

小規模な金採鉱コミュニティにおける 水銀汚染の把握および基礎データの構築

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【概要】

途上国などで行われている小規模な金採鉱（ASGM）は、開発がもたらす複雑な問題を示している。ASGMは、多くの貧困層の人々の生計手段となっており、その年間生産量も大きい。その一方で、特に鉱石から金を取り出す際に水銀を使うことから、水銀の最大排出源として知られており、環境・社会・人々の健康に深刻な影響をもたらしている。

現在UNEP（国連環境計画）は、水銀のリスクを国際的に削減するための「水銀条約」を2013年の採択を目指して策定中であるが、この条約の中でもASGMにおける水銀使用の将来的な廃止を目指して、削減方法などが議論されている。

フィリピンのASGMからの水銀排出量は年間70トンとされ、2006年の国連報告では、フィリピンのASGM労働者からWHO（世界保健機関）の基準値の50倍の水銀が検出されている。現在、フィリピン政府はUNEPの支援のもと、ASGMに関する国家戦略計画を策定しており、この取り組みを補完するため、バン・トクシックスは、高木仁三郎市民科学基金などから支援を得て、ASGMにおける貿易や水銀使用・排出の現状、金の採掘・生産方法、水銀汚染が人の健康や環境に与える影響に焦点を当てて、実態調査（魚、土壌、水質、大気のサンプル調査）を行った。さらに本調査では、ASGMの労働者やその家族などに水銀汚染

調査への参加を促し、ASGMコミュニティの人々の水銀汚染に対する認識を深めるとともに、金採鉱の現場で人々が水銀を使用せざるを得ない社会的背景の理解を試みた。

ASGMで使用される水銀のほとんどは先進国から輸出されるものである。EUおよび米国はすでに水銀輸出の禁止に踏み切ったが、日本はいまだに水銀含有製品などから回収された余剰水銀を年間約100トン輸出している。水銀条約では、水銀供給を絶つための輸出禁止も大きなテーマのひとつとなっている。

本調査では、以下の結論が得られた。

- フィリピンの水銀汚染は拡大しており、水銀の環境への排出を食い止めるためには、緊急かつ抜本的な取り組みが必須。近年では、水銀を使用しないASGM技術として、シアン化合物の使用が増加していることも懸案事項である。
- フィリピンのASGMを取り巻く複雑な問題解決に決定打はない。効果的な介入を行うには、ASGMコミュニティのニーズや発展のための目標に対する理解を深める必要がある。
- 様々な制約がある中で、ASGMを適正化し、管理体制を築くためには、以下のような戦略やメカニズムあるいは潜在的な解決手段を考慮する必要がある。
 1. 水銀の採掘を停止し、国際的な水銀供給の流れを絶つ

■ バン・トクシックス (Ban Toxics!)

バン・トクシックスは、特にアジア太平洋地域における廃棄物や製品、技術における有害化学物質の問題に取り組む環境NGO。現在は汚染物質である水銀問題に注力し、水銀貿易、小規模金採鉱、水銀の保管と処分の問題に取り組んでいる。2008年度は調査研究テーマ「廃棄水銀の最終保管をフィリピンで行う場合：最終保管施設運用リスクと国や自治体に求める政策の把握」で40万円の助成を受けている。<http://bantoxics.org/>

●助成研究テーマ

小規模な鉱山開発コミュニティにおける水銀汚染の把握および
ベースラインデータの構築——水・土壌のサンプル調査を通じて

●助成金額

2009年度 30万円



Ban Toxics! の報告書*1

*1 “The Price of Gold : Mercury Use and Current Issues Surrounding Artisanal and Small-scale Gold Mining in the Philippines” は、こちらからダウンロードできます。http://bantoxics.org/v2/images/downloads/BanToxics_The_Price_of_Gold.pdf

