MERCURY FREE MINING: AN EXQUISITE OPPORTUNITY TO MAKE A GLOBAL DIFFERENCE

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The jewelry industry has a chance to make a real difference in the health and quality of life for millions of artisanal gold miners, their families and communities. Metallic mercury is a permanent, potent neurotoxin that is increasingly pervasive in the global environment. We can take action to reverse this trend.

Mercury has been used to extract gold for as many as 3,000 years, yet it is a growing concern today. Why is this problem persisting and what can we do? Mercury–dependent artisanal and small–scale gold mining (ASGM) is the world's largest source of mercury pollution. There are between 14 and 19 million artisanal and small-scale gold miners in more than 70 developing countries who use mercury, a permanent, potent neurotoxin, in order to be marginally efficient in capturing gold.

FIGURE 1. *Illegal mining moonscape contrasts Zaragoza jungle. Photo courtesy of Toby Pomeroy.*

They mine to live, and in the process inadvertently release approximately 8,000 lbs. of mercury into our environment every day. They are poisoning themselves and the rest of the world as mercury vapors and micro-particles are transported globally on winds and in ocean currents. Mercury use was prominent in northern California from the late 1800s until the 1960s and the environmental impact will predictably persist for centuries and beyond. Figure 1.

HOW MERCURY IS USED IN GOLD MINING

Artisanal gold miners are mostly exceedingly poor and lack sophisticated mining equipment and methods and usually mine in one of two ways. Alluvial mining consists of collecting minerals from streambed deposits, which are formed when gold has eroded from its source, then transported by water to a new locale. Miners may use a sluice, pan or some other means of collecting the heavier minerals as a concentrate. Figure 2.

In hard rock mining, a pit or shaft is dug to follow a gold vein that is excavated by the miners and carried to the surface where the ore will be concentrated. Concentration means increasing the amount of gold in relation to other minerals by selectively removing lighter particles. If employed effectively, concentration methods can greatly reduce the need for mercury. Figure 3.

Before concentration can begin in hard rock mining, the ore must be crushed or milled to liberate gold particles from rock and to decrease their grain size. Concentration works best when grain size of the milled material or sediment is relatively consistent, so that most particles are of similar size. An appropriate grain size can be achieved using screens or sieves. Once the gold-containing material has the appropriate grain size, separation can be used to concentrate the gold bearing material. Most concentration methods are gravimetric due to the high density of gold relative to other minerals in the ore mixture[1].

Once the miners have achieved a concentrate of heavy minerals that include gold, in order to capture the finer grains, liquid mercury is worked into the concentrate either mechanically or by hand until the gold and mercury form a physical bond together while the lighter material is washed away. The resulting putty-like mixture or amalgam is then heated, often with a torch or over a stove, to vaporize the mercury and leave the gold behind[2].

[1] https://www.epa.gov/international-cooperation/artisanal-and-small-scale-gold-mining-without-mercury

[2] https://www.ncbi.nlm.nih.gov/pubmed/29314284

FIGURE 2. *Maria Eloisa Garcia sluicing. Photo courtesy of Toby Pomeroy.*

FIGURE 3. *Canada Mine, La Llanada. Courtesy of La Llanada, Colombia.*

IMPACTS OF MERCURY

Although mercury is a naturally occurring element, it is highly toxic to humans, animals, and the environment when handled improperly. Prolonged and high exposure to mercury by inhalation damages the nervous, digestive, and immune systems. It can also contaminate bodies of water and subsequently fish and shellfish. When ingested, mercury can accumulate in living organisms, and cause serious damage to the nervous system after it reaches high levels. In humans, this has been referred to as Minamata disease, named after a city in Japan where it was first observed in humans and animals that ingested mercury-laden fish and shellfish caught in the Minamata Bay.

Mercury poisoning's most notable symptoms are convulsions, loss of muscle coordination, damage to vision, speech, and hearing. Pregnant and nursing mothers as well as young children with developing nervous systems are most susceptible, causing physical and mental disabilities and compromised development[3].

Communities far downstream from mines that use mercury are affected due to mercury contamination of water and soil and subsequent accumulation in food staples, such as fish—a major source of dietary protein in many ASGM regions.

Mercury lost in ASGM's concentration and amalgamation processes releases approximately 1,400 tons of the permanent, pernicious neurotoxin into the atmosphere, water bodies and soil by artisanal mining every year.

ARTISANAL AND SMALL-SCALE GOLD MINERS (ASGM)

The Minamata Convention on Mercury came into force in 2017 leading to increasing political motivation to help overcome the problem of mercury in ASGM. To meet this challenge, it is critical that new, safe technologies or techniques are developed that are scalable to meet the needs of artisanal miners in the next decade or two.

ASGM produce about 20% of the world gold supply annually and the jewelry industry purchases more than half the production. This makes the jewelry industry the primary buyer and seller of gold mined with mercury. It's likely that our current and future customers will have a tarnished view of jewelry if they believe that jewelers ignored (they may have just not realized) the fact that 15 million ASGM, their families and the millions whose lives depend on them are being poisoned by mining our gold. If our customers aren't proud of their gold, gemstones will certainly lose their luster as well.

