Fact finding mission in Antioquia, Colombia

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Summary

A large number of small-scale gold miners extract gold in the Segovia province of Antioquia, Colombia. The mined ore is transported to processing plants in the town Segovia, where a two-step gold extraction takes place. First step is gold extraction using mercury. Second step entails cyanidation. This calls urgently for alternative methods such as the mercury-free gold extraction invented three decades ago in the Philippines and still is used by more than 25,000 small-scale miners. Workshops and lectures for representatives from two mining associations and local government officers have been held explaining the mercury-free method. One mine has been visited as well as several processing stations where the mercury-free method has been discussed. Meetings with miner's associations indicated that they were very positive towards initiatives to reduce/stop use of mercury. Colombian government issued law 1658 in 2013 on use of mercury giving the miners 5 years for the transition. The ban started 16th July 2018 so it is obvious high time for intervention.

Introduction

I was approached by Jorge Ivan Contreras from Colombia studying to master degree in Techno-Anthropology at Aalborg University Copenhagen. He expressed interest in working with behaviour of groups of people who were exposed to new technologies. Jorge Contreras had heard about the serious health problems caused by small-scale gold miners use of mercury and of the various ways to mitigate these problems. Jorge Contreras being from Colombia, a research project among small-scale gold miners appeared logic.

Furthermore, a survey by Cordy *et al*, (2011) *concluded: that the average levels of mercury consumption estimated by mass balance and interviews of entables (processing*

station) owners, the mercury consumed (and lost) in these 5 municipalities in Antioquia must be around 93 tonnes/a. The total mercury release/emissions to the Colombian environment can be as high as 150 tonnes/a giving this country the shameful first position as the world's largest mercury polluter per capita from small-scale gold mining.

Together with Jorge Contreras I decided to carry out a fact-finding mission in the Segovia area of Antioquia region in Colombia, where numerous miners extract gold using mercury. Segovia is a turbulent mining town surrounded by small-scale gold mining sites. Recently a large Canadian mining company has taken concession and started gold mining. Many of the small-scale gold mining sites are within the concession area of the commercial gold mining operation. The miners have been given two years to close down their activities within the Canadian concession. However, some miners not using mercury have made a deal with the Canadian company allowing them to continue mining. This shows that serious action should be taken to reduce/stop use of mercury in gold extraction. The Colombian government has recently imposed restriction on the use of mercury for gold extraction widely used in processing plants in Segovia. The scene is thus set for a variety of problems and confrontations between the miners, the cyanide plant owners, the mining company. A governmental ban on using mercury for gold extraction started 16th July 2018. It was thus decided to carry out this fact-finding mission aiming at laying out an avenue for mercury-free gold extraction.

Mines and processing plants

The gold ore is a pyrite-rich ore occurring in quartz vein systems. Some ores have contents of magnetite.

Mining and processing setup in Segovia area is different from similar setups in many other countries. In Segovia area the small-scale gold miners bag their ore when it is hoisted up to the surface. Then they transport the ore to Segovia town where the processing plants are located. The reason is that if the gold is extracted at or near the mine site far from town, it is an easy target for robbers. Instead the ore is transported to town where the processing facilities are located. No robbers will bother stealing hundreds of kilograms of gold ore.

Visit to “la Cuenca” mine

Drove out of Segovia into a hilly district with steep slopes and lush vegetation. Along the road towards the mine to be visited several mines were seen. The mine entrance is a decline with the approximate length of 100 m. A hoisting system pulls a small wagon up with the ore which has been blasted loose underground. Visible gold is very sparse. The ore is a quartz-pyrite vein system with occasional more massive pyrite ore. At surface the hoisted ore is wheelbarrowed to a depot where it subsequently will be picked up by a truck from the commercial company owning the concession.

The financial arrangement is as such. The commercial company has sole rights to the land. The miner is obliged to hand over the ore to the company. The company collect samples in order to determine the grade. When that is done, the miner is paid for the number of sacs he delivers with the determined gold grade. If the determined grade is say 5 grams per ton and the actual grade is 7 grams per ton, the miner loses. If on the other hand the determined grade is 5 grams per ton and the actual grade is 3.5 grams per tons, the miner benefits.

Mine entrance

Visit to milling station Jaime Muñoz Jaramillo in Segovia

Ore is brought to the milling station from mines outside town. Size of the ore is 4 inches. It is first passed through a jaw crusher down to 1 inch. Further to a hammer crusher yielding gravel size. Next step is milling which is carried out in more than 20 drums each containing 60 kg ore running with 60 kg hard metal balls in 35 litres of water together with 25 to 30 grams of mercury and “melaza” (Sugarcane honey). Three hours milling time. Drum is emptied into a bucket and stirred whereby the mercury concentrates in the bottom.