2. 全てのセクターでの水銀および水銀化合物の貿易及び使用の禁止
3. ASGMに対する以下の技術支援の実施
 - ① 鉱床の探査及び抽出
 - ② 採掘のための小規模な鉱物インベントリ－の作成
 - ③ 州や市の鉱業管理当局による「民衆の小規模金採鉱地域」の特定
 - ④ 水銀を使用しない金抽出技術を確立するための金鉱石の特性研究
4. ASGMに対する運転資本や信用供与、適切な採鉱装備の提供
5. ASGMの労働者に対する搾取をなくすためのASGMの正式団体の組織化および強化
6. ASGMを適法化するため、鉱業に関する一貫性のある国家政策の策定と規制や事務手続きの緩和化
7. 地域レベルの鉱業規制局の強化
8. 鉱山労働者や家族、コミュニティに対する水銀の毒性に対する意識向上

Engaging small-scale mining communities in understanding the impact of mercury pollution through sampling of fish, water and sediments and establish a baseline of mercury pollution in these communities.



Richard Gutierrez
BAN TOXICS!

1. Overview of the Research

Artisanal and Small-scale Gold Mining (ASGM) presents a complex development issue. While it provides livelihood to a significant number of people worldwide and accounts for a sizeable volume of annual gold production, it is also confronted with various grave environmental, social and health concerns. The sector is also known as the largest emitter of mercury. The global mercury treaty, which is currently being developed through a series of intergovernmental negotiating committee meetings, seeks to incorporate ASGM elements to reduce, moving towards elimination of mercury use in the sector and to protect human health and the environment. While the terms of the global pact are being considered, parallel efforts are underway to encourage migration of miners to mercury-free gold liberation techniques.

The Philippines is in the process of formulating its National Strategic Plan on ASGM with support from the United Nations Environment Programme (UNEP). To supplement this initiative, Ban Toxics a non-profit environmental non-governmental organization that aims to promote environmental justice, with the help of the Takagi Fund for Citizens Science and that Natural Resources Defense Council, and the Swedish Society for Nature Conservation conducted a study on the inner workings of ASGM focusing, among others, on

the trading, use and emission of mercury, gold mining and production methods, and the human health and environmental impacts of mercury pollution. The study was also conducted to verify levels of mercury in their communities, to acquaint grassroots communities such as ASGM miners to the processes used to measure mercury contamination, and understand the social context that prompts ASGM miners to continue using mercury in gold mining.

Mercury release from the ASGM sector in the Philippines is estimated at 70 metric tons per year, making the industry one of the biggest contributors of mercury pollution. In 2006, the United Nations reported that miners in the Philippines are found to have mercury levels up to 50 times above World Health Organization limits. About 18,000 women and children, the sectors most likely to succumb to mercury's toxic threats are also engaged in small-scale gold mining.

The study arrived at the following conclusions:

1. The problem of mercury pollution in the Philippines is widespread and that unless and until urgent and drastic steps are carried out to contain its further discharge into the environment, the effects will be disastrous. It also noted the sector's growing shift from mercury to cyanide and attempts to move to mercury-free gold production technologies.

2. There is no silver bullet that can adequately address the complex issues surrounding ASGM in the Philippines. Care should be taken to understand the specific ASGM areas, the needs of the community and its goals for development be for any effective intervention can take place.
3. Considering these constraints, to rationalize ASGM activities and improve governance of ASGM operations, the following broad strategies, mechanisms and potential solutions to various ASGM concerns may be considered:
 - A. Stop the global supply flow of mercury by putting an end to primary mining of mercury.
 - B. Prohibiting the trade and use of mercury and mercury compounds in all sectors.
 - C. Provide technical support to ASGM in:
 - i. Exploration and delineation of mineral deposits;
 - ii. Mineral inventory for extraction at the small-scale level;
 - iii. Identify areas that can be set aside by the provincial or city mining regulatory boards as People's Small Scale Mining Area; and
 - iv. Study gold ores properties to determine mercury-free gold liberation techniques
 - D. Provide needed working capital, credit facilities and suitable mining equipment to ASGM;
 - E. Organize and strengthen ASGM formal groups to reduce and eventually eliminate exploitation of miners.
 - F. Develop coherent national policy on mining and streamline regulatory and administrative procedures to remove barriers for formalization.
 - G. Strengthen local mining regulatory boards.
 - H. Increase awareness on mercury's toxic effects to miners, their families and affected communities.

