

## Appendix 2

Field notes by Peter W. U. Appel, Birgitte Stoffersen and Leoncio D. Na-Oy

*February 6-8:* Departure Copenhagen 17:30, drove to the airport. Flight to Paris considerably delayed due to snow in Paris. Flew to Paris at midnight. Arrived at an empty cold airport. After walking around in the airport we found a place where stretchers were supplied together with water and a few snacks. A thin blanket was also supplied. Got a little sleep. No service from Airfrance whatsoever. At around 8:30 Airfrance staff turned up at their counters and informed us that we were booked on the flight to Johannesburg with departure 23:30 same day. The plane left two hours late. Landed in Johannesburg February 8 at noon. Departed one hour later to Maputo. Met Vasco Coelho and Neus Peracaula at the Medicus Mundi office. Stayed overnight at a small hotel.

*February 9:* Went to the airport at 6 in the morning. Flew to Pemba. Spent most of the day changing money and buying equipment. Stayed at hotel at the beach.

*February 10:* Drove to Namuno together with Sergio Filimone Baquete and Jofa Falume and arrived late afternoon. Several of the rooms we had booked at the guesthouse were occupied in spite of early reservation by Medicus Mundi. Rooms for us were fortunately available. Drove to the carpenter who had prepared the sluice boxes and launders for us. Some minor modifications were called for which were promised to be ready next morning after breakfast time.

*February 11.* Picked up the modified sluice boxes and launders and drove to Nanlia. The drum for milling was moved from its previous position to a place close to the actual mine. A good place for sluice box and launder was found. It is close to the mill. The sluice box and launder were placed properly but would need some further adjustment. The mill was lying on the ground when we arrived. Before we left the site the drum was placed ready for use, but the setup was not very good. The drum was in a slightly tilted position. This could unfortunately not be changed because the setting for the drum was placed in cement which had solidified. A good deal of work had to be done before the testing and demonstration could be carried out.

Around noon we started our travel to Waiquia. The setup here was well organised. The drum was working. It was situated next to a tank which could hold some water. Next to the drum was a suitable empty space where our processing station could be placed adjoining to a local processing station. It will thus be very easy to run the gold extraction on our way parallel to the local way of processing.

It was agreed that overnight the local miners should mill about 75 kg of crushed ore. The milled material should be placed on a tarpaulin so that when we arrived next day, there would be a pile of milled ore ready for us. We would split the ore in halves and process one half with our method and the other to be processed by the locals using mercury.

Furthermore Mrs. Joja Alberto Semente told that the mill would run overnight milling batches of gold ore for our demonstration and teaching.

Dinner in Namuno where we met Mrs. Marga and her Medicus Mundi team.

*February 12:* Drove to Waiquia. We started with a short presentation of the the members of the MM team, our team and the miners participating in the project. Four miners were from two other mining sites. We brought them with us to Waiquia from Namuno. Mrs. Marga introduced the project and we gave a brief explanation of the mercury-free gold extraction method and told what Leoncio would show the local miners. From the technical side the situation was as follows. The site did not have running water, but was equipped with barrels to store water. There was shortage of water on the site and water had to be fetched from the river located around ten minutes away by car.

We were allocated two sacks of dry milled ore weighing just under 50 kg. The lot was carefully split into two batches which were weighed and the sacks were balanced so each contained 24 kg. We were told that the sacks expectedly contained 1.5 grams of gold. Leoncio made an excellent demonstration of our method and showed the miners through all steps until he produced a gold concentrate. The amount of gold was at or slightly less than one gram. It was considered not worthwhile to smelt the gold. The 24 kg milled ore which was intended to be treated by the local miners using their method was considered too low grade to bother extracting gold from.

Conclusion of that day's work is that the the setup of the processing site worked fine and the miners have got a good idea of how mercury-free gold extraction is carried out, but water is a problem.

*February 13.*

Drove to Waiquia. Due to the problems yesterday we wanted to do a comparison today. We were allocated 176 kg of milled ore which was split into two lots of 88 kg.

We carried out a processing program where the local miners used their traditional gold extraction method using mercury and we extracted gold mercury-free.

They recovered 1.6 gram of amalgam, which was burned to 0.9 gram very yellow looking gold + amalgam. The amalgam was melted by Leoncio Na-Oy and the outcome was 0.9 gram of pure gold.

We recovered 1.6 gram of pure gold mercury-free.

We thus recovered 78% more gold than them by using the mercury-free method.

