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TITLE: ENVIRONMENTAL TRANSFORMATION AND DISTRIBUTION OF MERCURY RELEASED FROM GOLD MINING AND ITS IMPLICATIONS ON HUMAN HEALTH IN TANZANIA, STUDIED BY NUCLEAR TECHNIQUES

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SCIENTIFIC BACKGROUND

Tanzania experienced unprecedented rush for gold mining in late 1980s and early 1990s when a similar gold rush was taking place in Latin America and other developing countries because of good gold market prices. The gold rush in Tanzania was also prompted by the socio-economic and political transformations that were taking place in the country. The liberalization of mining policy and regulations by the government allowed foreign and local private investment in mining and encouraged small-scale mining and gold trade. Because of the liberalization, thousands of local miners, mostly from rural communities, rushed to gold mining for subsistence income. The use of mercury in gold recovery became widespread in Tanzania as a result of the gold rush.

From 1992/93, the Department of Geology of the University of Dar es Salaam (UDSM) in collaboration with the National Environment Management Council (NEMC) initiated studies to assess the extent of mercury pollution in the country. Further studies on mercury and other heavy metal pollution were undertaken between 1993 and 1997 by UDSM, under a broader project on "Environmental Aspects of mining and industrialization in Tanzania", supported by the Swedish Agency for Research Cooperation with Developing Countries SAREC (Sida/SAREC). The above studies revealed the presence of elevated mercury concentrations in gold-ore tailings and river sediment in several gold mining areas. Studies to evaluate environmental transformation, partition and bioaccumulation of mercury in different environmental matrices and the long-term impact of mercury pollution have not been done. The present research project was initiated to provide scientific database necessary to better understand the environmental behaviour and cycling of mercury in the southwest Lake Victoria goldfields. Such data are necessary in the evaluation of environmental impacts of mercury pollution and in the mitigation of adverse impacts on the ecosystems and human health.

PROJECT OBJECTIVES

The main objectives are to:

- Determine the levels and dispersion patterns of mercury in different environmental media in selected areas of the southwest Lake Victoria goldfields

- Evaluate the implications of mercury levels in the environmental media on fish and human health
- Study the transformation and partition of mercury in sediment-water systems contaminated by gold-ore tailings in order to determine environmental factors or conditions that enhance the mobility and cycling of mercury in tropical ecosystems impacted by metallic pollution from gold mining operations.
- Evaluate the long-term impacts of mercury transformation and cycling in the southwest Lake Victoria gold fields on the ecosystem and human health, based on experimental results.

ACHIEVEMENTS

The scientific achievements of the project are embodied in the following findings:

- Mercury transport along the Mabubi River from the Mugusu mine is low. Mercury levels in the river sediment fall almost to background levels (<100 μg/kg) about 9 km downstream of the gold-ore processing site.
- That mercury levels in 8 fish species from the Nungwe Bay in Lake Victoria are extremely low (2 - 34 μg/kg). Hence the consumption of those fish species do not seem to pose any serious human health risks, based on WHO mercury limit of 500 μg/kg in edible fish.
- That mercury contamination from gold mining operations in the southwest Lake Victoria goldfields has so far not led to elevated mercury concentrations in the Lake Victoria fish in the Nungwe Bay which receives river and storm drainage from the gold mining areas.
- Lichens, especially Parmelia sp., were found to be suitable as a bio-indicator in the assessment of air mercury pollution from gold mining operations in the southwest Lake Victoria goldfields.
- Mercury uptake by gold fish in a sediment-water system contaminated by metallic mercury from gold-ore tailings in an aquarium experiment was very low, suggesting low bioavailability of mercury in the system; hence the necessity to study the speciation, partition, and bioaccumulation of mercury in such aquatic systems.