

Identifying Sources of Mercury in Peruvian Amazon Aquatic Systems using Hg Stable Isotopes

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Mercury (Hg) is a toxic global pollutant that affects both humans and wildlife, especially those dependent on aquatic ecosystems. In many developing parts of the world, Hg is used to extract gold from sediments and ores during artisanal and small-scale gold mining (ASGM). ASGM is driven by high gold prices, currently producing 12 to 20% of the world's gold, and directly involves ~20 million people. However, ASGM is also considered the largest source of Hg to the atmosphere and to freshwaters. In the Amazon ASGM is often the source of downstream contamination, but this can be complicated by other potential sources of Hg especially increased soil erosion from land-use change (e.g., deforestation) since soils are a large sink for Hg.

Mercury stable isotope geochemistry is a particularly powerful tool for source differentiation in regions where ASGM is prevalent because of the differences in the isotopic compositions of ASGM-derived Hg versus Hg from soils and erosion. For example, elevated Hg in Amapá, Brazil, was consistent with mobilization of Hg from soils. Whereas elevated Hg downstream of Portovelo, Ecuador, was indicative of Hg used during ASGM. Understanding the source of elevated Hg in ecosystems is key to implementing effective mitigation strategies. In this study, we assessed the sources of Hg in aquatic ecosystems in Madre de Dios (MDD), Peru, a region with prevalent ASGM and local populations affected by Hg contamination. Aquatic sediment samples collected upstream and downstream of ASGM were analyzed for Hg and Hg isotopes along with soils in forested and deforested areas along the MDD river system. Initial results show that ASGM signatures are found near mining areas, but that sources of Hg are more mixed farther downstream. Results will be discussed in the context of locations and types of ASGM operations.