Fact finding mission in Bolivia

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Introduction

A large number of small-scale gold miners extract gold in in Bolivia. In Sorata and other areas within the Cordillera mountain chain the miners are mainly organised in cooperatives. They extract gold from hard rock using mercury. In the Guanay area of the Amazon part of Bolivia gold extraction takes place from rivers. Sand and gravel is dug up from the bottom of the rivers and mixed with mercury. After thorough mixing mercury is separated from sand and gravel and subsequently burned off leaving gold behind.

Both types of gold extraction release phenomenal amounts of mercury, which is not only a major health hazard for Bolivia, but provides a significant contribution to the global mercury pollution. Release of mercury is not only a major health problem, but also a financial problem. The mercury contains high amounts of gold. This gold which is lost, could have provided substantial addition to the Bolivian economy.

More than thirty years ago a mercury-free gold extraction method for small-scale gold miners was invented. The method was swiftly adopted by a large group in Philippines. This Philippine method was successfully demonstrated in Sorata in 2013 and 2014 in a project sponsored by European Union, Danish Embassy in Bolivia and Geological Survey of Denmark and Greenland. The proposed project described below will hopefully be financed by Dialogos (Danish NGO). Such project will contribute to reduction of mercury release from Bolivia. The method to be used has been used for several decades in Philippines and has so far been introduced in several countries e.g. Africa and south east Asia. January 2019 a successful introduction was carried out in Uganda. By comparing gold extraction with mercury free gold extraction the result was that mercury-free gold extraction took

about ten percent long time compared with amalgamation, but recovered 40 percent more gold then amalgamation method.
Considering that Bolivia not only have signed the Minamata convention but also ratified the convention it is high time to take action.

Mercury toxicity

Elemental mercury is a liquid that is volatile at room temperature and causes pulmonary and neurologic toxicity, as well as nephrotoxicity in severe or prolonged exposures. Mercury evaporates easily and inhalation of mercury vapors may cause a severe and potentially fatal lung-injury. Chronic exposure to lower concentrations of mercury vapors results in predominantly nervous system effects. Several studies have shown a dose-response relationship between subjective symptoms and/or impaired performance on psychologic tests. In severe cases, permanent central nervous system impairment may result.

In the ecosystems elemental mercury is transformed to organic compounds (methylated mercury) that is built into microorganisms and enter the food chain. Eventually some of the mercury from small-scale goldmining ends up in the fish we eat all over the world. However, the local mining communities remain subjects to the most immediate consequences of mercury pollution. The fetal brain is considered the tissue most sensitive to the harms of mercury. Exposure to mercury in fetal life can cause diffuse and widespread neurologic damage, best illustrated by episodes of community-wide mercury poisoning in Japan (Minamata disease) and Iraq. Pregnant women exposed to high levels of mercury in these communities did not develop symptoms themselves, but their children had delayed attainment of developmental milestones and, in some cases, devastating neurologic handicaps, including blindness, deafness, and cerebral palsy.

There is a way that can stop release of mercury from mining

Recovering gold by using mercury (amalgamation) has been used for generations. Up until the 18th century the number of miners using mercury was small and did not cause serious

damage to the health of the planet. However, with the dramatic increase in population it has become a major health problem. Today 37 percent of the mercury released to Planet Earth come from small-scale gold mining.

There are methods to recover gold for small-scale miners without using mercury.

The mercury-free gold extraction method in question was invented in Philippines about 30 years ago. Subsequently about 25,000 thousand miners have used it for more than 30 years. Recently a project sponsored by Danish Government taught a group of 1800 Philippine miners mercury-free gold extraction. Those miners have used that method for seven years. The method has successfully been introduced in several countries e.g. Mozambique early 2018, where it was demonstrated that a significant increase of up to 78% gold recovery, was achieved when extracting gold mercury-free. A project carried out in Uganda January 2019 financed by Dialogos proved that mercury-free gold extraction required about ten percent longer time, but recovered up to 40 percent more gold than gold extraction using mercury (amalgamation). A further advantage of going mercury-free is that the miners don't need to buy expensive mercury.

Previous work in Bolivia

In 2013 and 2014 a project teaching Bolivian miners to replace mercury gold extraction with mercury-free gold extraction was carried out. It was financed by European Union, Danish Embassy and Geological Survey of Denmark and Greenland. The conclusion of the project was that comparing mercury-free gold extraction with amalgamation (using mercury) the mercury-free gold extraction recovered most gold. The advantage of changing was then better health, no need to buy expensive mercury and higher gold recovery. The results have been published in an international journal (see reference below). Due to lack of international funding no follow up could be carried out on this project. Small processing plant for demonstration and teaching was established August 2014. In 2019 it is still functioning in Santo Domingo although not completely mercury-free.

