NEW APPROACHES IN GOLD RECOVERY, TECHNICAL BULLETIN

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Much of the world's gold is in the form of free-milling and alluvial gold. Gold has a high density, about 20 times higher than water, which means that free gold can be economically recovered by a myriad of gravity processes such as jigs, tables, sluices, and centrifugal devices. It is generally accepted that the size of such particles should be greater than several hundred microns to be efficient. At the same time, conventional flotation such as flash flotation, which is often used in gold flow-sheets, is only effective for part¬icles less than about 100 microns, and flotation is complicated when free gold and gold bearing sulfides are present together. This is further complicated by the ubiquitous practise of using cyclones to close mill circuits, which preferentially returns free gold back to the mill. Because of gold's ductility, these particles often flatten into a lamellar morphology, and get lost in the plant.

The HydroFloat™ by Eriez is a fluidization assisted flotation cell that increases the effective range of flotation by several hundred microns. It does this by contacting bubbles and ore in a dense phase fluidized bed which has low turbulence and a zero order froth. Both of these properties minimize the phenomenon known as "drop-back". Although the HydroFloat has been in commercial application for phosphate and potash flotation since the beginning of this century, the sulfide processing industry has taken notice of this game-changing technology and is now confirming its suitability in base metal and gold processing.

In 2013, an alluvial gold miner in Colombia approached Eriez to help them increase their gold recovery and plant safety. Their plant treated alluvial gold through centrifugal gravity separators, generating a tailing stream of 5-50 g/tonne of gold. To recover the remaining gold, this company used a mercury amalgamation process, which has the potential of environmental and health risks. The company was very motivated to eliminate the unfriendly amalgamation process, but there was no technology that could concentrate the significant amount of gold left in the gravity tail. Eriez showed that the HydroFloat could be added after the gravity separation device to generate a directly smeltable gold product with an average recovery of greater than 95%. A 0.4 metre diameter production unit has been in operation since 2014. A picture of the production unit is shown as Figure 1.

Figure 1: A 16 inch diameter small-scale production HydroFloat™ for gravity tails flotation

More recently, Newcrest Mining Limited in Australia has investigated the performance of the HydroFloat in three situations; on mill cyclone underflow samples in the lab, in a pilot plant with an integrated mill and with pilot units on live plant mill cyclone underflow streams. The HydroFloat feed consisted of free gold grains, free gold-bearing sulfides and a lesser quantity of composite particles. The results consistently showed comparable and high recoveries of gold up to 600 microns. In the pilot work, 98% of coarse free gold was recovered by the HydroFloat. In practise, this would allow for the adoption of a throwaway tail, removing material permanently from the circuit at a coarse size. It would also reduce the likelihood that free gold would be returned to the mill circuit where it could be over-ground and potentially lost. The HydroFloat compares favourably to flash flotation, which

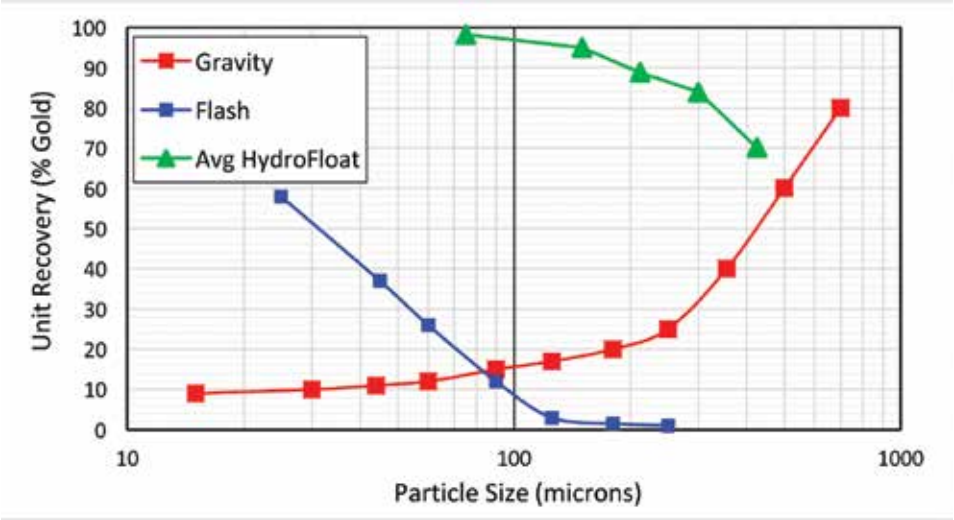

Figure 2: The effective ranges by size for gold recovery, from Seaman and Vollert (2017).

does not recover coarse material and has typically low single-pass unit recoveries, thereby sending the majority of free gold back to the grinding mill.

In their work, that was conducted by Brigitte Seaman and Luke Vollert, and published last month at World Gold 2017 in Vancouver BC, Newcrest compares the range of applicability of the HydroFloat with gravity techniques and conventional flash flotation. Citing the work of McGrath (2014) and Laplante and Dunne (2002) they have concluded that the HydroFloat, which operates with high efficiency between 150 and 600 microns, fills the "gap" between gravity techniques which generally have low efficiency below 600 microns, and flash flotation, which has poor recoveries above 100-150 microns. As shown in Figure 2, the HydroFloat occupies a range which makes it complementary to gravity separation when the feed has a wide distribution. This is empirically what has been practised for a number of years in the gravity tail scavenging application in Colombia, where the coarse gold was picked up with the centrifugal gravity separator and the remaining finer gold in the tail was picked up with the HydroFloat. Although every ore body is unique, the HydroFloat should be considered as an additional unit operation in the toolbox of the process metallurgist, with capabilities and unique advantages in the mid-size range for gold processing.

For more details on either of these case studies, please go to www.eriezflotation.com.

REFERENCES

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