ABSTRACT

A study of the effects of mining on groundwater, surface water, sediments and soils was carried out at Athens mine, sulphide-ore gold and previously copper mine, Mvuma, Zimbabwe. Representative samples of secondary minerals, slimes, leachate, soils, sediments, surface and groundwater were sampled from May to August 1999, during the dry season and from November 1999 to March 2000, during the wet season. Levels of iron, copper, nickel, zinc, lead, cobalt, cadmium, chromium, antimony and arsenic were determined using atomic absorption spectrophotometry and inductively coupled plasma spectrophotometry. The pH and levels of cyanide in water and leachate samples were measured in the field using the pH meter and the cyanide field kit respectively. Multi-electrode resistivity profiling was carried out over the active slimes dump using the ABEM LUND IMAGING system.

The results showed that chemicals used such as ferrous sulphate and lead nitrate, for the processing of gold contributed significantly to the high concentrations of iron, lead and sodium while all the other metals were mainly derived from the site mineralogy.

Acid mine drainage (AMD) is a serious problem at the mine and results in the release of elements into the environment. It results in higher concentrations of metal elements during the wet season as the solubility of most of these elements increases due to low pH conditions. AMD also leads to the dissolution of the secondary minerals that are found as precipitates on the surface of the dump and surrounding mining area. These secondary minerals remove most of the metal elements from solution during the dry season when they precipitate out. The resistivity profiles suggest that there is no deep vertical seepage of leachate into ground water from the active slimes dump but there is lateral seepage into the soils surrounding the dump.

Ground water, surface water, sediments and soils were found to be polluted with iron, copper, nickel, zinc, lead, cobalt, cadmium, chromium, antimony and arsenic from the mining activities and the levels were above the World Health Organisation (WHO) and the Zimbabwe waste effluent limits of 2000. The water is not suitable for human or animal consumption.

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