

Trace Metal Contamination in Water from Abandoned Mining and Non-Mining areas in the Northern Parts of the Ashanti Gold Belt, Ghana

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Abstract

A survey was conducted on the levels of trace metals (Ni, Cu, Hg, Pb, Mn, Fe, Zn, Cr, Cd, Mg and Ca) in ground and surface water sources from the northern parts of the Ashanti gold belt. Water samples were collected from 67 boreholes, 24 wells, and 10 streams during dry and wet seasons for trace metal analyses using Philips PU 9200 atomic absorption spectrophotometer. The main objective was to determine whether trace metal contamination in the study area was as a result of mining or geochemical and biochemical processes within the aquifer. The results showed that ground water (pH range 4.09–7.29 and mean 5.87 pH units) was slightly acidic (low pH) than surface water (pH range 5.81–7.74 and mean 7.12 pH units). The ground waters (with conductivity range 96–1553 $\mu\text{S}/\text{cm}$ and mean 407.7 $\mu\text{S}/\text{cm}$) in the study area were also more mineralized than surface waters (with conductivity range 113–540 $\mu\text{S}/\text{cm}$ and mean 323.30 $\mu\text{S}/\text{cm}$). Correlations between the trace metals revealed expected process-based relationship between Mg^{2+} and Ca^{2+} ($r = 0.76$), derived mainly from the geochemical and biochemical processes within the aquifer. However, there were also other strong linear relationships between trace metals, such as Fe^{2+} and Ca^{2+} ($r = 0.61$); Mg^{2+} and Mn^{2+} ($r = 0.72$), Hg^{2+} and Mn^{2+} ($r = 0.61$), that are not normally expected to be linked in terms of processes. All the well and stream water sources had one or more trace metal level outside acceptable limits set by the World Health Organization for drinking water, and only three borehole water samples at Konongo (Abronikrom), Ntronang (Ahenbronoso) and Bomfa (Nkubem) were safe for human consumption.