Ban Toxics also recommends for the government and civil society to initiate a dialogue to find out how and where does ASGM fit into national development. Oftentimes, ASGM is linked with sustainable development, but no concrete consultation with mining and other stakeholders have taken place to define ASGM's role. Currently the serious social, health and environmental costs that accompany small-scale gold mining are externalized and borne by communities and local governments where these operations occur. Any real discussion of the benefits of ASGM and its role in national development must be weighed by these external costs that are often ignored. Particularly, efforts towards internalizing the external costs of gold production must be carried out before we seriously consider mainstreaming ASGM into the national

development agenda.

2. Outcome of the Research

a. Continued use of mercury in ASGM.

The use of mercury in the artisanal and small-scale gold mining sector is still quite prevalent. However there are areas that have migrated away from mercury-use, while others still utilize large quantities of mercury in their operations.

Primary use of mercury comes from whole-ore amalgamation, wherein mercury is poured into the gold ore as it is being crushed in either a ball mill or rod mill.

b. There is awareness of the danger of mercury use among miners, however, this is not translated into action.

In our interviews, we often see that miners have a sense of the dangers posed by mercury to health and the environment. However, the miners persist to use mercury due to lack of alternatives that can address their financial and technical needs for gold processing; availability of mercury and inexpensive cost; and habit.

c. Mercury is used in areas where communities have migrated away from this technology, because of the need for quick money.

d. Almost all small-scale miners operate illegally, and have no tenure in the areas where they conduct small-scale mining activities.

This contributes to a vicious loop among the mining community not invest in safety gears and equipment. Since they do not have tenurial insecurity in the areas where they operate, they are not motivated to clean up their process or make it safe.

e. Sampling results have been variable.

Ban Toxics is revisiting some of the sites and conducting new samples for the following reasons:

- Initial results did not coincide with the observed practice;
- Lack of available sample media in the initial visit;
- Checking if there was error in the analysis of the first laboratory; and
- Isolate possible discrepancies

Particular concern was raised in the Paracale, Camarines Norte samples. See table below. In Ban Toxics' visit, this area is one of the high mercury usage

水銀使用が多いエリアでの魚介類サンプル調査

	Sample	Sample code	Total Hg content / ppm
Paracale, Camarines Norte January 22-24, 2010	Fish	1	ND
		2	ND
		3	ND
		4	ND
	Crab	1	ND
		2	ND
		3	ND
		4	ND
Hinobaan, Negros Oriental February 15-18, 2010	Fish	1 Hito	0.04
		2 Hito	0.05
		3 Dalag	0.05
	Shellfish	1 Bungkawel	0.03
		2 Sikad	0.02
		3 Susong Dalag	0.08
Aroroy, Masbate February 22-25, 2010	Fish	1 Balanak	0.02
		2 Bugaong	0.8
		3 Bugaong	0.4
Itogon, Benguet April 17-18, 2010	Fish	1	0.03
		2	0.02
		3	0.02
		4	0.03
		5	0.03
		6	0.02
	Shrimp	1	0.02

areas. Yet, in the sample results, mercury is none-detected (ND). We are going to re-visit the area and obtain new samples to corroborate the older samples, and we will have samples analyzed in a new laboratory to isolate if there was error by the first laboratory we utilized.

f. Distrust by miners over scientific process.

Due to the perceived collusion among large-scale mining companies, local government units, and academic institutions, ASGM miners were very wary of attempts to engage them in undertaking sampling process.