Planned work in Bolivia

Sorata Area

Sorata is located in the department of La Paz. Some 700 mine-cooperatives have been registered in the department of La Paz, around 400 are active. The sizes of the cooperatives range from approximately 60 people and up. In total, about 7000 people are involved. The cooperatives are headed by partners who typically live in La Paz and are only engaged in mining operations at the administrative level. The owners are typically part of the management of the regional mining organization FERRECO (Federacion Regional de Cooperativeas Mineras) who has strong ties with the current Bolivian government under Evo Morales

During this fact finding mission some of the gold mines situated as pearls on a string through valleys in the steep Cordillera mountain range the Sorata district have been visited in order to find the best site for introducing mercury free gold extraction. The La Suerte cooperative mine in the Sorata municipality was chosen as the best for the purpose

Cordillera mountain range

One of the many cooperative gold mines in the valley of the Cordilleras

Meeting with partners

Plagbol

The factfinding mission was carried out in collaboration with the local partner Plagbol. The Plagbol Foundation is a Bolivian NGO on Occupational and Environmental Health created in 2008, a private non-profit organization for public service and with national coverage. It started as the project Plagbol in 2001 with the support of DANIDA through Diálogos. The vision of Plagbol is to improve the conditions and quality of life of the general population, especially of the poorest and most vulnerable ones for them to enjoy a healthy, productive life and a clean environment. Through years of devoted work with the pesticide problem, Plagbol has become a benchmark organization on the pesticide issue on a national level and gained great experience in the training of human resources in the agricultural and health areas, at level of farmers, technicians, health professionals and teachers.

FERRECO

A meeting was held with FERRECO in La Paz. The participants were the president of FERRECO, 3 members of the board, Plagbol and Dialogos.

Review of the plans for the project was presented by Plagbol – including the display of a film produced by an EU-funded project in 2013. The members of the Board were positive about the project and gave an oral commitment to support.
Plagbol/Dialogos was invited to attend a conference in Guanay at the end of July, where there will be the presence of all the leaders of the cooperatives in La Paz.

Local authorities in Sorata

A meeting was held at the townhall in Sorata with the participation of 33 local authorities, Plagbol and Dialogos. Among the participants were: the mayor of Sorata, the president of the mine cooperatives of Sorata, the chief physician and several other leaders of mining-cooperatives and traditional leaders. The plans for the project was presented by Plagbol - including the display of slides and film about the mercury free method.

The ensuing discussion with many inputs from the participants showed a great deal of knowledge among participants about the harmful effects of mercury. Both mayor, chief physician and several local authorities indicated the importance of limiting mercury emissions is in the interest of the population health status. There was generally strong positive support for the project and an oral commitment of support was made from both the mayor and the president of the mine cooperatives. We were given the permission to visit 2 local mining cooperatives. La Suerte and Santo Domingo were chosen.

La Suerte

La Suerte mining cooperative was found as an excellent place to establish a teaching and training center for miners to learn the method of mercury-free gold extraction.

Processing station at La Suerte

Processing station at La Suerte

The two photos above show where the introduction of mercury-free gold extraction is suggested to be introduced.

La Suerte processing station has presently two procession lines. They are fed from above where truckloads of gold ore are deposited. The ore is channelled down into the large drum where the gold ore is milled with mercury. This is a standard processing line in this region.
The suggestion is to build a third processing line to the right of the present lines. The roof will have to be extended somewhat and the ore feeding channel for ore has to be enlarged towards right side of the photo.
The new line will serve as teaching place for other miners, coopertives, and as production line for the cooperative. This is a win-win situation. The cooperation will recover more gold and the miners from other cooperatives can come and view mercury-free gold recovery as well as hands on learning to recover mercury-free gold.
The significant increase in gold production from the new line will be a major asset for the cooperative. It might be considered that the cooperative cover a substantial part of the building costs of the line.

Santo Domingo

This cooperative is situated pretty far away from most other mining cooperatives. It was the site of a project teaching mercury-free gold extraction in 2013-2014 (see reference below). The mining cooperative did in fact pay interest to the method and after teaching they build a processing plant as shown below.
After screening the milled ore the light fraction is directed to mercury-free god extraction. The heavy fraction is collected and with irregular intervals milled together with mercury. It is a good step towards mercury-free god extraction, but a further step, extracting gold from the heavy material should have been taken.

