MinExTarget

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PCA, SOM

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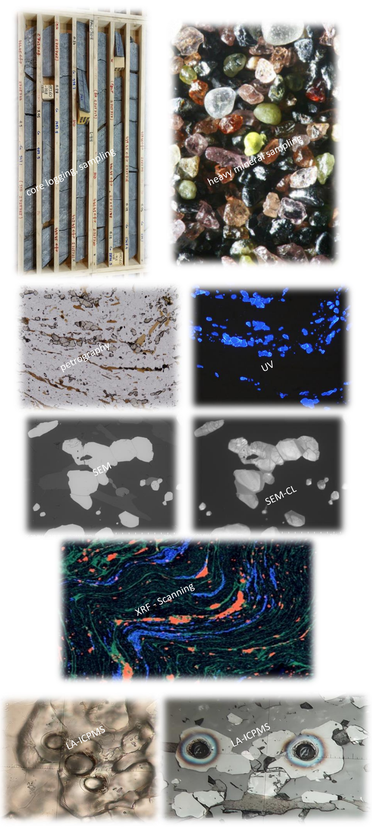
Advanced Mineral Exploration by heavy mineral trace element geochemistry.

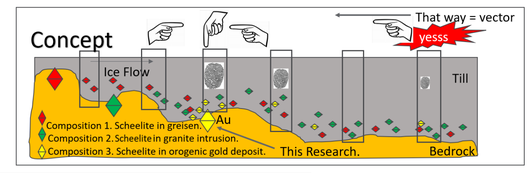
GTK MAWSON AGH GEUS UNIVERSITY OF OULU UNIVERSITY OF TROMSØ PALSATECH CRS Laboratories

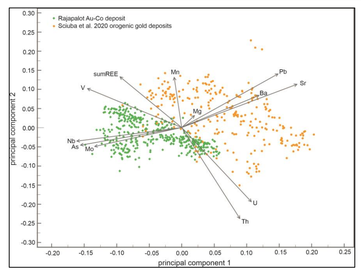
Introduction

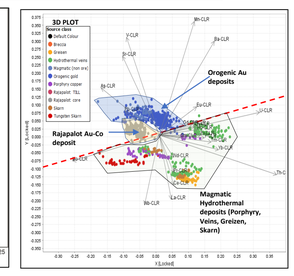
- MinExTarget is a GTK coordinated European Union project, funded by EIT Raw Materials under grant agreement no.19217 with partners including; AGH University of Science and Technology, Poland; CRS Laboratories Oy, Finland; Geological Survey of Denmark and Greenland – GEUS; Mawson Oy, Finland; Palsatech Oy, Finland; University of Oulu and University of Tromsø - Arctic University of Norway
- The project develops new exploration and targeting technologies and services, by incorporating automated electron - optical and laser ablation inductively couple mass spectroscopic analytical methods into the everyday practice of characterization of heavy mineral separates (e.g. pyrite, scheelite, apatite, cassiterite, rutile) from unconsolidated sediments.
- Trace element characteristics from analyzed heavy mineral grains can more effectively predict localizations and types of ores deposits compared to the bulk geochemical methods.
- The Rajapalot Au-Co project (Ranta et al., 2018), Peräpohja belt serves as the prototype testing area, where trace element signatures of pyrite, scheelite and monazite were analyzed from bedrock and till samples, within and around the prospect areas. Statistical data analysis, as well as supervised and unsupervised machine learning methodologies were applied to the resulting pyrite and scheelite datasets and gave the following results:
  - Analyzed <u>pyrite</u> bedrock grains carry an orogenic-Au signature, when compared with a global pyrite dataset, which is further subdivided into an Au-base metal style of orogenic-Au deposits in Lapland (Raič et al., 2022 and Raič et al., 2023 under review).
  - Although <u>scheelite</u> trace elements are closely associated with the orogenic Au-type in a global context, their heterogenous composition could point to a potential orogenic Au-base-metal-type (just as described for the pyrites; Szentpeteri et al., 2022 in press).
  - Both pyrite and scheelite, with trace element signatures of the Rajapalot Au-Co deposit, were successfully identified in till heavy mineral concentrates, pinpointing the orebody location up-ice.

