



WATER, SANITATION, ENVIRONMENT and DEVELOPMENT

Surface water quality and mining in Ankobra



Ebenezer A Barnes, Adwoa Paintsil, and Rose Osafo

Introduction

The Ankobra basin covers an approximate area of 8366 km² in the south western part of Ghana. The river is about 222 km long, taking its source from the Birim range.

This basin is interspersed with mining industries which discharge their effluent into the river via its sub tributaries. Among the mining industries are the State Goldmines at Tarkwa and Prestea and Manganese at Nsuta.

Effluent from these mines contain heavy metals such as arsenic and mercury (Mensah, 1976) derived from the mines. This poses a threat to human health because arsenic and mercury among other metals have been found to be poisonous and cause skin cancer (WHO, 1984). Glimpses of the extent of pollution in the mines became evident in the report by Amasa (1976) which showed high arsenic concentrations in human hair samples and vegetation at the mines at Obuasi. This has raised many environmental concerns and has generated calls for effective environmental auditing programmes especially in the mining areas.

A monitoring scheme of the basin was therefore initiated by the Water Resources Research Institute in 1988 to determine the effect of industrial waste discharges on the water quality of the river system.

Levels of arsenic and mercury which are by-products of the mining processes were monitored. This paper presents the results of the investigation.

Materials and methods

A total of 6 sampling stations were established within the Ankobra basin at Sefwi Anwiaso (SA), Asuokofie (AKE), Apeapea (AA), Sumang (SUI), Tarkwa (TA) and Prestea (PT). With the exception of the station at Sefwi-Anwiaso which serves as a reference station, all the sampling sites were located on the downstream sections of the river receiving mine effluent.

Rain and river-water samples were collected quarterly over a period of two years, from January 1988 to December 1989. The water samples were acidified in the field and sent to the laboratory of the Geological Survey Department for arsenic and mercury determination. Atomic Absorption Spectrophotometer was used.

Aquatic invertebrates and other fauna were also sampled quarterly using the wade and kick method at some of the sampling locations. These samples were digested with 6ml

of aqua regia solution and later filtered into a 25ml volumetric flask for analyses.

Results and discussion

Results obtained during the period of investigation are summarised in Table I and illustrated in Figure 1.

The total mercury distribution in the Ankobra river was very high especially at the goldmining areas of Apeapea, Asokofie, Sumang and Prestea. The lowest mean mercury concentration at the reference station (Sefwi Anwiaso) was 0.001 mg/l and the highest value of 0.004 mg/l was observed at Prestea.

The main sources and pathways of the high mercury concentrations in the goldmining areas could be the direct disposal of residual Hg used in the mining process and also the emission of mercury vapour from secondary treatment of coarse free gold.

Similarly, arsenic concentrations were also very high at all the stations monitored along the various sections of the Ankobra river. This observation may be attributed to the uncontrolled spread of volatile oxides of arsenic (As₂O₃) from smoke stacks of ore roasting plants in the mines by wind action.

The scrubbing action of rain also accounts for the high concentrations found in rain water. This poses a potential threat to the inhabitants of the basin since harvested rainwater is one of their main sources of drinking water. Long term exposure to Arsenic in drinking water at a concentration of 0.2 mg/l gave a 5% risk of getting skin cancer, hyper-pigmentation and other skin diseases (WHO, 1984).

Invertebrates sampled had high levels of As concentration. This suggests widespread As pollution of the river water. The results emphasize the urgent need for an effective environmental auditing programme. These arsenic levels in the invertebrates will be subjected to the food chain with consequent danger to human beings at the apex of the trophic levels.

Conclusion

Effluent from the mining operations in the Ankobra basin are adversely affecting the chemical quality of the rivers and streams. The concentrations of arsenic and mercury in the Ankobra river and also in rainwater were very high

at all the sampling sites with exception of Sefwi Anhwiaso which served as a reference station.

Analyses of the invertebrates sampled also revealed the presence of high arsenic contents which poses a serious threat to human health. There is therefore, the urgent need for the formulation and promotion of an environmental Impact Assessment to govern the siting and operations of the mining industries and their effluent discharges into water courses.

This will lay an effective foundation for the protection of the environment especially the surface water resources of the country.

References

Amasa, S.K. 1975 - *Arsenic pollution at Obuasi Goldmine, Town and Surrounding Countryside*. Environmental Health Perspective, Vol 12, pp. 131-135.

Mensah, G. G. 1975 - *Water Quality and pollution survey of inland and coastal waters of Ghana*. Accra, Ghana.

WHO 1984 - *Guidelines for drinking water quality vol.2. Health criteria and other supporting information*. WHO Publication, Geneva.

Table 1.
Arsenic concentration in some aquatic fauna

Station	Specimen	As(μ g) (Dry Weight)
Sefwi	Mayfly	4.87
Anhwiaso	Shrimp	3.32
Prestea	Mayfly	5.32
	Gerridae	6.89
Sumang	Shrimp	8.92
	Tilapia	3.02
	Mollusc	14.17

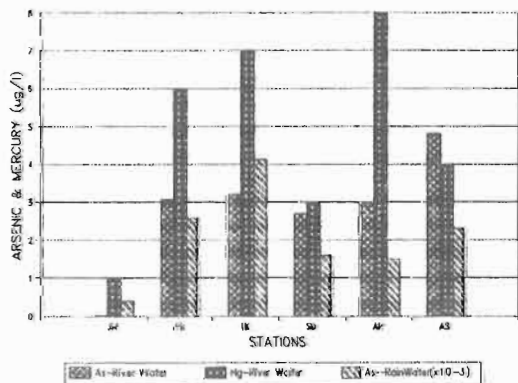


Figure 1. Levels of arsenic and mercury in river and rain water