Infrared imaging in assessing ground and surface water resources related to mining development sites, northern Finland

A. Rautio[1*], K. Korkka-Niemi[1] and V.-P. Salonen[1]

[1]*Department of Geosciences and Geography, P.O. Box 64, University of Helsinki, 00014, Helsinki, FINLAND (*correspondence: anne.rautio@helsinki.fi)*

Environmental issues play an increasingly important role in planning large-scale mining activities. Potential impacts are often related to groundwater and surface water systems, which may be inadequately understood and assessed. This is true especially in Lapland, northern Finland, where subsurface and surface water reserves and their hydraulic connections have rarely been studied.

However, the mining development sites occasionally host complicated aquifer systems with notable connections to natural surface water bodies. There are aquifers related to fluvial and glaciofluvial sands and gravels, which have observed to feed sensitive groundwater dependent ecosystems e.g. wetlands or rivers bearing critical spawning grounds for the sea trout (Salmo trutta trutta), an endangered species.

According stable isotopic composition (δD, δ^{18}O) of waters and low altitude aerial infrared (AIR) surveys (helicopter and drone), surface water bodies studied are dominantly fed by groundwater. AIR was found to be a highly applicable method to identify thermal anomalies as potential groundwater discharge areas into the rivers and wetlands, to identify potential thermal refugees and to record spatially continuous patterns of river water temperatures.

This study revealed that GW–SW interactions are far more common phenomenon in our study sites than has thus far been acknowledged and should be taken into account in environmental assessment and managing critical thermal habitats in rivers and wetlands. Hydrogeological background information is crucial in planning and siting essential mining facilities such as tailings storage areas. This research provided new insights into the water management in subarctic environments, and the results can be used to secure and sustain the groundwater dependent ecosystems in the future.