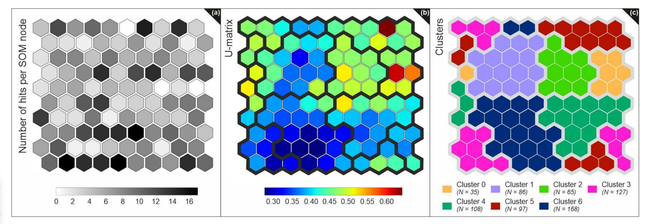


Concept and Methods

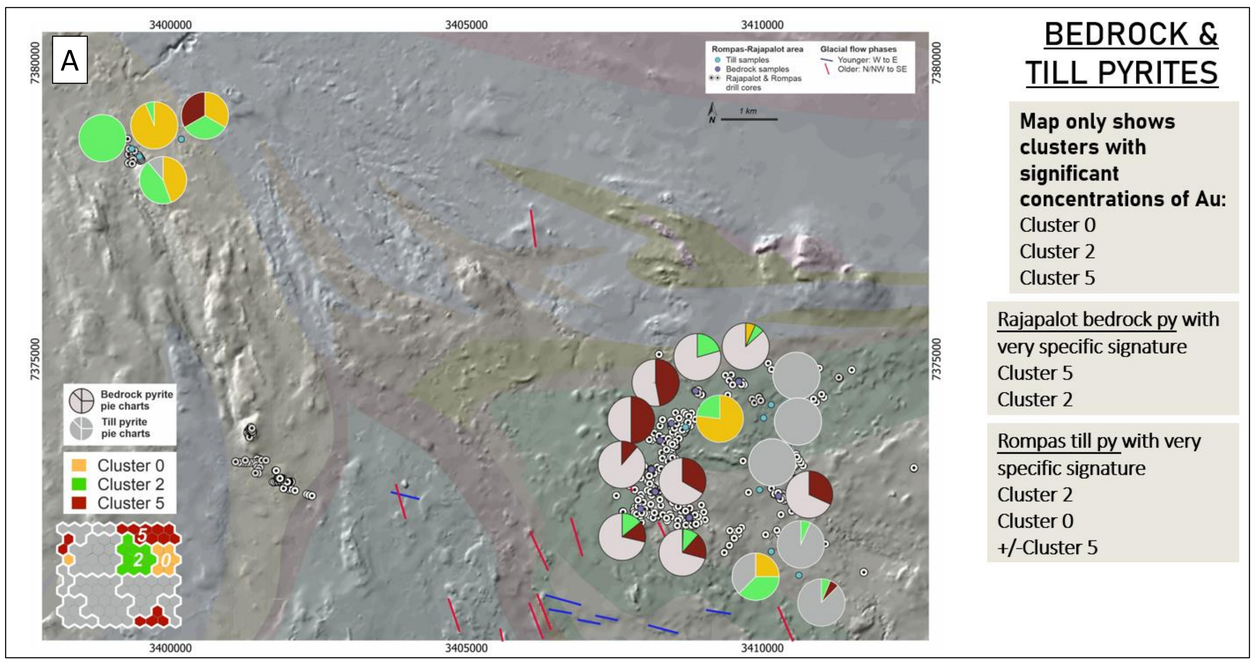








Prototype Area, Final Results

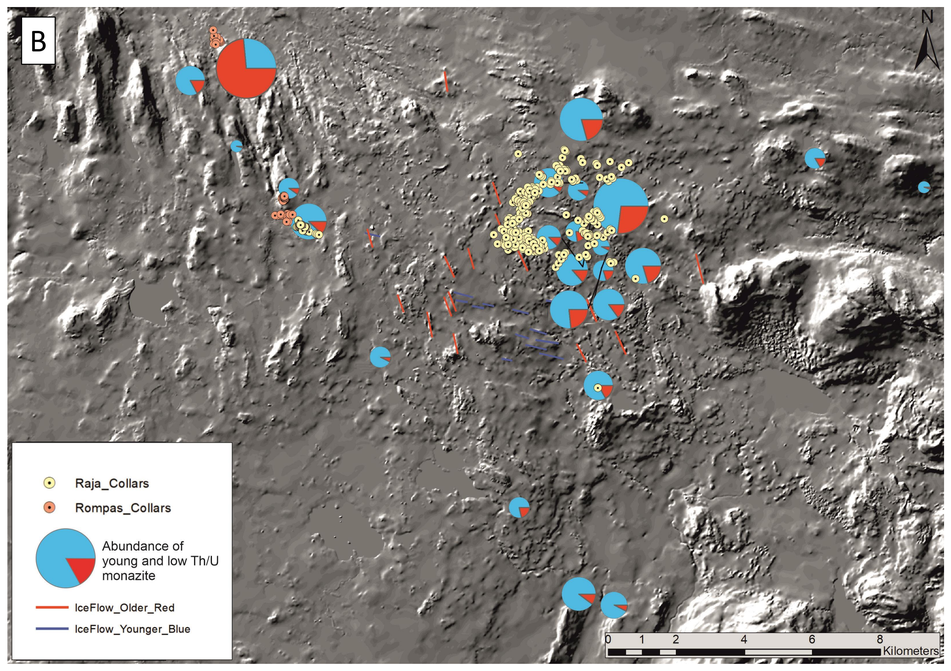