THE PATH GOING FORWARD

Over the years there have been a vast number of laudable efforts of multilateral, bilateral, civil society and academic initiatives to improve or solve the unacceptable condition in which these miners find themselves. Advances have been made, yet a scalable solution remains nowhere in sight.

It is clear that any potential solution will be easier to implement if it is extremely low in cost, scalable, easy to transport to remote locations, operate with intermittent or no central power supply, require little or no training for operation, and provide immediate and obvious benefit to miners. Only then, will uptake of any technological solution be realistic[4].

Challenge prizes are being increasingly utilized to bring innovative minds and cutting-edge technologies to focus on solving the most thorny issues we face. Challenges are an important tool for companies, institutions and many federal agencies, including NASA.

In this age of astonishing technological prowess, abundant financial resources, and ongoing, high-level discussions on how to have a clean environment and responsible sourcing of our minerals, how is it that we allow millions of people who are essentially working for us, to continue being poisoned?

This travesty continues because we're hoping someone else

[3] https://www.thegef.org/news/making-mercury-history-artisanal-small-scale-gold-mining-sector

[4] https://onlinelibrary.wiley.com/doi/full/10.1002/chem.201704840

FIGURE 4. *Gabriel Macea with Toby Pomeroy. Photo courtesy of Toby Pomeroy.*

will fix the problem. The bad news is, the cavalry isn't coming. The good news is, there's something we can do about it.

Our customer base is increasingly concerned about environmental responsibility, integrity and doing business with companies they can trust. They prefer brands that are authentic and purpose-driven, brands that stand for something and do good in the world. Our customers are increasingly socially conscious and care deeply about inclusivity and social impact[5].

Seemingly bullet-proof industries continue to be shocked and blindsided by more nimble, hungry, innovative upstarts. If we are going to thrive, we must transform. The condition of mercury in our gold supply chain may be the greatest opportunity the jewelry industry has ever had. By being courageous and authentic, informing the world of this massive problem, we can capture the world's attention and earn its respect.

We have an opportunity to inspire our socially and environmentally conscious customers; to be the vanguard, declaring our commitment to the discovery of a viable alternative to mercury use in ASGM, a healthier environment, a mercury-free gold supply chain, and 15 million empowered artisanal gold miners, their families and communities.

A fundamental aspect of being human is that we all want to contribute to others and to the quality of life. Our industry has been built on, and we promote ourselves as, the business of celebration, acknowledgment, appreciation, connection and love.

Maybe we should take a step back and ask, but are we really? I suggest that we aren't living up to our purported reputation.

Artisanal gold miners have supported our businesses and lifestyle for hundreds of years and we now have an opportunity to tell their story and acknowledge their contribution. Perhaps it's time we let the world know that we value them, care about their health, and are actively engaged in finding a way they can mine safely and profitably.

Our industry and businesses would soar if we were truly committed to empowering ASGM and their families, dramatically reducing global mercury pollution, creating a clean, responsible gold supply chain and contributing to the health of all people and the global environment.

I propose we commit to three life-altering and industry-disrupting innovations. Following through on these commitments will establish a deep emotional bond with our customers who will relate to us as bold, creative, and caring.

First, let's begin by acknowledging the problem with mercury in our gold supply chain and share it with the world. Far better that we share the issue than for the media to launch an exposé. Our forthright authenticity will engender new levels of trust and respect for jewelers and for our industry.

Second, let's boldly commit to solving the massive global problem of toxic mercury in the gold supply chain by pooling our resources and incentivizing scientists, engineers and innovators to discover a safe, highly effective, affordable, and scalable replacement for mercury in ASGM.

Third, let's acknowledge and celebrate the millions of artisanal gold miners, declaring our commitment to their health, wellbeing and prosperity, and to the wellbeing of all life.

By marshaling the world's technological prowess, utilizing our massive computational power and accessing the genius of the crowd of 4.3 billion people online[6], we will discover a process superior to mercury for artisanal miners. ◆

To learn more, go to www.mercuryfreemining.com

Toby Pomeroy is an award-winning jewelry designer. Figure 4. He has created jewelry in his Oregon studios since 1968. A social and environmental activist, Toby stands for the jewelry industry being a driving force in responsible gold mining practices, transparent supply chains and jewelry that is authentically beautiful, from mine to market. Toby has served as a member of the Board of Directors of the Alliance for Responsible Mining based in Medellin, Colombia since 2010. In 2017 he founded Mercury Free Mining, a non-profit organization committed to the discovery of a safe and effective mercury alternative so that 15 million subsistence gold miners can mine safely, cleanly, and profitably without poisoning themselves and polluting the earth.

[5] http://www.cibjo.org/cibjo-releases-marketing-education-special-report-analyzes-next-great-jewellery-buying-generation/

[6] https://www.statista.com/statistics/617136/digital-population-worldwide/

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