Independent Nickel Evaluates Bioleach Option

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Wardrop is currently compiling a pre-feasibility study for Independent Nickel Corp. on its wholly-owned Lynn Lake property. The Lynn Lake nickel mine was operated by Sherritt-Gordon from 1953 to 1976. During its 23 years of operation, the mine produced over 20 million tonnes of nickel-copper ore at a grade of 1.02% Ni and 0.54% Cu, making the Lynn Lake mine the third largest nickel producer in North America after Sudbury and Thompson. An estimate of unmined mineralization includes 5.76 million tonnes of 0.80% nickel, and 0.32% copper, including a higher-grade portion of 2.32 million tonnes grading 0.92% nickel, and 0.34% copper. Wardrop has taken an unconventional approach to the re-development of this property.

As an adjunct to the current study, Wardrop is evaluating a nickel bioleach option, which has the potential to significantly improve project returns. Preliminary testing has demonstrated that the concentrate is amenable to bioleaching and that high nickel extractions in excess of 92% Ni are possible. In order to evaluate the technology first hand, a trip to South Africa and Uganda was recently undertaken by Richard Murphy, president and CEO of Independent Nickel, accompanied by Andy Carter, Wardrop's chief metallurgist based in the UK office. Andy has over 15 years experience in the technology and was involved in the early development and commercialization of the BIOX® technology during his time with Gencor.

The itinerary for this one-week trip was intensive and included meetings with Mintek in Johannesburg, one of the world's leading minerals R&D centres and an established leader in minerals biotechnology development; a visit to Barberton Mines Fairview BIOX® plant, the world's first commercial refractory gold bio-oxidation plant which has been in continuous operation since 1986; BHP Billiton, developers of the BioNic® and BioCop® processes; Goldfield's BIOX® group; and a visit to KCCL's Kasese Cobalt bioleach plant in Uganda, which is the only commercial base metal bioleach plant in the world.

Bioleaching or bio-oxidation is often perceived as a new technology, yet for most of human history this was the principal method of generating sulphuric acid or "oil of vitriol" which was produced from "vitriolous earth" (pyrite ore) by processes akin to heap bio-oxidation or vat leaching.

> *"The fourth method of making vitriol is from vitriolous earth or stones. Such ore is at first carried and heaped up, and is then left for five or six months exposed to the rain of spring and autumn, the heat of summer, and the rime of winter. It must be turned over several times with shovels, so that the bottom part may be brought to the top and is thus ventilated and cooled."* - Georgius Agricola, De Re Metallica 1556

This sounds remarkably familiar to the current heap bio-oxidation practice and, according to Agricola, this process was well known to the Greeks, Phonecians, and Egyptians. Even though our forebearers had no knowledge that it was the bacteria that was doing all the work, they did everything that was necessary to promote biooxidation.

Since the 1970s the mining industry has seen the emergence of a number of biologically based extraction processes including BIOX®, BioNic®, BioCop®, Geocoat, BioHeap, etc. Of these, the Goldfields BIOX® process is probably the most well known. Eight plants have been installed worldwide of which six are still operating producing well over 1 million oz. of gold annually between them.

The primary focus of the trip was the visit to KCCL's Kasese Cobalt operation. Kasese processes the pyrite stockpile of the dormant Kilembe Mines, which assays 1.38% Co, and produces 720 tpa of finished cobalt metal, 15 tpa of copper and 22 tpa of nickel as hydroxides. The Kasese plant was built at a capital cost of $160 million and commissioned in 1999, and apart from a hiatus during 2002–2003 at a period of low cobalt prices has been in continuous operation. At Kasese the pyrite is recovered by water monitoring, the pyrite is then ground to 80% -35 µm before being leached in four of five 1380 m3 reactors, three primary reactors configured in parallel, and a single series secondary reactor. Overall sulphide oxidation is between 90% and 92%. The Kasese reactors are the largest in the world, although those at Bogosu are almost as big. The base metals are then recovered by a process of selective precipitation, solvent extraction and electro-winning. Production costs were stated as being US$7.50–8.00/lb cobalt. The overall impression was of a neat well laid out plant run by competent operators.

When one considers that bioleaching or bio-oxidation is a very ancient technique and thinks about the commercial success of both the Golfields BIOX® process and Kasese Cobalt plant, it is difficult to explain why biological metal extraction technologies have not enjoyed more widespread implementation. However, there can be no doubt that these kinds of processes will see increasing application in the future.