## Characterizing ore textures by combining synchrotron-based X-ray 3-D nanotomography and LA-ICP-MS analyses: Insights from the Suurikuusikko orogenic gold deposit, Finland

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High resolution X-ray micro- and nanotomography (CT) are emerging, non-destructive analytical tools for visualizing ore textures at micro- and nanoscale, and providing a holistic 3-D approach of ore-forming processes. In this study, we analysed in-situ microscale textures in 3-D using centimetre-scale drill core samples from the Suurikuusikko orogenic gold deposit, northern Finland. For the 3-D nanotomography, individual arsenopyrite (APY) crystals were separated and scanned, followed by 2-D imaging and micro-analytical procedures. The micro-CT scans of drill cores were carried out with a lab-based custom-built Phoenix X-ray Nanotom 180 NF scanner at the University of Helsinki, with an effective pixel size of 31µm. Nanotomography scans of individual sulphide grains were performed on beamline ID16B at the European Synchrotron Radiation Facility, France, with the voxel size of reconstructions from 50 nm to 150 nm. Field emission scanning electron microscopy (FE-SEM) and laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) imaging and analyses were performed at the Geological Survey of Finland, Espoo.

Microtomography revealed the size, shape, spatial distribution and geometrical orientation of sulphide minerals in the oriented drill cores, which are rather difficult to discern from 2-D optical or SEM imaging technologies. The synchrotron-based nanotomography illustrated 3-D distribution of micron to nano-scale gold particles, mostly associated with rutile (primary) or along microfractures (secondary) inside APY. The same set of APY crystals were then analysed using LA-ICP-MS, which show correlations in the concentrations of Au and associated elements, and an especially strong antithetic relationship with Sb. The latter results further indicate gold occurs lattice-bound in each APY crystal and also in association with nano-scale Sb-Ni-Co bearing mineral inclusions, beyond the detection limits of synchrotron-based X-ray nanotomography.

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### References:

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