Ban Toxics initial attempt to work with ASGM miners

ベンケット州イトゴンで測定された大気中の元素水銀濃度 (2010年11月21～22日調査実施)

Location	Average reading	Maximum reading
Ball Mill Plant	19.2 ng/m ³	30.4 ng/m ³
Top-Hill Panning Area	92.4 ng/m ³	710.7 ng/m ³
Retail Store	18.1 ng/m ³	33.0 ng/m ³
Miners Barracks	3751.8 ng/m ³	30000.0 ng/m ³
Field Test	6.3 ng/m ³	7.7 ng/m ³
Ball Mill Plant with Women Miners	3.44 ng/m ³	17.3 ng/m ³
Lime Process Area	26.3 ng/m ³	41.0 ng/m ³
Cyanidezation Area	8.9 ng/m ³	10.4 ng/m ³
Carbon and Leach Area	26.5 ng/m ³	64.7 ng/m ³

北カマリネス州で測定された大気中の元素水銀濃度 (2010年11月24～25日調査実施)

Location	Average reading	Maximum reading
Brgy. Maluguit Residential Area	266.7 ng/m ³	5516.2 ng/m ³
Mangrove Forest	9.0 ng/m ³	19.7 ng/m ³
Gold processing Area	14275.3 ng/m ³	30000.0 ng/m ³
Compressor mining area	93.2 ng/m ³	96.4 ng/m ³
Actual amalgamation	7548.5 ng/m ³	30000.0 ng/m ³
Brgy. Hall-Tugos, Paracale	78.8 ng/m ³	86.9 ng/m ³
Tunnel area	17.8 ng/m ³	142.7 ng/m ³
Ball Mill and Panning Area	227.0 ng/m ³	620.4 ng/m ³

in obtaining environmental samples was greeted with suspicion. Due to the resource conflict between large-scale (LSM) and ASGM miners, the favorable treatment LSM gets from the national and local governments, and the financial resources LSM has to conduct environmental samplings, ASGM miners were very suspicious of the research being undertaken by Ban Toxics.

Ban Toxics succeeded in encouraging ASGM miners to participate in some areas, but were unsuccessful in others.

g. Use of cyanide has become prevalent.

Ban Toxics has observed that in areas where there



写真 1 フィリピン北カマリネス州Paracaleの採鉱現地にて使用中の水銀濃度分析計“Lumex”

has been a decline in the usage of mercury, cyanide processing has increased. Although, cyanide has different chemical characteristics from mercury, unregulated use of cyanide could present problems to the community if left unchecked.

3. Perspective after the research

The ASGM use of mercury is not simply a technical question, replacing one technology for another, but is very much rooted in the social context surrounding the ASGM miners. Poverty, lack of education, illegality of operations, absence of government support and financial credit, resource conflict with large-scale miners, negative public perception, among others, are the challenges that ASGM miners face.

Oftentimes, mercury use continues because this is the only process they are comfortable with or what they perceive is the cheapest alternative available. There is openness among ASGM miners to look at mercury-



写真 2 フィリピン上院でのイベントにて、ファン・ミゲル・ズビリ上院議員（右）にASGMに関する報告書を手渡すバン・トクシックス代表リチャード・グティエレス（左から3人目）

free technologies not from an environmental or health perspective, but from a profit-maximization perspective. There are areas that have migrated away from mercury because they were able to maximize profits through the use of cyanide. Concrete change in miner behavior should take this into account, especially in formulating environmental and health interventions.

It was also observed that there are sectors within the mining community that is receptive to change, particularly well-off miners or cyanide facility owners. These actors have the financial leeway to look at the broader issue and can be approached to initiate and instill changes among ASGM miners.

Lastly, the conduct of scientific sampling and health monitoring is important, and needs to be sustained. The ASGM community can benefit from being familiar with this scientific process, by engaging them to raise their awareness of the impact of mercury in their environment and health.