Mercury-free gold extraction plant
in Santo Domingo
8 to 10 tons of ore is processed
daily

Santo Domingo could have been chosen as teaching and training site but considering the remote location from other mining sites Santo Domingo was not selected for training for miners from other mining cooperatives.

Guanay region

We were unfortunately not able to visit Guanay region where gold extraction is carried out from rivers (placer mining). The following section is copied from a report written in 2014 will give an impression of the advantages and disadvantages of introducing mercury-free gold extraction in that area:

A mercury-free demonstration plant was erected and a demonstration followed by borax smelting of the gold concentrate was carried out producing a gold pellet of ~5 g.

The miners were keen to learn how the mercury-free gold extraction method work, but the general attitude was that it is too time consuming. However, when summing up time spent on all the processes presently used in their alluvial mining, it is obvious that the time spent on the new method is not much longer than the method they use now. The time available for us was far too short to allow in depth discussions with the miners to make them aware that the new method indeed would give them higher gold recovery without major investment in equipment and time. A proper presentation of the new method with pros and

cons was not arranged, and there was not time allocated to make a presentation of the technical details behind the process. It is clear that in order to convince people to change working procedure they must have very good explanations of the advantages of changing their working method.

Next day a meeting was held with leaders of the cooperatives running alluvial gold mine operations along the river. The leaders were negative towards using non-mercury methods in their operations, and were not really interested to discuss advantages of the method.

Convincing miners to stop using mercury

Teaching miners to change working methods is not an easy task. Miners like other people stick to the procedures they used to do. It is thus a difficult task to teach the miners to stop using mercury and change to no-mercury gold extraction.

Short term teaching

During teaching and training we demonstrate that no-mercury gold extraction recover more gold than using amalgamation. Having seen that some miners switch to no mercury, whereas others are more reluctant.

Long term teaching

We suggest to carry out a long term sampling programme in order to show long term increased higher gold recovery.

In order to make a long term proof that no mercury method yield higher gold, we suggest to carry out a test: When everything is established and the two parallel lines are processing the same type of ore, we will with intervals sample tailings from the two lines. It is suggested to start sampling tailings from the two lines starting one year from start. During a period of every 4 months daily samples are collected 2 weeks in a row from the two lines.

The samples shall be well packed to avoid loss off mercury from evaporation. The samples are suggested to be submitted to Actlabs Canada for assaying to determine the amounts of gold and mercury in the tailings.

Conclusion

The emission of mercury from small scale mining poses a major health problem for both the local population in the affected areas and at a global level. The factfinding mission has confirmed significant use of mercury in the areas visited. Based on past experience, the mercury-free method is an alternative to the traditional use of mercury in Bolivia.

In Sorata and other areas within the Cordillera mountain chain the miners extract gold from hard rock using large amounts of mercury. In the Guanay area extraction takes place from the abundant rivers also with the use of mercury. In both areas, the mercury-free method is an obvious alternative.

Through meetings with mining-cooperatives and local authorities a considerable knowledge was found about the harmful effects of mercury and a willingness to resolve this problem. The possibility of extracting more gold at no additional cost as an attractive alternative which will facilitate the introduction of mercury-free mining with the borax method.

The local partner Plagbol is an institution with considerable knowledge and experience in the field and with resources in training and capacity building and hence to facilitate the introduction of mercury-free mining in the area.

The La Suerte cooperative mine in the Sorata municipality was found suitable for the introduction of the mercury-free method. This will require the building of a new line of production that will serve as teaching place for other miners, cooperatives and as production line for the cooperative. Based on previous Plagbol experience a 20-30% co-financing from the cooperative is expected.

Recommendations

- Build a full-scale mercury free production line at La Suerte
- Implement analytical sampling program of the tailings
- Demonstrate mercury free goldmining and educate local miners to be trainers in the mercury free method
- Educate local miners in mercury toxicity
- Capacitate health providers, teachers and others in teaching the community on the dangers of mercury
- Implement educational program concerning mercury toxicity targeted the most vulnerable population (women and children)
- Develop a strategy to promote and boost mercury-free mining at a national level

Reference: Appel et al. 2015: Introduction of Mercury-free Gold Extraction Methods to Medium-Scale Miners and Education of Health Care Providers to Reduce the use of Mercury in Sorata, Bolivia**.** Journal of Health & Pollution Vol. 5, No. 9 — December 2015