

Isotopic (^{18}O , ^2H and $^{87}\text{Sr}/^{86}\text{Sr}$) mixing and related geochemical controls on dissolved ions of surface waters downstream of historical Cu-F-W skarn tailings

M. SALIFU^{1*}, LINA HÄLLSTRÖM¹, T.

AIGLSPERGER¹ AND L. ALAKANGAS¹

¹Luleå University of Technology, 97187, Luleå, Sweden

(*correspondence: musah.salifu@ltu.se)

Understanding the contribution of tailings effluents to downstream surface waters is fundamental in the assessment of the extent of the tailings environmental impact. Therefore, in this study, mixing proportions in surface waters downstream of a Cu-F-W skarn tailings repository were investigated. Hydrochemical and isotopic (^{18}O , ^2H and $^{87}\text{Sr}/^{86}\text{Sr}$) data from groundwater wells in the tailings, surface and rainwater samples were analysed and used for this study. The mixing proportions were subsequently evaluated using a mathematical model, which was based on the premise that the sum of the fractional contributions (calculated using the isotopic data) of each end-member multiplied by their respective concentrations should be comparable to the measured raw data. The mixing calculations indicated that the contribution of the tailings groundwater to the mixed surface waters downstream ranges from as low as 1% in May to a peak value of 14% in August. Differences between the model and raw data in the mixed surface waters suggested that the transport of dissolved ions in the groundwater are modulated by processes such as sulphate reduction, adsorption by peat and pyrite beneath the tailings as well as formation of Fe(III)-oxyhydroxides at the outlet of the tailings. These processes explain the generally low ionic contribution of the tailings effluents to downstream surface waters. It is recommended that the interpretation of such mixing results must be coupled with detailed knowledge of the potential hydrogeochemical processes along its flow paths.