Mineral Exploration in Estonia's Crystalline Basement: Insights from Reinvestigated Drill Cores in Northeastern Estonia

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Although the Fennoscandian shield extends beneath Estonia's Neoproterozoic and Paleozoic sediments, deep ore deposits are not known. Moreover, there is a remarkable archive of crystalline basement drill cores, last systematically studied for mineralization decades ago. The Geological Survey of Estonia has started a project to explore the mineral potential in crystalline basement starting with re-investigation of preserved drill cores employing an automated drill core workstation equipped with VNIR spectrometer, XRF and Magnetic susceptibility sensors to collect geochemical, mineralogical and petrophysical data.

Our primary focus is on the Alutaguse metasedimentary rocks and Jõhvi iron ore occurrence in Northeastern Estonia. These structural zones have previously been correlated with the Svecofennian Bothnian basin (Sundblad et al. 2021) and the Falun subunit in Bergslagen (Sundblad & Kivisilla, 1991), respectively. Preliminary findings from the Jõhvi drill cores showed that in addition to previously documented pyrite, pyrrhotite and chalcopyrite, associations of loellingite and arsenopyrite occur within the magnetite-garnet-pyroxene gneisses. Moreover, fire assay results of mineralized sections showed up to 200 ppb of Au. Further studies with scanning-electron-microscopy (SEM) studies revealed up to 30 μm inclusions of Pb-Bi-Te-Ag and Ag-Au element associations spread in hairline veins in magnetite gneisses. Notably, a similar vein system and mineral association was described in graphite bearing biotite-cordierite gneisses in the Uljaste drill cores, located 45 km west of Jõhvi (Kont, 2022). These findings suggest that such mineralisation occurrences are part of a larger system and connected with a tectonic evolution of the whole Northeastern Estonian part of the Fennoscandian shield.

References

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