Report on Cleangold Project on the Madre de Dios River,Peru
4/08

PART I

Acknowledgements:
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Introduction:

Cleangold was contacted by ACEER, in 2007 with the interest in learning if our technology could help the miners working near ACCA's Los Amigos Research Station to reduce their use of mercury. They also provided two samples of concentrates recovered from the carpets of dredging operations for preliminary study. The gold was found to be very thin and the bulk of the gold being recovered was between 40 and 400 mesh (about 450 microns down to as fine as 40 microns). I learned from this testing that the miners were doing an excellent job recovering some of the most difficult gold I had encountered. I also expected that this would be an excellent opportunity to work with miners who had already solved many of the problems that they encountered in their own way. I found the miners of the Madre de Dios to be naturally trained scientists with a special knowledge gained through their long work with this difficult gold.

Small and medium scale miners collect mostly very fine gold from the sediments of the Madre de Dios River as well as from land operations close to the river. The sediment load in this river is very high and erosion is continuous in the tightly looping river. Oxbow lakes are common. Progressing further upriver the terrain becomes steeper and the river takes on a "braided" appearance which I would describe as a low angle waterfall! The area of the Madre de Dios where we were working is from Tres Islas and

upriver past Boca Amigos at the mouth of the Los Amigos River. There are estimated 100 river mining operations working in this stretch of the river. The river dredges are called “balsas” and the land operations have many different names depending on the arrangement of the equipment. The land operation that we worked on was described to me as a “chuparera”. While the balsas are self contained with dredge and sluicebox on the covered float which includes sleeping and cooking accommodations, the land operations often have a floating dock with the engine and pump feeding ore to a sluicebox mounted on poles and which dumps tailings outside the pool containing the dredge. Balsas have steel piping for carrying ore and the chupareras have plastic piping due to the remote locations and the distance the ore travels to the sluicebox. We performed testing on both types of operations. The sluiceboxes on the chuparera were very easy to rearrange giving us more opportunity to extend our testing.

In addition to testing our technology to improve the recovery of fine gold in both operations, the most important work that we did on this trip was to refine and teach a method to the miners that would allow them to recover the gold from their sluicebox concentrates without using mercury. Over the course of our training our method became faster and more streamlined and grew in acceptance with the miners.

During our testing and training I had the opportunity to collect a number of samples which in my laboratory have revealed even more about the gold in the Madre de Dios and the current use of mercury.

Testing on the Balsa

We had the opportunity and pleasure to do some testing on the balsa owned by Senor Aquilles Velasquez. We were able to test in various places in the fixed sluiceboxes, examine samples from tailings, and work with the concentrates of the carpet sluices. The balsa dredge is a steel pipe of about ten inches in diameter which is attached to a trash pump impeller driven by a diesel engine. The pipe is attached to a triangular derrick used to raise and lower the pipe and support the weight. The pipe is sucked into the sediments until large rocks are encountered and then it is withdrawn or moved. The smaller balsas dredge to a depth of about ten feet or more. The dredged sediment is carried overhead where it is deposited in a crashbox with a ½ inch classifier. The finer material is passed to a cascading set of sluiceboxes approximately 10 feet wide and 15 ft long in each section. It is estimated that 90% of the gold is captured in the upper sluice. The upper box is cleaned out every 20 hours of operation while the lower box is cleaned out once a week.

This is the oversized outfall of the crashbox of a typical balsa. I was told that they lose 20% of the gold out of the crashbox with the oversized rock. With the equipment that we left behind the miners will be adapting to recover some of this gold.

Typical gold recovered from crashbox tailings pile of Balsa. The smallest particle is about 70 microns (200 mesh).40X magnified.

A Cleangold test being set up in the bottom of the upper of two sluiceboxes.

Some of the ongoing costs that the miners face are mercury (about $50-$100 per week), replacement of carpets as they wear out (about $250 every six weeks), fuel, food, repair on the pump and engine, and replacement of piping as it wears out. A crew seems to be 3 to 5 people.

This shows a Cleangold test in progress. The Cleangold system is on the top center portion of the sluice and is apparent by the smooth flow traversing the Sluice Inserts which turns turbulent again as it passes back onto the carpet. Ramon, the operator of the balsa is taking a sample at the sluice inlet to confirm that the balsa is located on a good spot. This is done periodically and the balsa moved if he is not satisfied.

The testing that we did on this operation showed us an important piece of information relating to the Madre de Dios River. While we were capturing some gold that the carpets could not, it seems as though the gold finer than 200 mesh (smaller than 75 microns) was simply not there in any great amount because the river was so swift in this stretch that it could not settle into the sediments. Reports from miners who attended our workshop on the balsa indicate that further downriver, the river slows and widens allowing more of this fine gold to settle. In these locations, modifying the main sluices of the balsa to include Cleangold Sluice Inserts would pay for itself quickly with improved recovery of fines. Upriver from Tres Islas the payoff would be slower. This idea would be revisited when we moved our testing upriver and onto land at the chuparera of Senor Hugo Miranda.

A sample of the gold recovered from the balsa carpet concentrates using the Cleangold method showed the following distribution:

greater than 100 mesh-	85%
less than 100 mesh but greater than 200 mesh-	11%
less than 200 mesh-	4%

The miners on the balsas use no mercury in their sluiceboxes nor while they are

recovering the concentrates from the carpets. They beat out the carpets and recover all of the sands which from a typical run is about 50 liters in volume. Then they climb into the concentrate barrel and using their feet to move the ore around they work the mercury throughout the concentrates. After a period of time (maybe 20 minutes) the cons are panned off to recover the amalgam. I collected a sample of some black sand beside the balsa where the panning off took place and with a Prospector's Sluice was able to recover the floured mercury and amalgam that was lost from the panning.

Mercury and amalgamated gold lost during panning following amalgamation of concentrates from the balsa carpets. The finest particles seen in this sample are less than 10 microns (1250 mesh) which is smaller than can be seen with the naked eye. The large particle is amalgamated gold while the small spheres are mercury and gold. 40X magnified.

Typical gold from carpet concentrates recovered from Senor Aquilles balsa. 40X magnified

It is important to note that when mercury and sands are ground together during concentrate amalgamation the mercury can break into particles so small that when they encounter a fine gold particle they only partially coat the gold which can prevent it from recombining with the amalgam being collected. This is one of the mechanisms by which mercury use results in the loss of gold that had already been caught by the miners sluice. This fine mercury is also more biologically reactive in the river because its high surface area which can be colonized by bacteria that convert the mercury into methyl mercury, the organic form of mercury that accumulates in carnivorous fish. Methyl mercury is the compound that was responsible for the severe health problems and birth defects seen in Minimata, Japan and described in the literature as "Minimata Disease".
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