

Gold deportment in Goldex mine tailing: A particle counting approach

Rejean Girard, IOS Services Geoscientifiques Inc., Saguenay, Canada

The recovery of gold is critical in the economics of developing and/or operating a mine. Any slight increase in the recovery allows improving profitability, and such increase requires understanding on how the gold is deported in the tails. Traditionally, gold deportment was evaluated using conventional metallurgical balances based on concentration tests and assays. However, although such methods provide insights into where the gold is lost, it does not provide clues on how and why it is lost. Mineral compositions and associations affect the recovery, and direct observation of the lost gold grains or minerals is required, although impaired by their very low abundance. Tailings from the Goldex mine (Val-d'Or, Quebec), grading approximately 50 ppb, were studied using an applied mineralogy approach in order to quantify the contribution of various gold assemblages. The SEM-based routine (ARTGold™), developed for gold exploration purposes, enables the efficient concentration of very fine gold particles as well as their detection, counting, imaging and analysis. Material was processed to concentrate fine (20-250µm) and very fine (1-20µm) free gold grains, electrum grains or gold-bearing minerals, as well as for particles containing non-liberated or encapsulated gold grains. The gold grains were analysed and measured, and the volume, obtained from a Corey factor, was converted into masses and grades. Free gold grains larger than 20µm accounted for approximately 10-15% of the deportment whereas free gold between 1 and 20µm accounted for 15-25%. Encapsulated gold is present as inclusions within pyrite, most of them being below the micron in size, but of minimal contribution to the deportment. Many of these gold inclusions are Te±Bi-bearing phases, hindering cyanidation. No liberated gold-bearing mineral (e.g. tellurides, bismuthides) nor non-liberated gold attached to silicate was detected. Refractory gold in pyrite was also measured by LA-ICP-MS, its contribution to deportment being insignificant. The study shows the usefulness of characterizing mineral phases in understanding the gold deportment in mining operations, while direct grain counting can be used for fast trouble shooting in the course of production.

Rejean Girard, Jonathan Tremblay, Alexandre Neron, Raphael Mermillod-Blondin, Yanick Bergeron