# METAL, ARSENIC and CYANIDE POLLUTION OF THE ENVIRONMENT IN THE VICINITY OF A MINING WASTE DISPOSAL DUMP AT ATHENS MINE

**BY**

**KUDZAI MUSIWA**

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**DEPARTMENT OF GEOLOGY**
**FACULTY OF SCIENCE**
**UNIVERSITY OF ZIMBABWE**
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# ABSTRACT


## Abstract

Mining activity and mine wastes at Athens mine; Mvuma, Zimbabwe, have been generated since the 15th century accelerated significantly during the 20th century. The mine wastes constitute a potential source of contamination to the environment as elements and acid are released in large amounts. Oxygen and microbiological processes are largely responsible for the environmental hazards created by the mine wastes. The leaching of soluble elemental contaminants by the acidic water from the waste is of great environmental concern, since it represents a threat to the surrounding environment at Athens.

This study was aid at investigating the impacts of mining waste on the environment and groundwater at Athens mine. The principal objectives were to asses the seasonal variation in the element concentration in stream sediments, surface water, ground water, soil, leachate and slimes, the elemental dispersion, role of acid mine drainage, identification of secondary minerals and to propose possible remediation measures. The study was centred on the active slimes dump and the old slimes dumps that were being reworked.

Parameters studied were arsenic, antimony, chromium, cobalt, copper, cyanide, iron, lead, nickel, zinc and pH. For the metals only bioavailable concentrations were measured using an atomic absorption spectrophotometer (AAS) and inductively coupled plasma mass spectrometer (ICP-MS). Cyanide was determined in the field using analytical test strips (field kit). Cyanide and antimony were found to be <0.01ppm in all the samples during the wet and dry seasons. Iron, copper, zinc, lead, nickel, cobalt, chromium and arsenic show elevated concentrations in all sampled media with the stream sediments having the highest concentrations during the dry season. Iron and copper have the highest concentrations of 44886 ppm and 20246 ppm respectively in the stream sediments in the dry season. Lowest concentrations were in the groundwater with iron and copper having the highest concentrations of 103.45 ppm (wet season) and 5.95 ppm (dry season) respectively. There was a significant increase in the elements concentration during the

wet season with the exception of the stream sediments. Elements levels exceed the Zimbabwe Waste and Effluent Disposal regulations of 2000. In the borehole water near the dump, the levels exceeded world health organisation (WHO) standards for drinking water resulting in drinking water being pumped from Nyamafufu dam. Acid mine drainage (AMD), a result of pyrite and other sulphides oxidation was the main problem at Athens mine that was responsible of releasing the elements into the environment.

However the levels of element concentrations suggest that at present the degree of contamination was modest.