Uranium and trace metal fate in the Rakkurijoki system, Kiruna, Sweden

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Screening and isotope analysis of sediments

Elemental screening analyses and isotope ratio measurements of U-Th isotopes were performed using ICP-SFMS combined with ^{210}Pb-dating to reconstruct historical changes in sediments. Results give a detailed view of metal fate and mobility with emphasis on uranium, an emerging contaminant, in lakes receiving mine waters from the local Fe-ore mining operation.

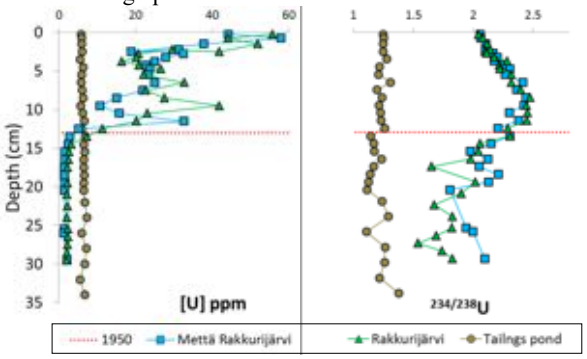

Figure 1: Uranium concentration increase in recipient lakes since the 1950s combined with a $^{234/238}$U shift indicating input signature change.

Discussion of Results

Iron–Mn cycling in the suboxic sediment enriches a number of trace metals in the surface sediment. Bi, Cd, Hg, P, Pb, Re, Tl and Zn show enrichment in the Fe-hydroxide/sulphide layers while As, Ba, Co, Cu, Mo, Sb, Se, V and W are enriched in the uppermost Mn-hydroxide dominated layer. Natural redox cycling can fragment pollution events and make tracing more complex.

Uranium concentration indicate a steady accumulation since water discharge started into the lake system in the 1950s. The shift in $^{234/238}$U confirm this change of U-signature in the system. Soluble U activated from Fe-ore mining operation, not retained in the tailings pond, is transported to recipient lakes. These signatures can be used to trace U discharge and behaviour in Kalix River, Europe's largest unregulated river and other similar systems.