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A note on the artisanal and small-scale gold mining in Ecuador

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Introduction

In Ecuador, the artisanal and small-scale gold mining (ASGM) is estimated to account for 85% of the national gold production and is thought to be produce between 10 and 20 tonnes per year (Veiga et al., 2014; The Global Environment Facility, 2015). In 2010 National Institute of Geological, Mining and Metallurgical Research identified a total of 1,349 mining activities.* In 2017 it was estimated that this number has increased to 1,700 in response to the soaring price of gold. (*A mining activity is defined by the Ministry of Mining as mining in legally registered area in which one miner is the title holder who has manpower for the operation.)

The majority of mining occurs in the south of the country, with the three main ASGM areas "Portovelo-Zaruma" (Province of El Oro), "Ponce Enriquez" (Province of Azuay), "Nambija" and "Chinapintza" (Province of Zamora Chinchipe). This letter describes the brief history and present situation to base assessment and action plans in response to the Minamata Convention.

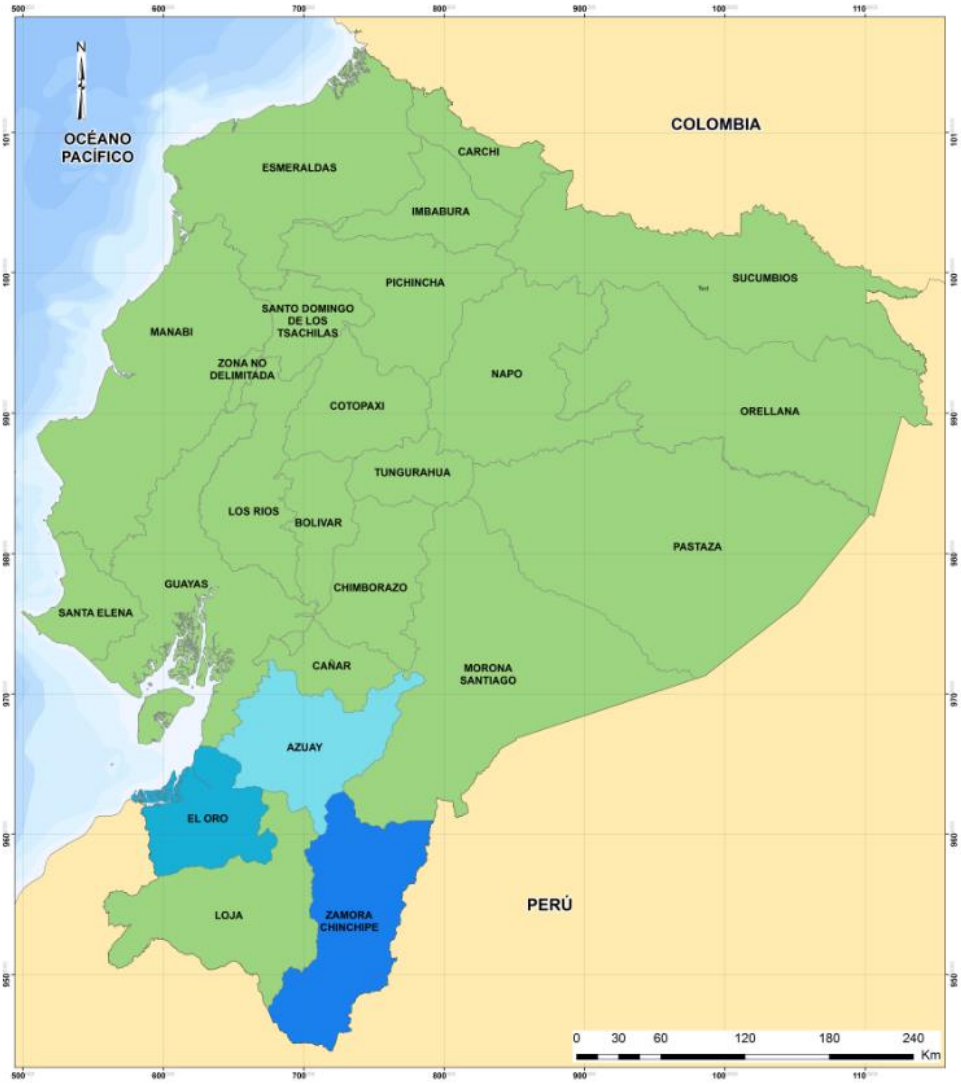

Fig. 1 A map showing the locality of main mining. sectors.

Fig. 2 Panoramic view of mining activities, Nambija Mining District, Zamora Chinchipe-Ecuador.

History of ASGM

Artisanal and Small scale Gold Mining (ASGM) is one of the oldest and most traditional forms of mineral extraction in Ecuador. It emerged towards the end of the 1970s in Southern Ecuador's Portovelo-Zaruma area (Fig. 1), as result of two factors: the rising international gold price and substantial unemployment caused by the bankruptcy of the Compañia Industrial Minera Asociada (CIMA) that had been active in the Portovelo-Zaruma gold district. This area had been explored and developed from 1904 until 1950 by the South American Development Company (SADCO), when SADCO's mining rights were transferred to CIMA.

