

Pore water quality at an abandoned tailings site after reclamation: a case study of the Manitou mine site, Quebec, Canada

M.-P. ETHIER^{1*}, B. BUSSIÈRE¹, T. PABST², B. PLANTE¹,
M. AUBERTIN², S. BRODA^{2,3}

¹Research Institute on Mines and the Environment (RIME),
Université du Québec en Abitibi-Témiscamingue, Rouyn-
Noranda, Québec, Canada (*correspondence: marie-
pier.ethier@uqat.ca, bruno.bussiere@uqat.ca,
benoit.plante@uqat.ca)

²Research Institute on Mines and the Environment (RIME),
Département des génies civil, géologique et des mines,
Polytechnique Montréal, Montréal, Canada
(t.pabst@polymtl.ca, michel.aubertin@polymtl.ca)

³Federal Institute for Geosciences and Natural Resources
(BGR), Berlin, Germany (stefan.broda@brg.de)

Sulphidic tailings deposited at the Manitou mine site were left exposed to oxidation during over 30 years, resulting in the extensive production of acid mine drainage. The pre-reclamation pore water was characterized by a pH close to 2 and concentrations of Fe, Zn, Cu, and sulphate that exceeded 10,000, 350, 200, and 2,500 mg/L, respectively. A portion of the site was reclaimed in 2009 by using an elevated water table combined with a monolayer cover made of non-reactive tailings produced at a nearby mine. This study aims to evaluate the evolution of the pore water quality in the Manitou tailings following reclamation works. Pore water in the upper Manitou tailings was sampled from eleven wellpoints distributed across 38 ha. The pH, Eh, electrical conductivity, acidity, and alkalinity were measured on a regular basis, along with the dissolved concentrations of major cations and Fe²⁺. Water quality varied depending on the location on site. Results showed an improvement of the water quality, with pH values from 5.5 to 7 and negligible concentrations of copper. Alkalinity (30 and 500 mg CaCO₃/L) decreased slightly, while acidity (40 and 2500 mg CaCO₃/L) was stable over time. Iron concentrations were highly variable between wellpoints (typically between 100 and 2000 mg/L), but relatively stable over time. Zinc concentrations were between 0.3 and 1650 mg/L and decreased slightly over time. Both Fe and Zn concentrations were often similar to those observed prior to reclamation. Most of the parameters were stable over the investigation, which spanned four summers. The present study focuses on understanding the processes that have resulted in the persistent contamination of the Manitou tailings' pore waters following reclamation.