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Baseline concentrations of trace metals in stream sediments of the lower Lom Basin, East Cameroon: Implications for environmental studies

Mumbfu Mimba (1,2), Takeshi Ohba (1), Salomon Nguemhe Fils (2), Melvin Nforba (3), Nozomi Numanami (1), Tasin Bafon (4), Festus Aka (2), and Cheo Suh (5)

(1) Department of Chemistry, School of Science and Technology, Tokai University, Hiratsuka, Japan , (2) Institute of Geological and Mining Research (IRGM), Yaounde, Cameroon, (3) School of Geology and Mining Engineering, University of Ngaoundere, Ngaoundere, Cameroon, (4) Compagnie Minière du Cameroun SA, Yaounde, Cameroon, (5) Department of Geology, Mining and Environmental Science, University of Bamenda, Bamenda, Cameroon

Abstract

In the heavily mineralized Lom Basin in East Cameroon, environmental studies have focused mainly on soil and water quality. This investigation seeks to quantify the levels of selected trace metals in the bottom sediments of streams draining the area. Fifty-five bottom sediments were collected near stream confluences, at a density of one sample every 5 to 10 km. Areas of anthropogenic influences were avoided. The mineralogical composition of 6 pulverized sediment samples was determined by XRD. Each sample (<150 μm) was subjected to total digestion (HF+HCl+HNO_3) and analyzed for 14 trace metals using a combination of ICP-MS and AAS analytical methods. Elements considered in this study either have an environmental impact or are associated with known mineralization/ores. Results show that the mineralogy of stream sediments is dominated by quartz (39¬–86 %), phyllosilicates (0–45 %) and feldspars (0–27 %) derived primarily from the weathering of the complex plutono-metamorphic basement. The mean concentrations of the metals are low (e.g As = 99.40 μg/kg, Zn= 573.24 μg/kg, V= 963.14 μg/kg and Cr= 763.93 μg/kg). Iron and Mn have significant average concentrations of 28.325 mg/kg and 442 mg/kg, respectively. Background and threshold values of the trace metals were computed by statistical techniques to determine geochemical anomalies of geologic or anthropogenic origin particularly, mining activity. From factor analysis applied, three geochemical associations were identified: Ni-Cr-V-Co-As-Se-pH, Cu-Zn-Hg-Pb-Cd-Sc and Fe-Mn. The first association is controlled by source geology and the neutral pH, the second by sulphide mineralization and the last by chemical weathering of ferromagnesian minerals. Spatial analysis reveals similar distribution trends for Co, Cr, V, Ni reflecting the lithology of the basin. Relatively high As levels correspond to reported gold indications in the area. Similar background distribution patterns for Cu, Zn, Pb, Sc are indicative of sulphide mineralization while Fe and Mn distribution are consistent with their source from ferromagnesian rocks. The main result of this study is the newly generated stream sediment data which will serve as guidelines for future studies in the region and other mineralized areas in the country. Although this study shows that the stream sediments are not polluted, the evaluation of metal composition in environmental samples from abandoned and active mine sites for comparison and environmental health risk assessment is highly recommended.

Keywords: Trace metals, Stream sediments, Baseline, Lom Basin