

Multi-Scale Characterisation of Cobaltite at Palokas, Rajapalot by X-Ray Computed Tomography and Electron Microscopy

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Rajapalot is a Paleoproterozoic hydrothermal Au-Co deposit near Rovaniemi, northern Finland, with a cobalt mineralogy comprising cobaltite, linnaeite, cobalt pentlandite, and cobaltian pyrite. Cobaltite is the main cobalt mineral and is therefore the most important mineral for cobalt extraction. However, at present, the deposit model for the cobalt mineralisation at Rajapalot and details of the ore paragenesis remain unclear. In a geometallurgical study, the cobaltite at Rajapalot is described to have a consistent grain size of 23-28 μm , but initial results of this study reveal greater complexity. The objective of this study is detailed characterisation of cobaltite at Rajapalot using optical and scanning electron microscopy (SEM) combined with X-ray computed tomography (XCT). A combined 2D and 3D approach facilitates a rigorous characterisation of mineralisation; precise characterisation of the cobaltite will inform the paragenetic sequence for Rajapalot Au-Co and processes of remobilisation and deposition of cobalt.

Detailed petrography and analysis by SEM have revealed four styles of cobaltite mineralisation, with differing apparent grain sizes, morphologies, and mineral associations. Small (<5 mm) fragments of cobaltite rich ore were scanned by XCT. The high attenuation coefficient of cobaltite allows segmentation from pyrite and pyrrhotite, gangue minerals, and denser phases such as gold. The XCT scans show the three larger fractions of cobaltite and their 3D morphologies.

XCT analysis provides quantitative non-destructive volumetric data, while correlative 2D petrographic study by reflected light microscopy and SEM confirms the mineral species present in the sample and provides high resolution detail of mineral inclusions and microstructures. The data from this study highlights the added value and higher accuracy in ore characterisation through addition of 3D data analysis, especially for polyphase mineralisation, such as Rajapalot Au-Co.