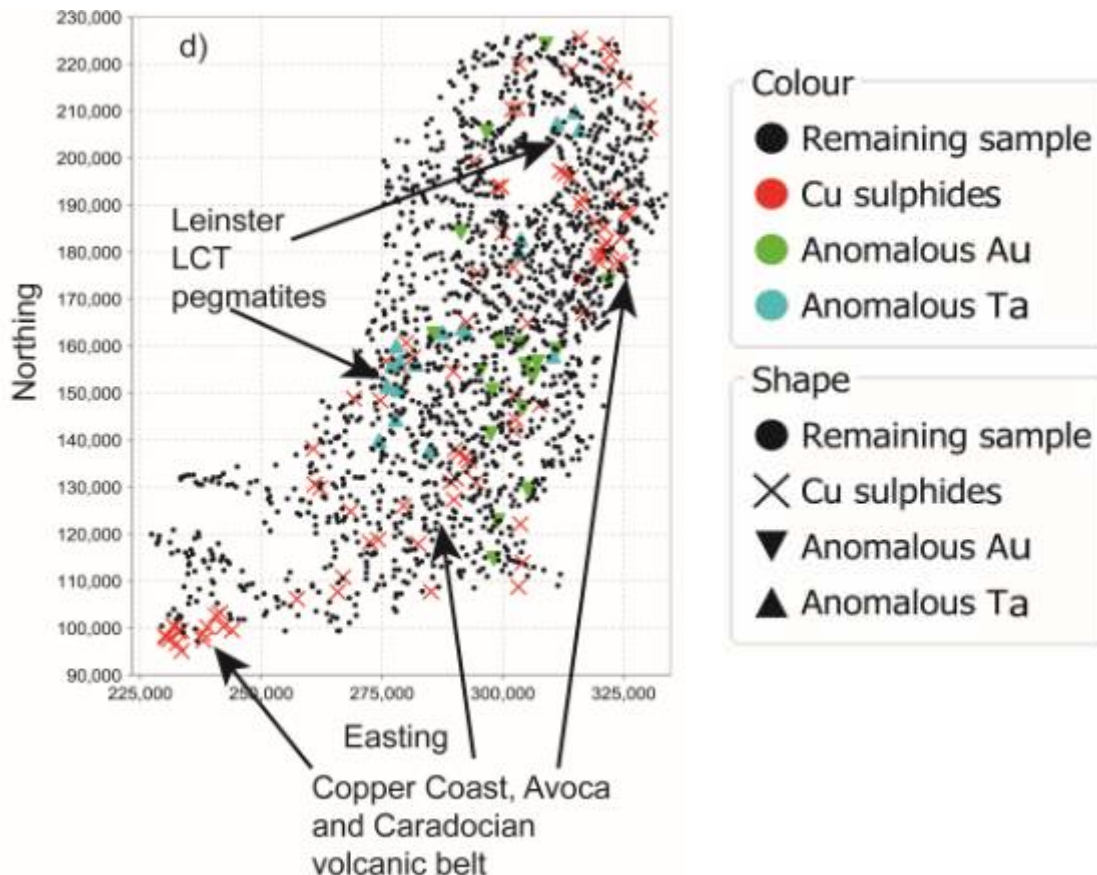
Many countries or federal states make geoscientific data available through respective governmental surveys. As most geologists know, these data repositories can truly be chests of information potentially hiding undiscovered mineral deposits. I have spent many years working with and sifting through geochemical data, looking for a number of commodity specific aspects. I am always surprised to uncover new information in 'old' data. In my recently accepted paper (reference below) I outline a workflow that allows geologists to quickly and efficiently screen regional and license scale, multi-element geochemical datasets and to fingerprint regional geology and mineralisation systems. Further applications in mining are lithological and geometallurgical domaining of drillhole data.

