

Brian Kosmyna  
Seegers Union Box 2347  
Muhlenberg College  
2400 W Chew St  
Allentown, PA 18104  
6/9/08  
bk233580@muhlenberg.edu

## **Effect of Gold Mining and the Use of Mercury by Gold Miners in Las Juntas de Abangares, Costa Rica**

Objectives:

- To observe current practices and procedures of miners and others in the gold industry
- To evaluate the effect of mining on the community through interviews with the general public
- To explore the possibility of health consequences due to mercury contamination in different populations of Las Juntas

Abstract:

Data was collected from interactions with and observation of workers from the gold mining industry, a doctor from the local government funded clinic, and the general public. All people interviewed felt gold mining is a necessary source of income not just for the workers but also the community. However, the risks and effects of mercury on the workers and the community is a concern of only a few individuals. I feel the lack of concern about the risks and effects of mercury is overlooked by many due to the importance of gold mining to the local economy. The practice of miners and the feelings within the community are so varied that a deeper investigation into the cost effectiveness and environmental and health consequences of different method can be study. Furthermore if the safest method of mining with the least health and environmental consequences is not the most cost effective, then it might be possible to create a different market to sell this environmental friendly gold for a higher price to offset production cost.

Keywords:

Las Juntas de Abangares, Costa Rica, gold mining, community

## Introduction

Las Juntas de Abangares is a small town in the Guanacaste province of Costa about 30 miles north of the City of Esparza and just north of the Port of Puntarenas. It is surrounded by hills which give way to mountains with rain forest tops. This small town of Las Juntas was founded in the late nineteenth century about the time gold mines were opening in the area. The history of the gold mining industry in the town greatly influences the community today. The isolated location of the town and the continued reliance on gold mining even after all industrial companies have left give the town a sense of historical importance (Hernández, 2001).

Currently small-scale artisan mines in the tropics and the Amazon are a constant environmental source of mercury (Anderson, 2007, Fields, 2001). This mercury contaminates the air, soil, and water of the surrounding environment but also accumulates in fish. This causes chronic mercury poisoning in many of the indigenous populations who rely on the rivers and oceans for water and food. A proposed solution to the problem of contaminated food and water supply is to limit the amount of gold being mined at each site (Fields, 2001). The reasoning behind this solution is the less gold being extract would equate to less mercury being used and eventually lost into the environment during the amalgamation process. However, the significance of mining on the town of Las Juntas can not be over looked. The negative impact of such a solution would not affect just the miners and the gold mining industry, but also affect the community culturally and economically. There would be a direct effect on the gold workers ability to earn a living if the amount of gold being mined was regulated which would greatly affect the local businesses. But it would also be hard for an organization to enforce such regulations on these artisan miners who do not work for a larger corporation.

Gold and silver have been consistently mined since colonial times in Costa Rica. However in the early 1990's, Costa Rica became a central point for the environmental conservation movement, which diminished its attractiveness to mineral exploration. Gold exploration was greatly affected but Canadian and U.S. companies continued a number of gold and silver exploration and mining operations. Production of gold and silver was from the Central Gold Belt of the Tilaran Cordillera in the northwest, primarily in the Abangares district of Guanacaste Province. The major gold producer was the Tres Hermanos Mine, which was a small underground operation 110 kilometers northwest of San Jose (Doan, 1998).

The Costa Rica government has not always been able to effectively enforce both environmental protection policies and mining regulations. In early August 1997, the Costa Rican Minister of Environment and Energy, Rene Castro, ordered the closure of three mines in Guanacaste Province. He stated that the closure of the mines had been ordered because the mines did not comply with basic requisites of being economically viable, of producing social benefits and of not damaging the environment. The mines were then allowed to reopen under the condition that commercial companies take responsibility for all aspects of mining including its environmental and social impacts (Mitchell, 1997).

Until 2002, mining was governed by law 6797 of 1982. This law dealt with general provisions that regulated all commercial aspects of mining including permits, exploitation license, concessions, expropriation, taxation, exemptions and privileges (GLIN, 2004). The government used the Ministerio de Recursos Naturales, Energia y Minas to control and development Costa Rica's mineral resources through the Direccion de Geologia Minas e Hidrocarburos, the Minera Nacional, S.A. (MINASA), and the National Environmental Commission. MINASA coordinated mineral industry activities between Government agencies

and the private sector. (Doan, 1998). However in 2001 influenced by low global gold prices, Ariel Resources Ltd. suspended operations and withdrew from El Rocío and the Tres Hermanos Mines (Velasco, 2002). This withdrawal of the major mining company in Abangares combined with a Presidential Moratorium on oil exploration, open pit mining, and cyanide processing approved by the Costa Rican Government in May 2002 lead all companies to abandon their mines in Guanacaste.

