

COMPARISON BETWEEN ACID ROCK DRAINAGE AND ACID MINE

DRAINAGE: NATURAL ALTERATION VERSUS ANTHROPIC ALTERATION OF

A SULFIDE ORE BODY

A. Courtin-Nomade, G.R. Scott, C. Grosbois, H. Bril

AMD supergene alteration iron oxides paleogossan

Part of a large rhyolitic body with locally abundant pyrite (small amounts of chalcopyrite, bornite, sphalerite and chalcocite) was exploited until the late 1920s to produce sulfuric acid. Located on an urban hillside, the mining site is now surrounded by houses and parks. No environmental remediation was undertaken and the remnant of the mining activities is a mine dump with tailings piled in a small valley. An acidic stream issues from the mine workings and winds through a neighborhood and then combines with relatively clean creeks. Another, unexploited part of the sulfide ore body, outcrops 500 meters away and is crossed by a "clean" creek. This site is "not impacted" by mining exploitation but, has a well-developed gossan. The aim of the study is to compare the alteration of the same sulfide ore body in these two different contexts and to forecast the behavior of the metals. The waters at the mining site are toxic and affected by AMD (pH \sim 3.1), with relatively high concentrations of sulfates ($9 < \text{SO}_4^{2-} < 32$ mM) and metals (Cu \sim 47 μM ; Zn \sim 138 μM) (Hauri, 2001). Mineralogical and crystallographic studies of the tailing materials showed native copper, sulfides and numerous secondary sulfates (e.g. jarosite). Some iron hydroxide precipitates, often observed in such acidic conditions, were also identified in the stream bed (e.g. schwertmannite and goethite). Weathering by surficial water promotes the mobilization of the metals and metalloids associated with the sulfides contained in the mine dump. At the "non impacted" site, the small volume of ground water in direct contact with the sulfide body is acidic (pH \sim 2.8). However, the impact of this acid rock drainage is spatially limited by mixing with large volumes of creek water. The pH measured downstream of the pyritic ore is close to neutral values (pH \sim 7). Measured sulfates ($\text{SO}_4^{2-} \sim 0.5$ mM) and metals concentrations ($22 < \text{Cu labile} < 51$ nM) are relatively low (Hauri, 2001). In the solid fraction (within the gossan and the precipitates), numerous unaltered sulfides (pyrite) are still observed as well as some Ti and Fe oxides. The first results indicate a different spatial impact of the acid drainage and some differences in the mineralogy of the secondary metal-bearing materials between the two sites.