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COMMENTSGUESS WHAT I FOUND IN THIS MONTHSCANADIAN MINING JOURNAL => ~~THAT ARTICLE~~YOU MIGHT WANT TO GET THE
COMPLETE PROCEEDINGS**"IF YOU CAN'T GROW IT, THEN YOU HAVE TO MINE IT"***Note: If this telefax transmission is not legible, please call to advise.*

Canadian Mineral Processors Meeting

Best Mineral Processing Information Exchanged

by Marilyn Scales

Over 350 delegates, including 24 students from 12 Canadian universities and colleges, gathered last January in Ottawa for the 31st annual meeting of the Canadian Mineral Processors Division of the CIM. The ever-increasing attendance is a testament to the growing relevance of the information exchanged there.

The topics presented were varied; mining's public image (see *Doing Some Digging* on page 5 of this issue), roasting and leaching, new operations, plant case studies, flotation, simulation, process control, and education. They covered diamonds, gold, oil sands, base metals, industrial minerals, and lessons learned using column flotation technology in paper recycling. The latter was interesting because the new knowledge is directly applicable to minerals flotation.

Excerpts from a few of the many excellent papers follow. The complete *Proceedings* is available from the CMP Secretary, Angela Putz at Canmet (phone 613-992-8895; fax 613-947-7800; or e-mail aputz@nrcan.gc.ca).

NEW KEY TO FLOTATION MODELING: BUBBLE SURFACE

Running a flotation circuit at optimum efficiency is difficult. So many variables are involved that it is hard to create an accurate model.

Models have been attempted using machine variables such as air flow number, power number and specific power, but none have proven entirely suitable. Perhaps their shortcomings are due to the fact that none of them directly includes the properties of bubble dispersion, according to McGill professor Jim Finch. Rather, he explained to CMP delegates, bubble surface area flux may prove to be the key machine variable in flotation diagnosis and modeling. He defines *bubble surface area flux* as the surface area of bubbles per unit time per unit cross-section area of a flotation machine.

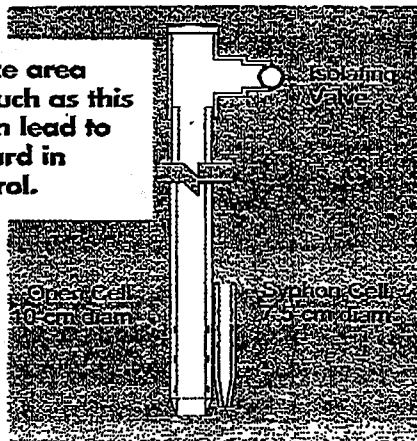
The concept is appealing because particles are carried on the surface of bubbles passing through the slurry. The production rate from a cell must be related to the amount of bubble surface passing through in a given time, he explained. The difficult part about determining bubble surface area flux lies in estimating the mean bubble size.

Both direct and indirect methods of estimating mean bubble size exist,

although direct, manual measurement of bubbles is very time-consuming. Finch has been working with an indirect method based on gas hold-up in a cell. He and his associates have developed a sensor based on conductivity measurement which is showing great promise.

The sensor is made of two parallel PVC tubes each with three stainless steel ring electrodes flush-mounted on the inside near the bottom. The "open" cell is

Bubble surface area flux probes such as this one may soon lead to a new standard in flotation control.



placed with its lower end below the froth to allow the free flow of bubbles and pulp. The upper end sticks out of the flotation cell so that the valve may be manually operated. It measures the conductivity of the bubble-pulp dispersion.

The "syphon" cell is smaller and completely immersed below the froth zone. It measures the conductivity of bubble-free pulp. Measurements of conductivity can be used to calculate gas hold-up and gas flow rate.

The sensor has been tested extensively in columns of different diameters, of different internal sparger types, and internal porous vs. external static in-line mixer types. Many of these tests took place in de-inking columns at a paper mill. Other plant trials were conducted successfully in a mechanical flotation machine zinc cleaner at a base metal mine.

Two conclusions can be drawn from this work: one, that bubble surface area flux is a key flotation machine variable; and two, that on-line measurement is feasible.

BREWERY CREEK: LEACHING NORTH OF SIXTY

Viceroy Resource Corp. operates the most northerly heap leach operation in North America, Brewery Creek, 55 km northeast of Dawson City, YT. Moreover, this was the only part of Canada not glaciated during the Wisconsin advance. The absence of glaciation has allowed the ore to weather for 80,000 years, creating eight shallow (50-metre) oxide deposits.

Certain winter design features were engineered into the Brewery Creek operation, explained chief metallurgist Michael Samuels. To combat freezing, drip emitter lines are plowed into the run-of-mine ore heaps to a depth of 300-600 mm. Small feed lines (100-mm) are placed in ditches and allowed to cover with snow, a natural insulator. Main feed and collection lines are heat-traced and insulated. Pregnant and barren solutions are pumped directly to and from the plant to minimize heat loss. Barren solution is also heated by stack off-gases, diesel engine waste heat, and used oil burners.