Most of us routinely use geochemical survey data to define anomalous vs. background populations. However, the availability of multi-element geochemistry offers a lot more to geologists than merely locating anomalies. Key to this all is a fundamental understanding of petrogenesis and primary and secondary dispersion processes, principally the basics of every 'Igneous and Metamorphic Petrology' lecture that is sometimes perceived 'difficult' by generations of geology students. In simple words, you will have to understand how rocks form and how elements are distributed throughout primary and secondary rock forming processes. Every rock type is unique in its major and trace element composition and therefore can be fingerprinted. A compilation of unique lithogeochemical values and petrogenetic ratios is consequently of great importance for each area under investigation.

I will demonstrate some interpretation techniques using selected examples from SE Ireland and a West African country.

**SE Ireland (GSI dataset):**

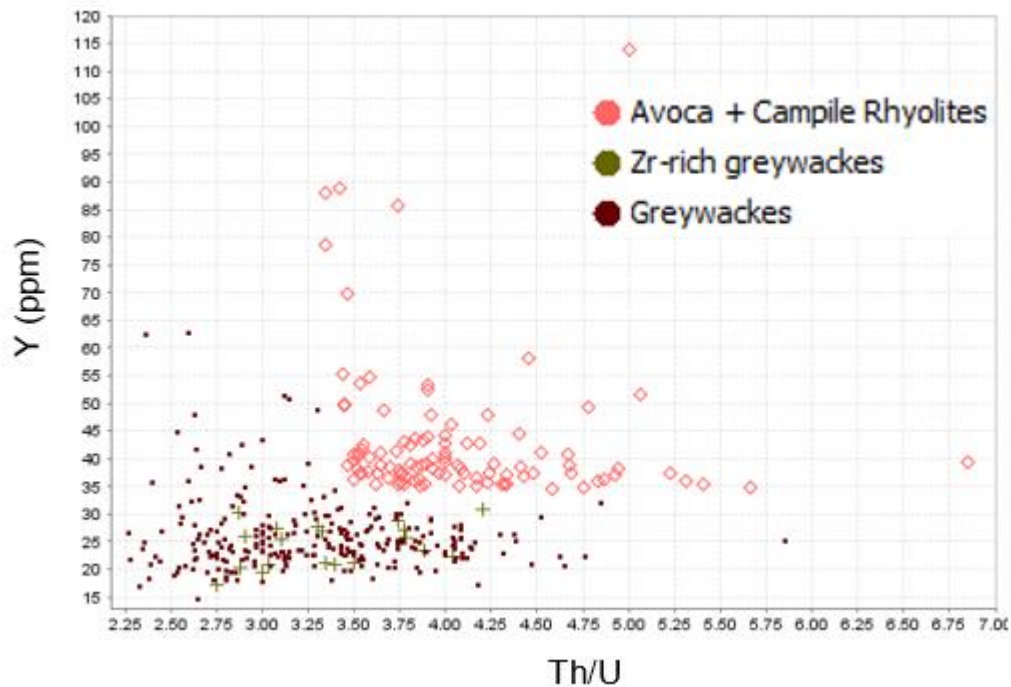
The Leinster Granite and the Caradocian Volcanic Belt are host to a multitude of mineral deposits, such as LCT pegmatites in the Leinster Granite and VMS deposits at Avoca and the Copper Coast. Determining the 99<sup>th</sup> percentile in Au, Cu and Ta cumulative frequency plots allows to quickly screen several thousand square kilometres of land for prospective LCT and VMS occurrences.



That was easy.

More challenging is the actual fingerprinting of rock types, such as the occurrence of peralkaline rhyolites in Ordovician greywackes and schists. This will require a more fundamental understanding of petrology and geochemistry. In the example below, I separated a rhyolite cluster from metasediments by using a combination of Y enrichment (a **High Field**

