

ALTA Metallurgical Services

PLENTY OF HYDROMET ACTION IN 2004

2004 appears likely to see plenty of action in the hydromet process development arena, with new technology continuing to push ahead for copper nickel/cobalt, gold and zinc extraction and recovery.

Copper

The race for success in the leaching of chalcopyrite concentrates, will continue to be a major focus this year. Pressure oxidation is making a strong move up the field, with Phelps Dodge continuing to run their successful demonstration plant in Arizona and looking at possible commercial applications at Cerro Verde in Peru and El Abra in Chile. Not to be outdone, Teck Cominco have signed up with Brazil major CVRD to operate a CESL process pilot plant on feedstock from the Alamo and Salobo properties in Brazil. Meanwhile Anglo American/UBC and Dynatec continue to develop their medium temperature processes. Anglo/UBC completed an extensive continuous pilot plant program in 2003. CAMP (University of Montana) are also testing their NSC (Nitrogen Species Catalysed) process for a various projects.



Phelps Dodge Pressure Oxidation Demonstration Plant

Hot competitor tank bio-leaching is also hitting its straps with the operation of Alliance Copper's (BHP Billiton/Codelco) BioCop prototype plant near Chuquicamata in Chile. Whole ore heap bio-leaching is also making a run with Titan/Pacific Ore Technology working with Erdenet in Mongolia, and AMIRA facilitating an international research group including The Parker Centre/CSIRO and the Universities of Cape Town and British Colombia. In the meantime, GeoBiotics are continuing to push ahead with their GeoCoat Process for chalcopyrite concentrates.

After many false starts, chloride leaching is making another run, with Outokumpu running a HydroCopper demonstration plant in 2003, and

preparing campaigns for potential clients in 2004. The home-grown Intec chloride process is being tested by Nippon in Japan.

Ferric leaching is still in the race with Xstrata evaluating the Albion Process, inherited from MIM, for Mt Isa Open Pit ore. The Mt Gordon chalcocite ferric leach/pressure oxidation operation may have a limited future under its new owners, but a new entry from Oxiana, the Sepon Project in Laos, is galloping towards production in early 2005.

Also on the home front, 2004 will see the long awaited establishment of a heap leach/SXEW operation at Whim Creek in WA under the Straits Resources' banner. Other active Australian heap leach developments include Buka's Lady Annie project, and Matrix's White Range project, both in QLD. Overseas, heap leaching is still forging ahead in Chile, with BHP Billiton undertaking feasibility work on their large Spence project, and Codelco completing the basic engineering phase of the North Extension project at Chuquicamata Mina Sur. In Brazil, CVRD have moved into feasibility with the Projecto 118 in the state of Para.

The copper solvent extraction world was shaken by another major fire in 2003, this time at Phelps Dodge's Morenci operation in Arizona. Coming on heels of the two fires in recent years at Olympic Dam, it is likely to lead to some soul searching about the design and operation of SX plants. Areas likely to come under scrutiny include the use of HDPE for organic duty, the relative location of organic tanks and mixer-settlers, and the avoidance and dispersion of static electricity. Meanwhile, Koch are continuing with their development program for their "plant in a pipe" SX concept in the USA. Potential advantages include reduced fire risk.

Nickel/Cobalt

2004 looks like being a crucial year for the PAL process. All eyes will be on Inco for the outcome of Phase 2 of their review of the Goro project in New Caledonia, and a decision on the Ravensthorpe project in WA is anticipated from BHP Billiton in March. In the meantime, Sumitomo's Rio Tuba project appears to be moving ahead in the Philippines. Other active projects include CVRD's Niquel do Vermelho project in Brazil, and the Weda Bay project in Indonesia. Back in the news are Ambotovy in Madagascar, where Dynatec and Phelps Dodge have joined forces, and Ramu in PNG, for which Highlands Pacific have signed heads of agreement with the Metallurgical Construction and Operating Company of China. Of the three existing WA PAL operations, things appear to be looking up for Murrin Murrin, Cawse is still soldiering on supplying an intermediate to OMG in Finland, and Bulong's future hangs in the balance as a buyer is sought.

As in copper, chloride leaching is emerging as a challenger for nickel/cobalt laterites, with Jaguar Nickel (formerly Chesbar) adopting hydrochloric acid leaching at atmospheric pressure (AAL) for the Sechol project in Guetamala. In addition, Jervois Mining are evaluating the Jaguar's AAL Process for their Young laterite deposit in NSW. Meanwhile, the rival sulphuric acid

atmospheric leach process (AL) forms part of the Ravensthorpe flowsheet, and is being tested for Weda Bay.

Arguably the major development in nickel sulphide hydrometallurgy is Inco's pressure oxidation process for Voiseys Bay in Canada. A fully integrated mini-pilot plant operated successfully in 2003, and Inco expect to start on the design, engineering and construction of a \$100 million demonstration plant in 2004. Also pursuing pressure oxidation, LionOre Mining are proceeding with an Activox demonstration plant at Tati Nickel's Phoenix mine in Botswana. Another potential user of pressure oxidation is the Compass Resources' Browns Project in NT, for which a JV partner is being sought. In the bio-leaching camp, Pacific Ore Technology are looking for the right deposit for their BioHeap process.

Gold

Tank Bio-leaching has another starter with Perseverance's Fosterville project in Victoria moving into construction in 2005 using Gold Fields' BIOX technology. In the USA, Bactech plan to re-activate the Tonkin Springs mine in Nevada applying their in-house tank bio-leaching process. In other bio-activity, Geo-Biotics have their first Geo-Coat heap bio-leaching operation for refractory concentrates up and running. In pressure oxidation, CAMP is working on the application of their NSC process together with alkaline sulphide gold leaching to old gold dumps in Montana. Chloride technology is also on the move in gold, with Intec planning to run a pilot plant campaign at Metcon in Sydney on Hellyer refractory tailings, leading to the construction of a demonstration plant at Burnie in Tasmania. In another chloride development, Mintek/AngloGold are operating a demonstration plant for the Gravitaury gravity concentrates treatment process at Vaal Reefs in South Africa.

Zinc

Zinc appears to finally following copper into SX/EW. Anglo American's Skorpion project in Namibia is treating silicate/carbonate ore by atmospheric leaching coupled with Tecnicas Reunidas Modified Zincex solvent extraction technology. Skorpion produced its first zinc May 2003, and is expected to reach full capacity in 2004. On the sulphide front, Teck Cominco have announced the successful development of the HydroZinc process, which involves heap bio-leaching with naturally occurring bacteria, followed by SX/EW. The development program involved test heaps with ore from their Red Dog Mine in Alaska. Titan have also included zinc sulphides in their BioHeap development program. Also in Australia, Xstrata expect to continue pilot plant work in 2004 on the application of the in-house Albion process at the McArthur River Mine in NT.

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