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Geochronology of the unexposed crust within the Finnish Archean – insights from the Koillismaa Deep Hole in Kuusamo, northeastern Finland

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A 3000 m deep hole is being drilled in the Archean Karelian Craton in northeastern Finland in an area where the granitoids dominating the surface have yielded Neoproterozoic ages (2.8–2.7 Ga). Archean greenstones and Paleoproterozoic dolerites are exposed within the domain as well. The drilling site lies between ca. 2.44 Ga Koillismaa and Näränkäväära mafic layered intrusions. This site was chosen based on gravimetric, magnetic, magnetotelluric and reflection seismic studies, which have revealed a deep anomaly that seems to connect the two mafic layered intrusions. Based on modelling of the geophysical data, the upper boundary of this ca. 60 km long, roughly E-W oriented anomaly lies at approximately 1.5 km depth.

We sampled various rock types from depths of ~40–1600 m for zircon U-Pb dating. The lithologies include leucogranites, tonalite gneiss, hornblende diabase, quartz diorite and granodiorite. Based on observations from the drill core extracted so far, the source of the anomaly is likely to be ultramafic cumulates. Also, presence of Paleoproterozoic granitoids is likely. We will perform the U-Pb analyses during the winter of 2022. The results are expected to confirm the interconnection of the two layered intrusions, clarify the age distribution of the granitoids in the region, and help to decipher the detailed tectonic evolution of the Archean Koillismaa area.