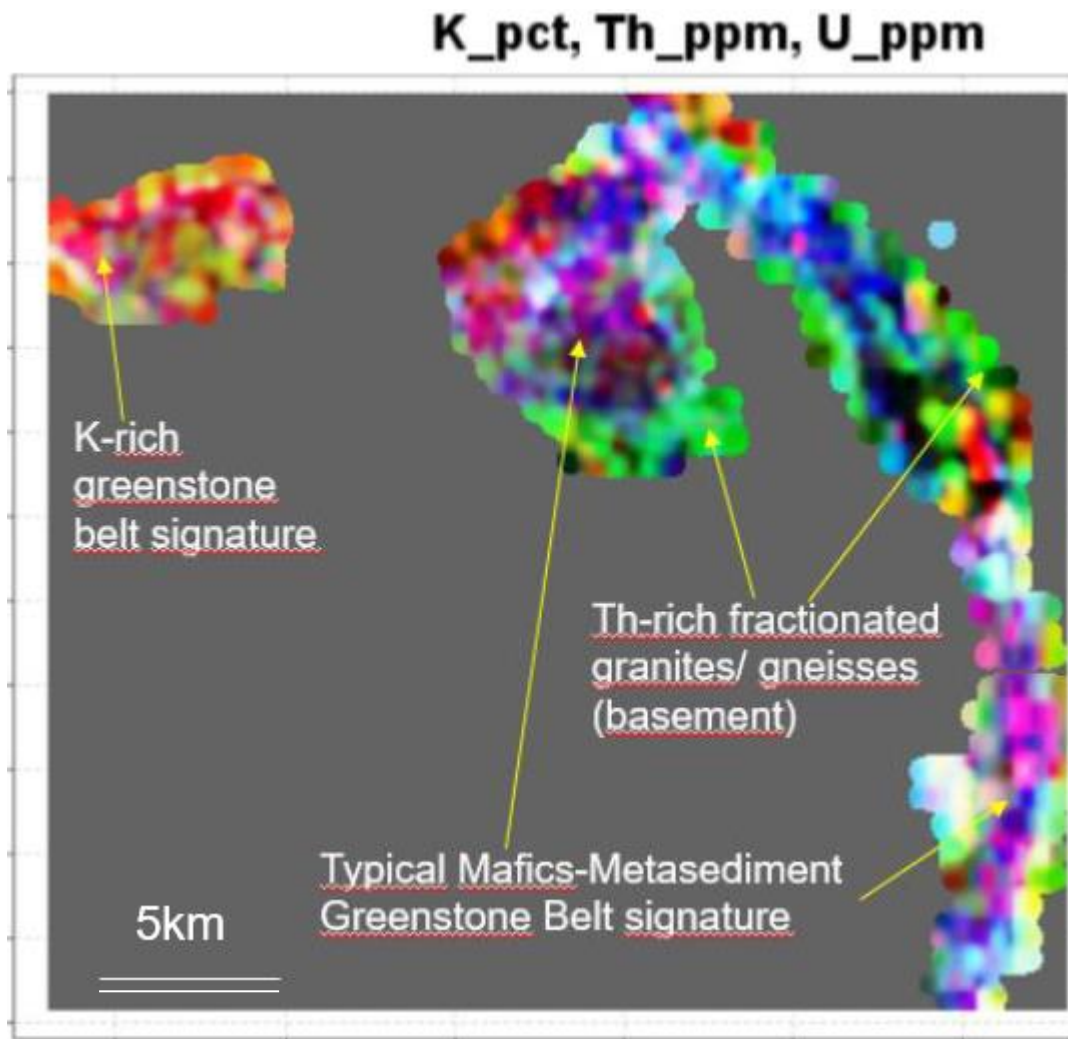
Strength Element often present in rhyolites) and a generally high Th/U ratio indicative of Th minerals present and not fractionated, i.e. removed from the melt.



