ASSESSMENT OF THE SOURCES AND MOBILITY OF SELENIUM IN MINING ENVIRONMENTS

Wijdane Limouni[1,2], Éric Rosa[1,2], Vincent Cloutier[1,2], Carmen M. Neculita[1]

[1] Research Institute on Mines and Environment (RIME), Université du Québec en Abitibi-Témiscamingue (UQAT), Rouyn-Noranda, Québec, Canada
[2] Groupe de Recherche sur l'Eau Souterraine (GRES), UQAT, Rouyn-Noranda, Québec, Canada

ABSTRACT

Selenium (Se) is an essential trace element for human health. However, Se is characterized by a very narrow tolerance band and the World Health Organization proposes a health-based guideline value of 10 µg/L in drinking water. Se is bioaccumulative and its concentration biomagnifies along the trophic chain and can reach toxic levels for fish and wildlife as well as for humans. In the environment, Se concentrations mainly depend on geology, although industrial activities can cause significant Se contamination. Given its recognized toxicity, it has become a contaminant of emerging concern (CEC) for the mining industry. However, the hydrogeochemical processes controlling Se mobility in mining environments are still poorly understood. Fitting in this context, the present study aims at developing novel approaches for identifying the sources and fate of Se in surface and groundwater in mining environments of the Canadian Shield. A review of the potential geogenic and anthropogenic sources of Se in mining sites is first proposed. Geochemical calculations conducted using PHREEQC are further performed to identify the main processes most likely to control Se mobility under the conditions prevailing in mine water and to predict the fate of Se once released in surface and groundwater. The calculations are based on data collected at a mining site of the Canadian Shield and on pre-existing data from the scientific literature. Ultimately, the study will provide a better understanding of Se geochemistry in mining environments and allow for proposing feasible technological processes to mitigate Se impacts on surface and groundwater and associated ecosystems.