Since the time the companies left Guanacaste, mining continues in small communities in the region. These artisan miners are unaffiliated with any companies and enter the mines at their own risk. This study explores the effect that this mining has had on the community. Through interactions and interviews with individuals that mine in the Abangares district, a local doctor and the general public, I examined the social and economical pressures as well as the health effects of mining and mercury contamination in the community of Las Juntas.

## Methods

The main tool I utilized to collect information was through observations, interactions and interviews. The interviews asked broad questions that allowed the individuals to answer in any way they felt appropriate. Also the questions began fairly vague and broad to allow for uninfluenced responses before becoming more specific to touch on important issues. The data obtained from all these interactions were placed into one of three groups. All information gathered through interactions with individuals with direct experience working in the mines was placed into one subset of data. From these interactions, the information gained was focused on the practice of mining, the lifestyle and living conditions of miners and any perceived dangers, health risk, or environmental concerns miners have themselves. The next set of data was collected with random interviews around the town of Las Juntas de Abangares. This data focused

on any feelings the general public might have about mining and miners. This data was collected from about 10 individuals around Las Juntas who were not miners or had family members who were miners. The data collected focused on any effect that mining had on the community. The last subset of information was collected from a doctor at the local government sponsored clinic and also a representative from the Ministry of Agriculture.

In order to observe the general practices and protocol of gold miners and others in the gold mining industry, they were asked about their daily work routines and how often they had to work. They were asked to explain the process by which they mine including the removal of rock from the mines until the final product of gold is sold. The gold workers were asked about the tools and supplies used as well as their use of mercury in the amalgamation process. Through this interaction, the greatest dangers and health risks associated with being a miner and also the environmental impact of mining was discussed. Also I observed one location where the extracting materials from a mine take place and two locations where gold is amalgamated to its final product.

The second subset of information was gained through interaction with the general public in the town of Las Juntas. The people in Las Juntas who participated were asked what if any effect mining had on the community. They were questioned about any perceived cultural and economic value of the mines. Lastly they were asked if they saw any negative effect that mining had on the community and specifically any health or environmental risks associated with mining and mercury contamination.

I had wished to gather information from numerous individuals that would be classified into one of the first two subsets. However, the unwillingness of miners to participate along with the selection of the general public limited the amount of sources of information. I had hoped to

have at least 20 gold mine workers and 20 individuals from the public participate however this was very difficult. The data from the subset of mine workers includes three representatives from the gold mining cooperative and the manager of a mine in Boston who gives tours of the mines in Abangares. Selection of individuals to place into the second subset was also difficult as not all individuals approached were willing to participate and also some people were not asked to participate because it was felt they were miners or had close association to miners. The data collected from the general public was from individuals of both sexes, of working age and with various socioeconomic statuses constant with the population of Las Juntas. The refusal of certain individuals and groups forced the study to broaden its scope to the effect mining has on the community as a whole.

To further supplement the data collected in the first to subsets, an interview with a doctor from the community clinic and a worker from the Ministry of Agriculture was interviewed. The doctor was asked if they were aware of the prevalence of any of the health effects of mercury exposures. The doctor also discussed the history of mining with respect to coverage under Costa Rican worker protection laws and universal healthcare. The worker from the Ministry of Agriculture briefly discussed the current government regulation artisan miners.

## Findings

The first interaction with miners was during a tour of the mine at Tres Hermanos. The group of miners that was approaching about participating in this study was unwilling to participate. However while at the mines, I was able to observe working conditions in the tunnels and also some of the equipment used to extract rock from the mine. The mine was of varying diameter but was approximately 8 to 12 feet in diameter. The floor had puddles of stagnant water and was a thick mud at some points. The miners used boots and a hard hat for protection as well

as an air compressor to force fresh air deep into the tunnel. The miners used hand tools to remove the rock from the miner. Next I was able to learn about and observe the process by which the gold is removed from the rock and then amalgamated. The larger rocks are crushed into a finer material by a powerful crushing machine. Next the rocks are added to a rastra where it is crushed and grinded smaller by a rotating mechanism. In this step mercury and water is added to help separate the gold flake from the mixture. After a set time, the mercury gold amalgamate is separated from the mixture and the mercury is burnt off the gold in two steps. The first step uses a device similar to a condenser that allows for the recovery of some mercury. The second step removes any remaining mercury to further purify the gold using a blow torch to heat the gold and evaporate any remaining mercury in a machine similar to a chemical hood.