BEDROCK & TILL PYRITES

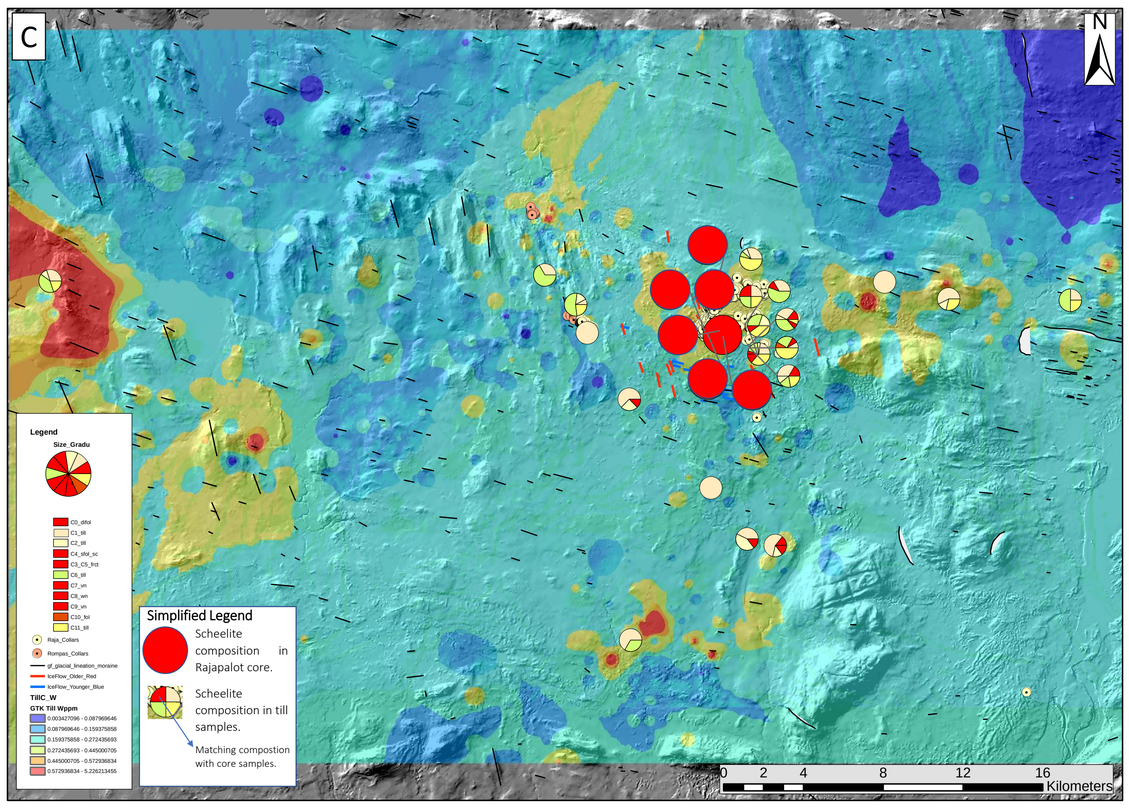
Map only shows clusters with significant concentrations of Au:
Cluster 0
Cluster 2
Cluster 5

