Process to unlock precious metals

A biological method initially developed for recovery of copper and uranium from ores, is currently being adapted by P.M. Mineral Leaching Technologies, a subsidiary of Giant Bay Resources of Vancouver, British Columbia, for use as an alternative to smelting or roasting minerals that contain precious metals.

The company began operations this May in Burnaby, British Columbia, on the Biotankleach process to see whether biological recovery of gold can work on a large scale. The process uses specially adapted strains of the common bacterium T ferrooxidans to treat refactory gold ores, in which precious metals are bound within the crystal structure of sulphides.

The Biotankleach process begins by agitating precious metal concentrates in tanks containing the bacteria, for one to five days. The bacteria attach themselves to the sulphide crystals and they drill their way into the 'weak' spots where the gold is found in the crystal structure.

The sulphides are oxidized to sulphuric acid and the liquid containing the bacteria is then drawn off and can be recycled and reused. The solid material left behind is treated with conventional cyanide solutions to remove the gold.

This process is similar to that used for copper ores and for treating pyritic uranium ores but it is less complex because the metals remain as solids and do not have to be recovered from solution after treatment.

The advantages of biological recovery are economic and environmental, said Albert Bruynesteyn, president of P.M. Mineral Leaching. The standard cyanide recovery will not work with refactory ores until they are either broken down by roasting or smelting or by biological action.

Economic advantages

Currently, roasting, which produces problems with removal of acidic pollution, can be done at only two plants in Canada. Transportation of ores to the plants can cost more than $100 a tonne, Mr. Bruynesteyn said. The Biotankleach process, however, can be done in small tanks at the mine site.

In small-scale experiments using samples of seven different levels of concentration they achieve up to a 45 per cent better recovery of gold and a 128 per cent better recovery of silver than from cyanide treatment of unbioleached concentrates. In bench-scale experiments, an average of 98 per cent recovery of gold was achieved from concentrates over a 30-day period of continuous operation. Concentrates of up to six ounces gold a tonne were used in the test period.

Treatment costs are estimated at $83 a tonne, including capital costs for a plant with a 50-tonne-a-day capacity, to $55 a tonne for a plant with a 150-tonne-a-day capacity.

Environmentally safe

In addition, there is no pollution associated with the process said Mr. Bruynesteyn. "We have total control over the process. The bacteria themselves are well-behaved in the environment, you can find them in your backyard," he said.

The Biotankleach process promises a way to handle arsenopyrite ores that could create arsenic hazards if handled by smelting or roasting, he added. Any arsenic or antimony in the biologically treated concentrate is oxidized during the leaching process and is left in an environmentally safe, insoluble form.

The bacterial process can also be used for heap leach operations and is not greatly affected by temperature, said Mr. Bruynesteyn. The reaction releases heat which keeps a heap from freezing, even at minus 40 degrees. The surface crust may freeze but the interior temperature remains fairly constant.

When the pilot plant study is completed next year, P.M. Mineral Leaching hopes to apply the process to larger scale applications.

The modular Biotankleach process could be used by an individual operator to handle as little as a quarter tonne of ore a day, said Mr. Bruynesteyn.

Seawater cools commercial complex

Purdy's Wharf, a new office and shopping complex in Halifax, Nova Scotia has an air conditioning and cooling system that uses the frigid seawater from the harbour which it overlooks. And according to Purdy's Wharf Development Limited, it is the first cooling system in North America to use seawater in a large commercial building.

The system was adapted by Purdy's project manager, John Doull, from the concept of how ships use seawater to cool their systems.

During operation of the computer-controlled cooling system, a 40-horsepower pump draws 5 000 litres of harbour water through a 30-centimetre plastic pipe into the basement mechanical room of the building every minute. In order to insure that the temperature of the water would be as cold as necessary, the intake pipe was placed 18 metres below the low-tide level, 170 metres out from shore.

In September, when the accumulated warmth is expected to break up the thermal layers of the water, especially as ships pass by and during strong tides, a conventional backup refrigeration system will be used. "Even then, we may get 10 to 50 per cent of our cooling needs from the seawater," said operations manager Alexander Hendry.

The water is filtered and circulated through two heat exchangers made of corrosion-resistant titanium. According to John Lindsay, the vice-president of Purdy's, the pipes are expected to last about 150 years — longer than the building.

Fresh water on the internal side of the heat exchanger loses its heat to the salt water, which is pumped back into the harbour. From there on, the cooling system is fairly standard. The fresh water is distributed through a closed system to cooling coils throughout the 18-storey building, and fans circulate the air through the coils.

Al Hendry (front) *and John Doull examine the pump of the cooling system installed in Halifax, Nova Scotia's new commercial complex, Purdy's Wharf.*

Mr. Doull said the entire cooling system cost $350 000, about $100 000 more than a conventional system, but it is expected to pay for itself within three years. Instead of an 800-horsepower motor required by a conventional system, Purdy's has only to maintain a 40-horsepower pump and, because the system is simple and computer controlled, the need for 24-hour operators will be eliminated.