Mercury is extracted. The remaining ore is returned to a drum together with citrus fruits plus 10 litres of water.

Tailings are partly dried, chalk is added. The mixture is crushed if necessary. Then placed in a basin, covered with clean water for three days. Then after partly drying, the basin is flooded at intervals with a cyanide solution. The solution seeps through the tailings and is collected in boxes containing zinc flakes below. The material with zinc flakes is retorted to recover mercury. The remaining material is heated with borax to melt the gold and silver.

Visit to milling station Luis Norberto Sanchez in Segovia

This milling station is smaller than the previous one. About 15 drums. After milling the ore with mercury, a separation gadget in a drum is used to separate mercury and gold from the ore. Sometimes the ore the loaded back into the drums. After separation the ore is channelled down to a cyanide tank where the solution is stirred for 4 hours. The rest is similar to the previous description.

Visit to milling station John Jairo Cardeño in Segovia

This is a large very well organised milling station which is operated along the same line as the two previous. The only difference is that it has a size which makes it suitable to host a teaching site for educating future trainers in mercury-free gold extraction.

Line of milling drums at John Cardeño

Visit to Las Palmas milling station in Segovia

This is a completely different setup. There are two sections:

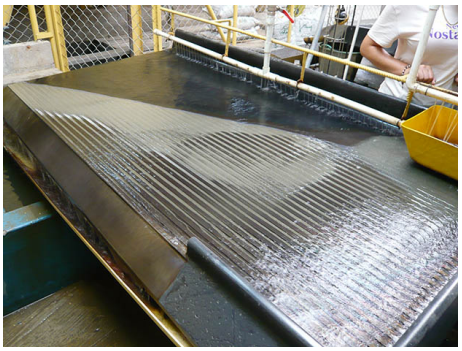
- One which is similar to the previously visited sites where gold ore is milled in drums with mercury and tailings subsequently are treated with cyanide.
- The other section is highly modernised, and mercury is not used.

The financial set up is as follows. When a small-scale gold miner arrives at the site with a number of sacs he can make an agreement with the plant. Five sacks are milled with mercury and the average gold content per sac is determined. The plant then offers to buy all his sacs for a price of the estimated gold content per sac. If he agrees he receives the money and can go home. His sacs will then be processed mercury-free and the plant owner cashes in the gold.

If the miner does not agree with the price he may use the milling setup at the plant and extract mercury and gold after paying a fee for using the mills.

In the modern section the ore is milled twice. The milled material is then treated in two successive shaking tables. The heavy fraction consisting mainly of sulphides, magnetite and gold is collected in flotation tanks.

Shaking table



Contact with local authorities

An information meeting was held at the town hall where local administrators. A meeting with representatives from La Mesa Minera mining association was held. Detailed information about the history of mercury-free gold extraction and the pros and cons of that method was presented. The association was really keen on trying ways to reduce/stop use of mercury. Meeting with Asociación de Plantas de Beneficio Aurífero de Segovia (APLABAS) and a short description on mercury-free gold extraction.

Mercury-free gold extraction in brief for small-scale miners

The mercury-free gold extraction method in question was invented in Philippines where 25,000 thousand miners have used it for more than 25 years. A project sponsored by Danish Government taught a group of 1800 Philippine miners mercury-free gold extraction. Those miners have used that method for four 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: Stoffersen *et al*. 2018.

Scope

It is suggested to seek funding for teaching the processing plant owners in Segovia to extract gold using mercury-free method. It requires establishing a mercury-free area with mercury-free milling drums together with sluices, tubs and pans for gravitational separation of gold. The mercury-free station will be teaching and training facility of initially six to seven innovative workers. After training these people will act as trainers for fellow mates. Further information can be found at www.appelglobal.com.

Acknowledgement

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Reference

Cordy, P. *et al*. 2011: Mercury contamination from artisanal gold mining in Antioquia, Colombia: The world's highest per capita mercury pollution: Science of the total environment, 410-411 (2011) 154-160.

Stoffersen, B. *et al.* (2018): Introduction of Mercury-Free Gold Extraction to Small-Scale Miners in the Cabo Delgado Province in Mozambique. Journal of Health & Pollution Vol. 8, No. 19. September 2018. 1- 5.