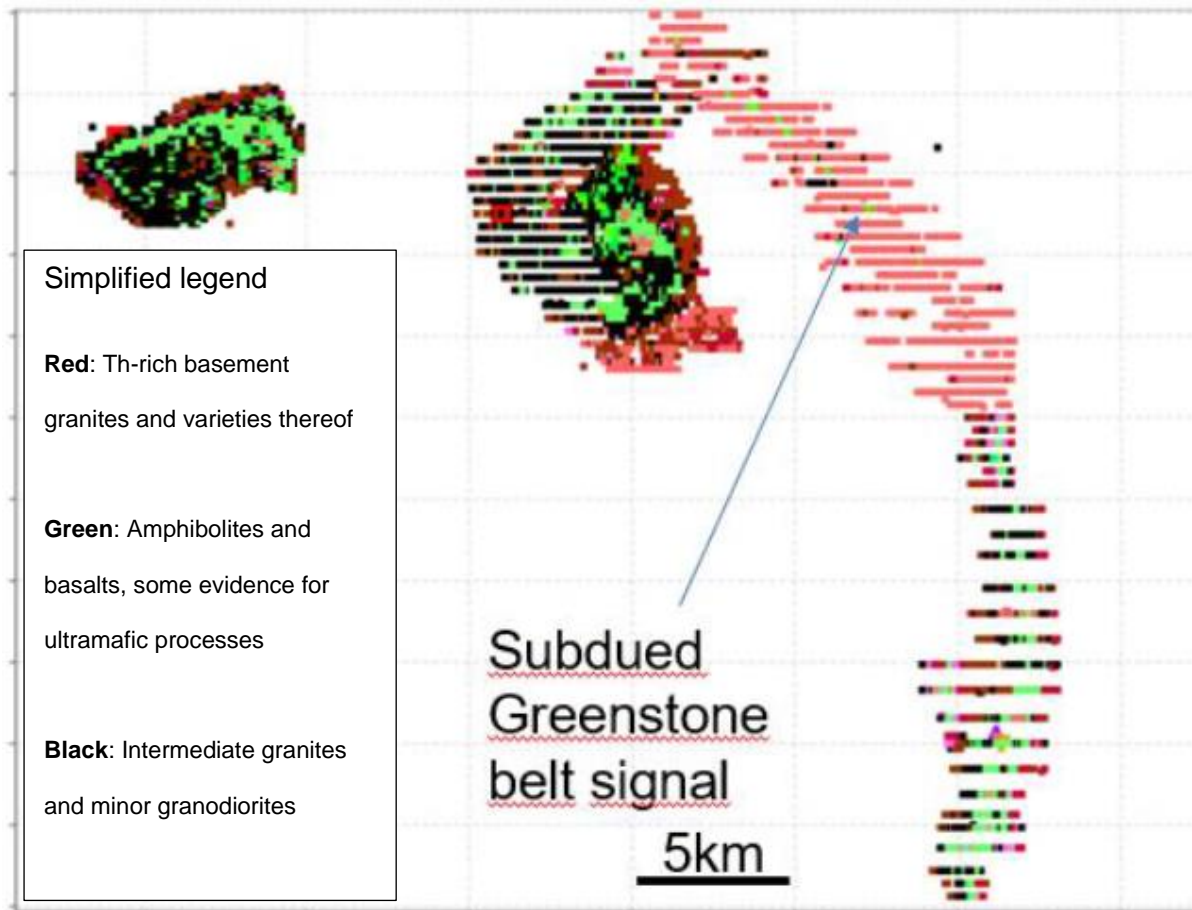
### West African country (Archean greenstone belt geology)

In 2017, I worked with a large proprietary dataset from a West African license area covered by tropical overburden. The aim was to locate areas prospective for gold in a greenstone belt setting (as it turned out, the greenstone belt contained LCT pegmatites as well).

A simple radiometric RGB plot helped to 'look' under cover and reconstruct regional geology within 5 minutes of starting the process, therefore improving a very broad 1980s governmental map in a short while. Normally, this approach is used when interpreting airborne radiometric surveys, but as you can see, it also does work with rather tightly spaced (25x50m) soil samples.



Looking into trace element relationships, I defined 13 different lithologies clearly outlining the narrow greenstone belt sandwiched in between older granites and granitic gneisses. In particular, this approach enabled the detection of small occurrences of amphibolites and basalts in previously mapped granitic gneiss, hence implying the presence of greenstone belt lithologies in areas that were considered unprospective before. New targets generated! For simplicity, I have modified the legend of the map below.



Geochemistry is a fascinating approach to mineral exploration. If you are keen to learn more, why not attend one of my practical workshops? The next one will be held in [London](#), on November 12<sup>th</sup>.

#### References:

Steiner, B.M., 2018. Using Tellus stream sediment geochemistry to fingerprint regional geology and mineralisation systems in southeast Ireland. *Irish Journal of Earth Sciences*, in press.

Benedikt Steiner, 17/09/2018