

Geochemical Baseline and Origin of Trace Elements in Soils and Sediments around Selibe-Phikwe Cu-Ni Mining Town, Botswana

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Abstract : Heavy metals may occur naturally in rocks and soils, but elevated quantities of them are being gradually released into the environment by anthropogenic activities such as mining. In order to address issues of heavy metal water and soil pollution, a distinction needs to be made between natural and anthropogenic anomalies. The current study aims at characterizing the spatial distribution of trace elements and evaluate site-specific geochemical background concentrations of trace elements in the mine soils examined, and also to discriminate between lithogenic and anthropogenic sources of enrichment around a copper-nickel mining town in Selibe-Phikwe, Botswana. A total of 20 Soil samples, 11 river sediment, and 9 river water samples were collected from an area of 625m² within the precincts of the mine and the smelter. The concentrations of metals (Cu, Ni, Pb, Zn, Cr, Ni, Mn, As, Pb, and Co) were determined by using an ICP-MS after digestion with aqua regia. Major elements were also determined using ED-XRF. Water pH and EC were measured on site and recorded while soil pH and EC were also determined in the laboratory after performing water elution tests. The highest Cu and Ni concentrations in soil are 593mg/kg and 453mg/kg respectively, which is 3 times higher than the crustal composition values and 2 times higher than the South African minimum allowable levels of heavy metals in soils. The level of copper contamination was higher than that of nickel and other contaminants. Water pH levels ranged from basic (9) to very acidic (3) in areas closer to the mine/smelter. There is high variation in heavy metal concentration, eg. Cu suggesting that some sites depict regional natural background concentrations while other depict anthropogenic sources.

Keywords : contamination, geochemical baseline, heavy metals, soils

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