<u>Rajapalot bedrock py</u> with very specific signature
Cluster 5
Cluster 2

<u>Rompas till py</u> with very specific signature
Cluster 2
Cluster 0
+/-Cluster 5



Rajapalot Scheelite trace element matching composition from core to till by using PCA, manually selecting points on biplots and 3D compositional plots.



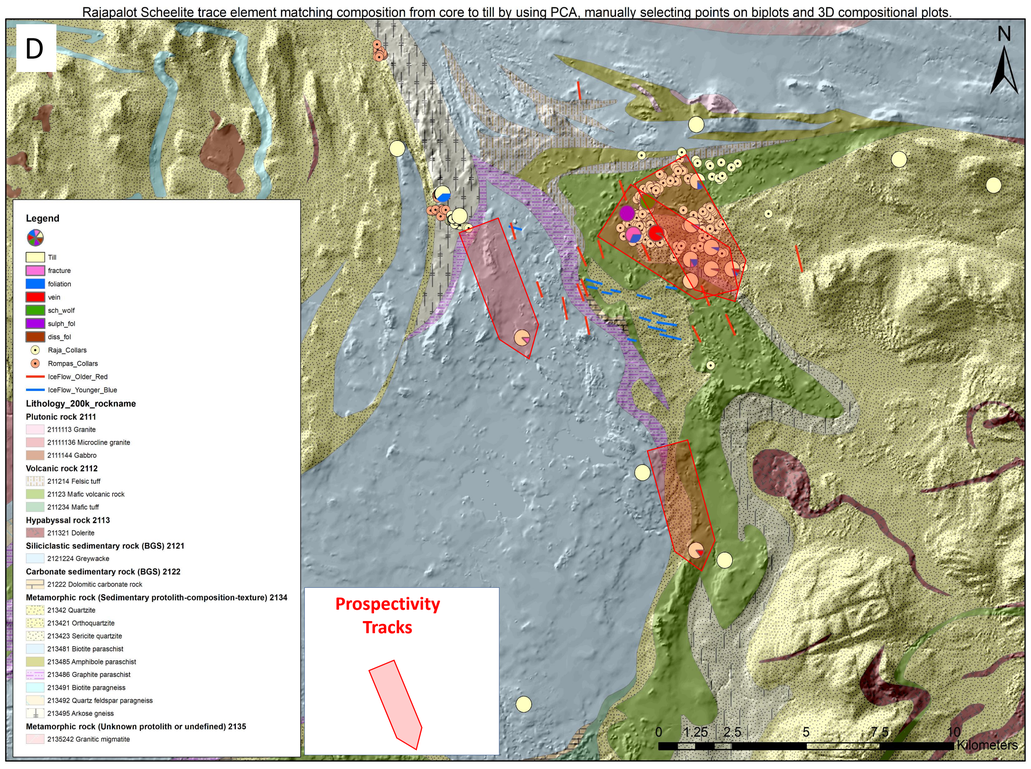


Figure 1. A: Pie chart map of Self Organized Map (SOM) results using GisSOM software, developed by GTK, for clustering trace element compositions of pyrite from drill core and till samples. SOM was able to distinguish compositions of pyrite and scheelite associated with Au-Co –mineralization of the Rajapalot Deposit. **B:** Pie chart map of abundance of prospective mineralization-age, low Th/U monazite from till samples. **C:** Pie chart map of Self Organized Map (SOM) trace element results for scheelite from drill core and till. **D:** Pie chart map of matching scheelite composition from drill core and till samples obtained by Principal Component Analysis (PCA).

References

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