The generators and critical pumps are each twinned to stand-by units so that solution movement is not interrupted. Should solution circulation stop for any reason all feed line systems can be drained to prevent freezing and rupture.



is of preg-robbing carbonaceous material, to reduce preg-robbing activity, to maximize carbon activity. With tasks completed, operators use a situation of masking agents, activation, increased carbon content and an activity to effectively reduce robbing effects.

Two types of carbonaceous material have been identified: the common, mostly and the less common, strongly robbing types. The addition of fuel and sodium lauryl sulphate as masking agents reduces the ability of carbonaceous material to adsorb gold from solution. Masking agents do not eliminate the preg-robbing potential, but do significantly reduce it. Unfortunately, fuel in the circuit attacks anything of rubber and frequent equipment replacements are necessary.

With organic and inorganic fouling of carbon was observed. To combat this the circuit is run lean, and thermal oxidation removes the remainder. The acid was relieved when sufficient acid was available and with the ability of good quality quicklime. At times limited carbon loading to 1 g/t Au, compared with 3,100 g/t as needed. By doubling the carbon strip-rate, operators report that gold load-

ing now runs about 1,600 to 2,000 g/t. The effort of solving such problems is paying off as Kumtor continues to be a rich source of gold.

EL INDIO ROASTER CLEANED UP

High in the Andes mountains of central Chile, the rich El Indio deposit yields copper, gold and silver along with a fair amount of arsenic and antimony. The wilderness 3,800-m above sea level was blackened by roasting ore to remove unwanted metals and sulphur. The mine was acquired in 1994 by Barrick Gold, which made the \$53-million clean-up of the operation a priority, Barrick's Lloyd Buckingham told CMP delegates.

Concentrate is roasted in three Nichols-Hereschhoff units. This is not a full oxidizing roast because antimony would not be easily removed and toll smelters prefer that some sulphur remain in the calcine. Roaster off-gases (containing SO_2 , Sb_2O_3 and As_2O_3) are passed through an electrostatic precipitator (ESP). ESP gases are air-quenched to create arsenic trioxide, which is collected in baghouses.

Roasting presented safety, operational and environmental challenges. On the health and safety front, a vacuum truck was purchased to clean up ESP dust and

roaster spillage; it continues to be used regularly. A new conveying system was installed to transport ESP dust, rather than let it drop to the floor and be shoveled manually. This was part of a complete dust-handling system. Better personal protection equipment was introduced, including the mandatory use of full-face respirators.

Several changes were made to roasting. The addition of extra burners and better gas-handling plus an increase in copper concentrate grade has kept antimony levels to 0.5-0.6% in the calcine. Careful roaster operation also lowered arsenic levels to 0.1-0.2%. The plant was plagued with general mechanical failures, which have been fewer but not eliminated by regularly scheduled maintenance. As well, the ESPs had to be rebuilt and the operating parameters changed by adding excess air.

All the operating changes combined to virtually eliminate particulate emissions in the stack gas. The installation of a gas washing scrubber reduced SO_2 and arsenic levels. Production of off-spec arsenic is now only 10% of production, compared to a high of 65% in 1995.

The bottom line, according to Buckingham, is that the Nichols-Hereschhoff roasters can produce a mar-

ketable product from El Indio ore. Maintenance costs remain high, so consideration may be given to replacing the roasters with pressure oxidation followed by solvent extraction for copper and cyanidation-electrowinning for gold.

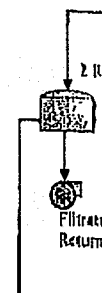
BRUNSWICK RELIES ON PASTE FILL

Paste fill is rapidly growing in popularity. It is strong. It doesn't slump. There is no run-off water when it is placed. And it returns a significant amount of tails underground.

Noranda's Brunswick mine has recently commissioned such a system for those reasons and more, explained Michael Cooper at the recent CMP meeting. Paste allows tighter filling of stopes, thus reducing ground stresses. Filling and curing is fast. Using paste fill improves ore recovery, and will have a positive impact on the long-term viability of the mine. The delivery system of small boreholes is less likely to fail than the large raises previously used for rock-fill. And cost savings are anticipated.

The paste fill system at Brunswick was built for \$23.3 million in less than a year from the time management gave the green light. It was commissioned in June 1998. By the end of the year, paste fill

Concentrate
tailings



had replaced 65% of the to the mine.

Brunswick combusts underground tailings concentrate would not at the Ni Researchers concentrate ignite. How years, mill t

The Strongest Choice. Either

The Right Solution Every Time

At Lemess Mine, where AIL constructed Super-Cor® steel bridge (the largest arched structure of its kind in the world), it was important to minimize the impact on the environment and fish habitat. The Super-Cor® solution provided an economical and easily-constructed support for the gigantic ore trucks at the mine, while leaving the river bed