After being shown the process, the tour guide who was also a mine manager in Boston participated in an interview. He explained an individual miner was responsible for each step of the process and his profit was any gold recovered from the rock he mined. He stated that there are about 300 miners in the Abangares district and each is associated with one of three groups which give the miners more influence when seeking to sell their gold at true market value. This individual stated that miners make a very good living and can live comfortably and usually do not need to work everyday. He stated miners work because it is a great job that allows them to live in nice houses and also allows them to afford a car after provided for their household. When asked about risks and danger of mining the individual became defensive in saying mercury has no negative health effects and all warnings saying otherwise are used as a precaution to prevent waste of mercury. This particular individual stated that he had worked in a mine for over 20 years and has never felt any ill effects. Furthermore he stated that 85 to 90 percent of mercury is recovered in the process of amalgamation and the rest of the mercury is collected in lined pools.

The three individuals of the gold mining cooperative in the community of Chiri provided a very different view of artisan mining. These individuals from a small mining village informed me that although they were proud to be miners, they worked in the mines because of a lack of other opportunities. Two of these individuals were wives of miners who worked at the cooperative but were proud to point out that they have also worked in the mines. The two wives briefly discussed how the geographic isolation of the community and difficulty of obtaining an education leads many in the community to begin working in the mines at a young age. They said most of the miners in the community are able to provide for the family but can not afford much beyond that. They also described how the income generated is variable depending on the amount of gold in a rock. The two said you can get no gold for a week at a time working everyday and then make enough money for a week the next day. Furthermore they discussed how if a vein of gold is hit by a miner, many times the miner will only mine a little more than the amount that is needed. This allows the miner to work few days and allows the vein to last the longest length of time possible. They also discussed how you must respect the find of other miners because it is there living you would be taking if you mined from their vein. They said that miners do not have the luxury of being able to save extra money and any extra money had at the end of the week is spent on alcohol and good times which they say is part of being a miner.

They also tell a completely different story than the first individual with respect to the risks and dangers of mining. This community which has twenty rastras had no condenser-like device to recover any mercury during the amalgamation process. Each miner will use about one kilogram of mercury each month. The amount of mercury used per a gram of gold is dependent on many factors including heat and humid and also the sulfur content in the rock as well as the miner. Rocks with higher sulfur content require more mercury to amalgamate the gold. Also

mercury is added to every rastra even if the rocks added contain no gold. These individuals said the mining community knows of the environmental and health consequences of mercury use however see no other option.

The two miners also felt the mining community would welcome any safer way to mine, provided it was cost effective. They explained how boots and a hard hat prevent injuries which are an immediate danger to their ability to provide for their family. Preventative measures against chronic condition must first be proven cost effective and beneficial in a similar manner if we wish them to be applied. It is also each miner's decision to pay the added cost including gas to use the air compressor. Although it makes the working conditions in the mine much safer, the three representatives of the cooperative said it is not always used because it is not always cost effective, meaning they can not mine enough addition gold using the air compressor to offset its cost. They said different miners will use the air compressor only in different situations.

The next set of data was obtained from various conversations with the public regarding the effect that mining has on the community of Las Juntas. The information was collected from conversations with a few shop owners, mothers walking with children and some men outside a shop and others eating at a outdoor eatery were included into this subset. None of these individuals said that they were or had family that worked in the mines. I feel that this population was fairly representative of the non-mining population of Las Juntas. An estimated age range would be from late twenties to mid fifties. There also seemed to be a varied level of income, however this group probably did not include the lowest quarter of poverty level within town. All of the individuals seemed to be at least mildly educated and comfortable speaking through a translator. Although the actually opinions did vary some I feel with a larger sample size a pattern could be seen. Almost all of the individuals who participated realized the economic importance

of gold mining as the miners bring money into community. Some of those people also felt that mining is an important source of jobs to individuals that might not be able to find work otherwise. Of all the participating individuals fewer stated or acknowledged the risks and dangers of mining to the workers specifically conditions they work under in the tunnels and also their exposure to mercury. Lastly of all the individuals in this subset, no one recognized or agreed that mining could have a negative health effect on the community.

The last subset of information was collected from a doctor from the community clinic and a worker from the Ministry of Agriculture. The doctor explained some social policies including worker protection against unsafe work conditions, the law of worker pension and also universal healthcare. These laws providing social benefits are paid by income taxes by both the employer and employee. However except for healthcare, these laws do not cover independent self employed individuals such as miners. Although all of these laws are applied to individuals below a set poverty level, the doctor feels the miners do not keep all pay receipts to gain all available benefits.

The doctor also strongly suspects that mining, both the conditions in the tunnels and exposure to mercury, have negative health consequences on not only the miners but also the community of Las Juntas. However the degenerative effects of mercury have been difficult to diagnosis to provide a definite answer. The doctor has been trying to secure funding for a case control study on the high prevalence of Attention Deficit Disorder in Las Juntas. He feels that this study would be the first step toward showing that mining and mercury contamination is negatively affecting the community.

