Abstract

The application of accelerator-based analytical techniques to assess heavy metal contamination from legacy ASM and historic formal mine sites to produce contaminant status map and provide remediation options and for ASM environmental management in Ghana

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Artisanal and small-scale mining (ASM) in Ghana is a time-tested poverty driven livelihood activity that predates formal mechanised mining. Currently ASM contributes, on the average 35% of total gold output of Ghana. The sector's gold output outstrips the combined production of the top three of the nine large scale mines in Ghana. In the last decade, however, ASM's economic significance has been overshadowed by it devastating environmental impacts including widespread destruction and pollution of critical water bodies and farmlands, posing existential threat to populations in rural Ghana. Recent upsurge of highly mechanised illegal mining involving foreigners has exasperated the environmental crisis. Vast areas of legacy or ancient mining sites are currently being aggressively reworked by ASM and large-scale mining companies spurred by the buoying gold prices. These ancient mine sites and mine spoil constitute reservoirs of mercury which was the reagent of choice for gold processing by ASM practitioners and formal miners at the time. These sites constantly supply toxic heavy metals to the surrounding environment. There has, unfortunately, not been any systematic study to assess the extent of Hg and other heavy metal contamination in mining areas in Ghana, both historic and present, apart from isolated patches of studies targeting gold and a few associated heavy metals. Two exploratory studies focused on ASM sites and historic large scale mining sites include Akabzaa and Yidana (2012) and Ahmed et al (2004). The first assessed spatial distribution and sources of anthropogenic mercury and other heavy metal contamination in the Ankobra River Basin using cold vapour Atomic Fluorescence Spectrometry (CV-AAS) while the second studied a set of rock and soil samples from Dome Beposo in the Ashanti Region, suspected to contain gold. The media were analyzed using instrumental neutron activation analysis (INAA) coupled with conventional counting techniques for gold, arsenic, mercury, and antimony. These and other exploratory studies of spatial distribution of historic mine sites have shown high concentration of these contaminants in rocks, sediments, soils, and water bodies proximal to these sites. Given the obvious advantages of the use of accelerator-based ion beam analytical techniques, quick, highly sensitive and accurate with low detection limit, this paper explores the potential for the application these techniques to conduct brother assessment of the spatial distribution of the widespread historic mine sites across the country and their toxic potential. The results could provide guide for the design of comprehensive

remediation measures, reclamation options and general ASM environmental management. The research will commence with examination of satellite images of landforms across the gold belts of Ghana to identify ASM workings and legacy mine sites, followed by systematic sampling of these sites, and analysis of various environmental media, rocks, sediments, soils, historic mine tailings and other mine spoil using accelerator-based analytical techniques to provide a contaminant status map. The design of the suggested assessment campaign will be guided by the results of the stated limited works.