The setup of our processing plant at Waiquia has proved to be somewhat awkward in respect of access to water. The river is 10 minutes' drive away and since most of the pools in the river are rather shallow it is time consuming to fill buckets. It took thus more than half an hour to get a new load of canisters filled with water. This has significantly reduced the speed of processing. We looked at the possibilities of moving our plant down to the river, but it was not feasible to get water under the required pressure at that site without a pump. We discussed the problem with Mrs. Joia. She told that although their original method of gold extraction required less water than our method it has been very tedious to fetch water for processing. The small-scale association had considered to move the processing down to the river. When they informed the local government about their plans they got a blank reply not to do that. The local government did not want a processing station using mercury at the river.

We agreed with Mrs. Joia that at the present time we should continue with the position of the plant as it is. However, in the near future the small-scale association will move our processing plant down to the river and install a water pump. They also plan to enlarge our sluice box and possibly also the launder. At the end of the day we made an agreement with the miners that they would have 2000 litres of water stored for the following days' work.

*February 14:* Drove to Waiquia. The miners had not fetched the amount of water promised and due to very little water stored many hundred litres of water had to be fetched in the river. When that was done there was water enough to pull three processing's through the setup for training. This was done by three groups of miners. The processing went well with the supervision of Leoncio. There was produced a gold concentrates from each batch of 35 kg. The concentrates were lumped together in one, but the total amount of gold was estimated

to be less than one gram. That is considered too little for smelting. However, a concentrate from our very first demonstration was added and thus made up a total of slightly more than one gram of gold. It was decided by Mrs. Joia that the local miners would do the smelting themselves next day in our absence.

Before travelling back to Namuno we had a short discussion with the miners. They claimed that they were satisfied with the information they had obtained and they would start using mercury-free gold extraction. They had one reservation about the blower for gold smelting. We had brought two types. Two from Philippines which were manufactured in China and two from Denmark manufactured in France. One of the Chinese models is powered electrically whereas the other is hand powered. They were also concerned about how to get borax. The number of accessible pumps was too small to the number of associations participating in the training!

We suggested that the miners in the future should mill in water instead of dry milling. We told that the main drawbacks of dry milling were:

- Dry milling creates huge amounts of dust which give the miners stone lungs
- Dry milling cause major loss of fine gold
- Dry milling is very nosy and will create hearing problems over time

The miners realised that the advantages of wet milling are convincing and asked for information on how to build a processing plant using wet milling. We would try to find photos documenting how wet milling processing stations could be constructed. It was suggested that Medicus Mundi initiated construction of wet milling stations.

Following information on milled or and recovered gold was acquired from Mrs. Joia Alberto Semente. The Associação Mineira 7 de Abril where Mrs. Joia Alberto Semente is a member, mill in the order of 50 to 60 sacks of ore corresponding to an approximate weight of 3000 to 3600 per month. The outcome is about 200 grams of gold containing amalgam per month. The Associação Mineira Waiquia mill in the order of 25 sacks per month, which converts to about 1500 kg. No information of gold recovery.

*February 15:* Drove to Nanlia with four miners from other districts. At Nanlia we started with an introductory meeting where we explained the plan for the coming three days. The Associação Mineira de Nanlia had made an excellent setup for the sluice and launder. This part was ready for gold extraction. Unfortunately, was the milling setup not ready yet. It took until early afternoon to start milling. We agreed with the Nanlia group to get four sacks with

an expected 2 grams of gold milled and later split. The mill can treat two sacks at a time. In the afternoon the first two sacks were milled and milling of the two other sacks started.

*February 16:* The miners at Nanlia had milled 6 sacks at around 50 kg each for our comparative study. We processed our 3 sacks and recovered 3.6 grams of gold. The miners showed keen interest in our method. They had actually stopped using their processing method. I asked them why and they told that they had stopped completely extracting gold since November. One reason was that the authorities had told them to move the milling drum to a position closer to the village. Water in the mineshafts was also a problem. They furthermore said that they had decided to wait for our arrival and then adopt a mercury-free gold extraction method.

They had no active processing station for their method, but kindly established one for our purpose since it was part of our project to make a comparative study. They processed three sacks. Their processing was much more thorough than the processing done in Waiquia. They recovered 4.8 grams of amalgam which we smelted down to 3.6 grams of gold! The two methods are then even apart from a mercury pollution created by the local method. Our impression that the even outcome of our comparative test will not deter the miners to adopt our mercury-free method.

*February 17:* Drove to Nanlia. The miners were busy processing milling gold ore. During the day they processed about 150 kg. Leoncio was supervising the process and concluded that the miners did really well. The heavy mineral concentrate was smelted and 7 grams of gold was recovered. This is equivalent of a gold grade of about 50 ppm (grams per ton), which is really high grade gold ore. The processing did take a long time, but the miners expressed that they liked our processing model and would continue using it.