Another representative of the government, the worker from the ministry of Agriculture briefly discussed regulating environmental contamination by the artisan gold miners. He stated

there were laws with penalties for exceeding set limits of pollutants. However due to the way artisan mining is organized by which each individual works solely for himself or herself, it is nearly difficult to hold a single person responsible. Furthermore the government must perform test such as water quality test to check for compliance with regulations and these test are not performed often enough or in enough locations.

## Conclusions

The effect of mining on a community such as Las Juntas is a complex interaction between social, cultural, economic, and political factors. The economic impact of mining not only affects the mining families that have are dependent on the income as a mean to provide for a family but the community is also dependent on the influx of money that would otherwise not be entering the community. It is difficult to weigh the consequences, both health and environmental, of mining when it is important to the livelihood of a community.

After the mines had closed in 1997, the Costa Rican government allowed companies the right to reopen them only after they agreed to regulate the condition of the mines and the process used to extract gold. These conditions allowed the miners to qualify to be covered by social policies such as pension and worker protection laws that they are not covered by today. When the mining companies left Guanacaste Province, not only did the miners lose coverage by social policies, the Costa Rican government lost a level of control by which it could regulate the industry. The mining companies left families without jobs and a source of income, and also left without paying debts to other companies and wages to workers. This forced the government to allow these individuals access to the mines so that these people could continue to make a living.

Now these miners feel they have a right to earn a living off of the land just as they had for many generations when the companies were present. Since there is no sponsor company to

provide benefits to the miners they have little incentive to follow government regulations. Furthermore due to the fact mercury has more of a chronic effect on health it is near impossible to show any immediate tangible benefit for stopping or safer practices.

The findings of this investigation vary with the actions and opinions of those who participated. Different groups of miners use different processes to extract gold exposing themselves and the environment to different risk. Different miners within the same group mine with different levels of success and using different amounts of raw materials including mercury. Mercury contamination is dependent on something as variable as temperature and humidity. Although mercury is the direct cause of many negative health effects something must be convincing people there is no better way to survive. The representatives from the cooperative of gold miners said the community mines because it must but they are proud of what they do. It is this lack of options in the community and region that force people to endanger themselves and the environment. Although opportunity can not be created overnight, within the various current methods of mining used in Guanacaste today, some methods must be safer to the miners and the community and also more environmental friendly. I heard of miners within the region how did not use mercury to amalgamate the gold but rather panned in a stream. Future research is needed to provide cost analysis of the various different ways of mining. However the first step to doing such a study would be to develop a trust with a gold mining community that has already been betrayed by an outside cooperation. After doing a cost analysis of the different methods to extract gold, there would have to be a way to defray the increased cost of production. One possible way to help offset the increase cost of protection would be to create a different market for this gold to be sold at a higher price. In today's political landscape with rising gasoline prices and concerns about global warming, the general public through mass media is becoming more

aware of various environmental issues. If marketed correctly to the right audience, it might be possible to create a market for environmental friendly produced gold that would offset the increase in production cost. This idea is similar to the idea of blood free diamonds being certified and sold. People who believe in protecting the rainforest and biodiversity might be willing to fund this “alternative source”.

## References

- Anderson, S. T. 2004. THE MINERAL INDUSTRIES OF CENTRAL AMERICA: BELIZE, COSTA RICA, EL SALVADOR, GUATEMALA, HONDURAS, NICARAGUA, AND PANAMA. U.S. GEOLOGICAL SURVEY MINERALS YEARBOOK
- Fields, S. 2001. Tarnishing the Earth: Gold Mining's Dirty Little Secret. *Environmental Health Perspectives* **109**(10): 474-81
- Hernández A. Dec 2001. The Gold Rush Years! *El Residente*. Available online at <http://www.1costaricalink.com/elresidente/fa-11-12-2001.htm>
- Velasco, P. 2002. THE MINERAL INDUSTRIES OF CENTRAL AMERICA: BELIZE, COSTA RICA, EL SALVADOR, GUATEMALA, HONDURAS, NICARAGUA, AND PANAMA. U.S. GEOLOGICAL SURVEY MINERALS YEARBOOK
- Doan, D. B. 1998. THE MINERAL INDUSTRY OF COSTA RICA. U.S. GEOLOGICAL SURVEY MINERALS YEARBOOK
- Mitchell, J. 1997. MINING WEALTH OR FOOL'S GOLD. Tower Magazines Online. Available at [http://ourworld.compuserve.com/homepages/Harvey\\_Morris/mines.htm](http://ourworld.compuserve.com/homepages/Harvey_Morris/mines.htm)
- Global Legal Information Network. Law 6797 of 10/4/82 approves the new mining law. (GLIN ID 134259). Published Sept 29, 2004. Available online at <http://www.glin.gov/view.action?glinID=119748>