Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36140

The geochemical behaviour of Rhenium in an enriched watershed in Ontario

MEGHAN BOYD AND BAS VRIENS
Queen's University

Rhenium (Re) is one of the rarest elements on Earth and exhibits a complex, redox-dependent aqueous geochemistry. Although this trace metal is critical for various technological applications, much of the fundamental biogeochemical behaviour of Re remains poorly understood due to its typically very low concentrations. Our recent work has identified a significant enrichment of Re (>100x the global average background) in a tributary watershed of Lake Ontario (Canada). The Re enrichment originates from a precious metal recycling facility, with elevated Re levels persisting through the receiving sewershed and a downstream municipal wastewater treatment plant (WWTP). We collected surface waters and surface sediments in 2024 and 2025 along a 10km transect of the WWTP discharge-receiving river (NR), and a creek (SC) immediately adjacent to the metal recycling facility. Aqueous Re concentrations in NR increase downstream of the WWTP discharge point, measuring up to 0.11 µg/L, contrasting with sediment concentrations, which peak at 45 µg/kg near the discharge point but remain constant or decrease further downstream. Major hydrochemical parameters of both (calcareous) streams were otherwise comparatively constant in the years sampled. We attribute the positive downstream gradient in dissolved Re concentrations to a change in Re speciation in the NR, i.e., from (partially) reduced and insoluble forms of aqueous Re that progressively oxidize into more soluble forms of Re upon mixing downstream. In contrast, Re concentrations in the SC are up to 1.3 µg/L in aqueous samples and 6.3 µg/kg in sediments, both nearest to the metal recycling facility, but an input mechanism has yet to be identified for this non-hydrologically connected stream. I will present new data on the behaviour and mobility of Re in these contrasting streams, including its partitioning between solid and aqueous phases, as well as relationships between Re and other solutes of interest (Fe, S, DOC) to identify potential controls on Re dynamics in this enriched natural environment. This work will allow us to better understand the fundamental geochemical behaviour of Re, information that can be used to better understand the ambient cycling of Re and offer insights into the recovery or recyclability of this critical metal.