*February 18:* Drove to Waiquia to see progress. The miners had processed milled gold ore and tried to smelt it. However, they had forgotten to use a magnet to extract magnetic minerals from the gold concentrate. Smelting the concentrate was therefore not successful. The gold had spattered all over the clay bowl. Leoncio and the miners crushed the clay bowl in order to recover as much gold as possible. The gold recovered was then smelted again with borax, but since the clay bowl had been destroyed they used a bit of tile. This proved to be a bad idea. The tile cracked and the gold was partly lost in the cracks. About half of the gold was fortunately recovered, but about 1.3 gram gold was lost.

Fortunately, the accident did not reduce the interest of the miners to implement the mercury-free gold extraction. They were keen to continue. One stepping stone was probably that the government had last year visited the area and emphasized the importance of reducing/out phasing use of mercury.

At the end of our last day working in Waiquia we gathered the miners for a final talk about the mercury-free method and their thoughts on it and the program.

Ms. Joia was very understanding about the incident with smelting of the mercury-free gold. She said that implementing a new method takes time and practice, and the incident showed them the importance of making all the steps of the process correct. She assured us that she will not go back to using mercury. They have earlier wanted to move the processing station to the riverside, but the government had in September 2017 told them that they cannot use mercury close to the river due to pollution. The processing is slowed down due to the shortage of water, which works as an additional motivating factor for implementing the mercury-free method and then being allowed to move the processing station to the riverside. The lack of material is of great concern to the miners. The miners agreed that clay bowls could be made locally. Borax is not sold in the region, but we talked to them about the fact that MM will look into the problem and hopefully find a way to sell borax at reasonable prizes in Namuno.

Members of the Associação Mineira Waiquia asked if it was possible to use mercury in some steps of the process. The importance of not using mercury in any of the steps of the mercury-free process due to pollution of the equipment was again pointed out.

The miners feel that they learned a lot from our visit, but also mention that they would like to continuously stay in touch with MM about questions that might come up in the future and questions regarding materials.

Some of the members from other mines requested training at their mines in order to spread the use of the mercury-free method.

Several of the miners asked for a certificate to document that they have been trained by Leoncio in the mercury-free method and would also like to have a t-shirt that can show that they have gone mercury-free. At the end of the meeting all associations were given a box of borax and the blowers we had brought were divided among the associations



Waiquia final gathering

*February 19:* Drove to Nanlia. The sluice and launder had been dismantled and was presently stored in the village. The plan was to establish it at the river. This would save much long distance pumping of water. The miners were satisfied with the teaching and training they had received. They had made one smelting where the gold had small patches of black colour. Leoncio told that it came from poor gravitational panning. The major concern from the miners was the lack of stuff like borax, blowers and clay bowls. They feared that if those items did not appear soon, the interest for mercury-free gold extraction would dwindle.



Nanlia final gathering

At the last visit in Nanlia we like in Waiquia gathered the miners for a final meeting to hear their thoughts on the program.

The miners were very thankful for our visit. They felt that they learned a lot from the training, but find the burning of the gold the hardest part of the process and would have liked to see it done by Leoncio one more time. Due to lack of processed ore Leoncio was not able to show the burning again, but they had a talk about burning and what they had experienced the day before during their burning.

They told us that they feel comfortable with implementing the mercury-free method. Their biggest concern about the method is whether they can get the materials needed (Borax, clay bowls, blowers etc.) else they will fill forced to go back to the mercury-method. We told them that we will put pressure on Medicus Mundi to provide the miners with the essential materials needed to use the mercury-free method. They are especially happier with the mercury-free method as the gold produced is of higher quality.

The miners are generally very positive towards the mercury-free method and would like to spread it to their fellow miners in the area, but would like some guidance in how to spread it. We tell them that during their training they have become potential teachers that can teach fellow miners in the area. We talked to them about how MM will continue the program with



the chosen miners as trainers in other mines.

We advised them to make a federation with all the associations in the area and spread the mercury-free method and tell them that if they go together and make a federation with lots of miners they will have a stronger voice if they have to deal with the government. They acknowledge the importance in helping each other and told us that the also in relation to this program they have helped each other a lot, which had made it possible to do the different steps of the process correct and due to this would like to make a federation. We told them that we will inform Medicus Mundi about their wishes and make them help them.

*February 20:* Drove to Pemba

*February 21:* Meeting with Medicus Mundi in Pemba

*February 22:* Flew to Maputo

*February 23:* Meeting with Medicus Mundi in the morning. In the afternoon all three members of the team flow towards their home.

*February 24:* The members of the team arrived in their home capital at noon.