In the 1970s, when CIMA went bankrupt, the miners fought to continue the mining operations. This new phenomenon generated a series of conflicts with government authorities who questioned the legality of the operations. Despite the conflicts, the miners organized in to small groups and over the next 20 years, they produced roughly 42.5 tons of gold.

In the 1980s, artisanal and small-scale mining expanded to Nambija (Fig. 2), in the Amazon region and to Ponce Enriquez on the Southwestern flanks of the Andes. In Nambija the miners were organized into cooperatives (a product of the capital generated by mining, agriculture, and commercial activities). The cooperative became an important economic actor with the government and mining companies in the region. The gold rush in Nambija did not go very far because of the decline of the price of gold, but several of the most profitable ASGM operations continued their exploitation.

In the 1990s, a revealing change in the ASGM sector occurred (particularly in primary deposit operations) that led to a gradual incorporation of economic planning, new processing technology, and investment in modern equipment and machinery. Cyanide (Fig. 3), replaced mercury as the primary processing agent for gold extraction with an important associated increase in rates of recovery, however, mercury is still being used in ASGM as one of the recovery methods and as agent to treat small volumes of ore.

Fig.3 Recovery of gold by cyanide, Portovelo, El Oro-Ecuador.

Issues in ASGM

A productive artisanal mining sector serves as a source of jobs and income for communities in remote locations, contributing to regional development and mitigating the rural exodus. However, ASGM practices are generally characterized by low technology use, poor working conditions, lack of technical knowledge, low production yields, and limited formalization. As most artisanal miners are not formalized, potential tax and royalty revenues are lost and do not contribute to state revenues. Irvine (2017) estimates that 77% of the value of gold is of illegal origin in Ecuador.

The application of low technology practices cause significant damage to the environment resulting in deforestation, biodiversity loss, river siltation, soil erosion as well as water and soil contamination (Fig. 4), from the application of hazardous chemicals like mercury and cyanide in ore processing.

Ecuador holds approximately 10% of the world's biodiversity and poor ASGM practices are considered a major threat to the country's sensitive ecosystems. Environmental pollution caused by ASGM also impacts downstream livelihoods and quality of life (e.g., agricultural export products, water/food contamination) and has resulted in a trans-boundary pollution dispute with the Peruvian government.

Fig. 4 Alluvial and underground mining.

Fig. 5 Recovery gold with mercury.

Mercury in ASGM

Ecuador experiences similar environmental and social impacts as doother countries that have ASGM. Most are caused by mercury and cyanide use in the processing of gold, as well as the sedimentation and related pollution associated with tailings mismanagement and alluvial extraction activities (especially in rivers and other water sheds). The resulting water contamination has a direct impact on the ecosystem but also on water use for other economic activities, and on the health of the population.

Not surprisingly, the areas that have experienced the most ASGM impacts are where the sector has been most active over the years such as Portovelo-Zaruma, Ponce Enriquez and more recently Chinapintza and Nambija. For example in Portovelo-Zaruma, there are around 150 gold processing plants that discharge 20,000 tons of heavy metals to the aquatic system annually (Betancourt et al., 2005).

In 1997, it was estimated that Ecuador emitted 20 to 50 tons of mercury to the environment. Because of the specifics of the mining process, about 30% of the mercury emitted by ASGM ends up in mine tailings as low-reactive elemental metallic mercury and about 70% of the total goes to the atmosphere as mercury vapor during the amalgam burning and gold purification processes (Lacerda, 2003).

Later studies show a range of health problems associated with mercury and cyanide exposure. A 2002 study detailed mercury intoxication symptoms and elevated blood-Hg levels in children in the gold mining settlements in Nambija and Portovelo. In the same study there was some indication that even children who had low blood-Hg levels (<10 microg/L) may be affected by exposure to sodium cyanide, which is used extensively in the local gold-mining operations.

Another study of the health and environmental effects of gold mining activities noted that mercury storage at home is a key risk factor evidenced by gastrointestinal complaints and an increasing incidence of elevated diastolic blood pressure and elevated mercury levels in hair (Counter et al., 2006).

Concluding remarks

Currently the extraction of gold and silver by amalgamation has been banned in the country since June 2015, but this activity still occurs in illegal operations.

Estimation of Hg releases from the non-industrial ASGM level at 5.1 tonnes/year (Luis, 2016). A comprehensive regulatory framework to address the adverse impacts of ASGM is in place in Ecuador, however, ensuring environmental compliance of the non-industrial informal ASGM sector remains a challenge.

Barriers to improve ASGM practices and reduce Hg releases include a lack of: mining education; access to alternative technologies/practices; financing to procure cleaner technologies; access to markets which buy responsibly produced gold at higher prices; mistrust of miners towards government institutions; and formalization procedures that are complicated for informal miners to adhere to.

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