



Sulphide Recovery Potential

**A brief non-technical explanation of the opportunity
to recover copper and gold from sulfide minerals
at the Volcan Gold Project**

February 2011



What is the Prize?



- Volcan is a primary deposit with very little oxidation of minerals, meaning that they remain in the same state that they were deposited in some 9 million years ago.
- Fortunately most of the gold can be recovered because it is free gold, or attached to minerals that, once crushed or ground, yield the gold.
- There is, however, some gold and copper associated with sulphide minerals (mostly Pyrite and Chalcopyrite, respectively) that simple gold heap leaching or milling followed by carbon in leach cannot recover.
- Again, fortunately the sulfides generally reside with the higher grade mineral. Since Andina has decided to split the flowsheet to allow both heap leaching and milling operations means that there is an opportunity to recover some of the gold and copper in the deposit, that would otherwise be unrecoverable.
- By extracting sulfides not only can Andina expect a revenue stream from the recovered metal, the remaining material is less costly to treat because it will require fewer reagents - such as lime and cyanide.
- Additionally, the current resource and reserve does not include high sulfide areas, such as Dorado Central with 500,000 ounces. With testwork underway and the flexible process approach at Volcan it is believed that higher grade portions of these areas can be incorporated into the mine plan in the future.

How Can Sulfides be Won Volcan?



- Volcan gold mineralization contains relatively small amounts of copper. Some of the gold and most of the copper are in minerals that can be separated by froth flotation once the mineral is ground fine enough (150-75 μ m).
- Mineralogy work at Volcan indicates there is between 3 and 4% Pyrite in the ore and within this Pyrite, on average, 12% of the contained gold of the deposit is trapped.
- On average Volcan low-grade mineralization contains about 0.08% copper and the higher-grade averages around 0.14% copper. The copper mineral is mainly chalcopyrite, with lesser Tennantite and Enargite.
- As it is not economic to grind low-grade mineral at current prices and it must be heap leached, Andina has decided to mill the higher grade ore at Volcan which has created an opportunity.
- Together with air-swept fines of the medium & low grade ores it is a relatively small addition to the currently envisioned plant to insert a flotation section after the grinding and before the CIL section of the gold recovery plant (a form of a pre-leach treatment).
- Sulfides react with the reagents used to leach gold and therefore increases the use of those reagents which are costly. The flotation technology extracts the copper sulfides and pyrite reducing reagent consumption and improving gold recovery.
- The Volcan PFS does not consider recovery of sulfides but the project could be improved using the flotation process by reducing cyanide consumption and generating revenue from the sale of copper concentrate and the recovery of some of the gold trapped in the Pyrite.
- While we are optimistic that flotation will benefit Volcan, work was incomplete and our engineers could not be definitive about the benefits so they were left it out of the PFS study, which was fixed in September 2010.

What Will a Flotation Section Cost?



- A flotation section fits into an existing gold milling/CIL plant and consists of additional tanks, chemical storage facilities, a small concentrate thickener, flotation cells, pumps and piping.
- We estimate that a flotation section with the capacity to treat Volcan mill ore at 11,000 tpd will cost about \$15 to 25 million in addition to the existing plant.

What Will be the Benefit?



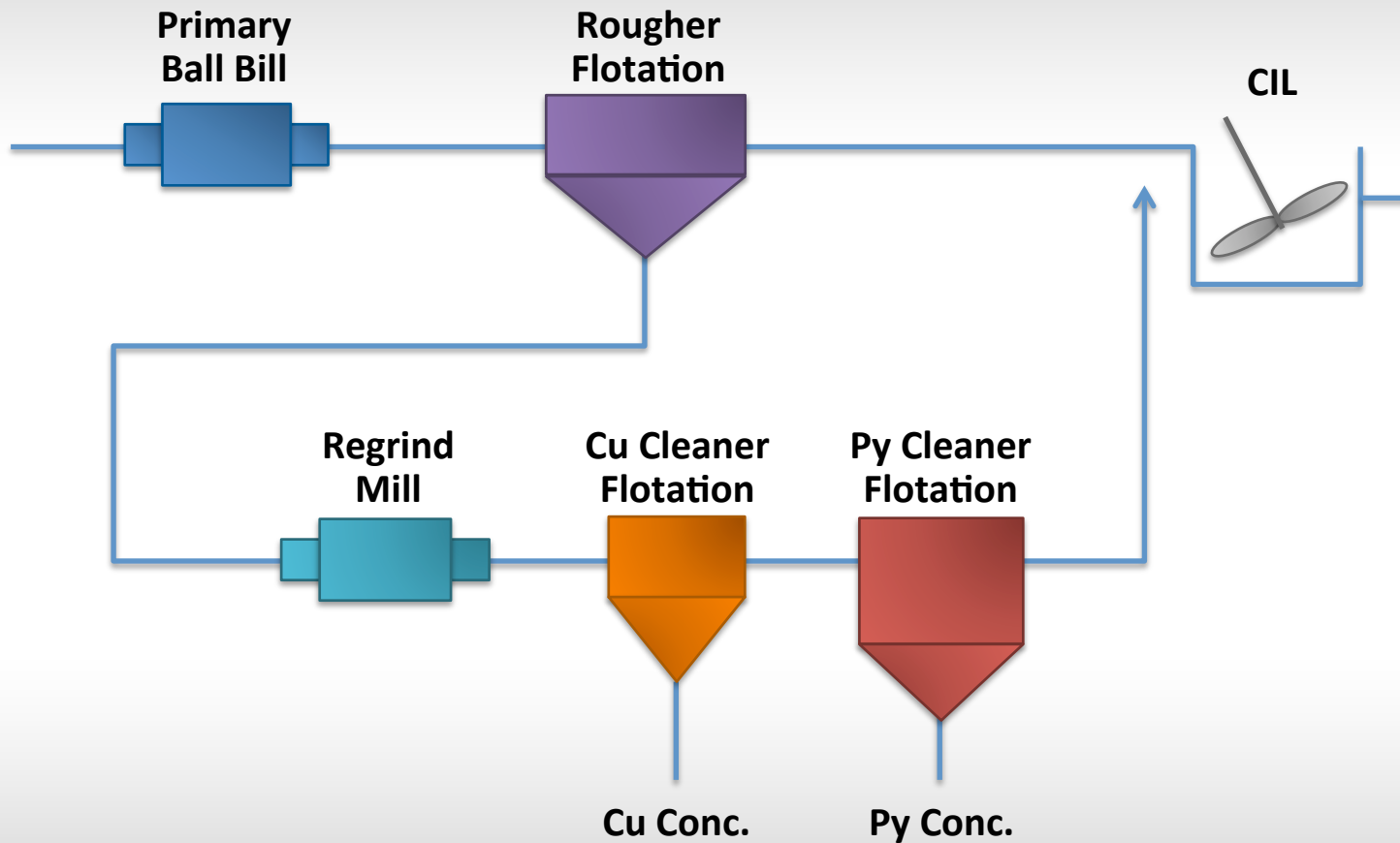
- As previously mentioned, our engineers did not have enough data to be definitive about the benefit of sulfide recovery using flotation at Volcan in our PFS. Work on flotation for Volcan continues in 2011.
- We can however speculate that a flotation section could:
 - Generate up to 20-30 tons of 15 to 19 % Copper concentrate per day with a annual value around \$13 million (\$10 million Cu and \$3 Au).
 - Produce 90-150 tons of Pyrite concentrate per day containing 38-63 ounces of gold of which anywhere between 40-90% could be recovered resulting in the potential to garner \$12 million in sales per year.
 - Cost about \$4.0 million a year to operate.
- Accounting for the investment of \$25 million, the return on investment in a flotation section could yield around a 40% IRR.
- These ball-park figures are speculative at this point and reliant on limited test data where two flotation tests returned 10 & 19% copper concentrates but reflects the magnitude of the prize that current work is aimed at capturing.
- Additional benefits of sulfide removal on remaining ore are not estimated and include reduced cyanide consumption in the CIL circuit.

Flotation Technology in Use



- Flotation technology has been around for many years and extensively used for the recovery of gold and copper in sulfide ore.
- As purely oxide gold deposits diminish the industry is now forced to look at production from gold and mixed copper-gold deposits with sulfides in them.
- Flotation is in use around the world by most resource companies.
- The challenge for low grade gold deposits has been that grinding and flotation have not been economic. Andina with its split flow sheet can consider flotation for its higher grade milled ore.

Flow Diagram of Flotation in High Grade Circuit



Typical Flotation Plant

