

## HEAP BIO-LEACHING PUSHING THE ENVELOPE

Heap Bio-leaching is now a well established technology for the treatment of secondary sulphide copper ores, with a growing number of commercial operations. The envelope is now being pushed by a number of serious players towards the processing of primary copper ores, as well nickel, zinc and refractory gold sulphides ores. Some of the significant developments include:

### ***BacTech/Mintek Tackle the Haib Copper Project***

Having successfully demonstrated their chalcopyrite bio-leaching technology for the treatment of copper concentrates in stirred tanks, BacTech/Mintek are focusing on the treatment of low grade chalcopyrite by heap bio-leaching. They have announced that they have signed a Heads of Agreement to apply their heap bio-leaching technology to the chalcopyrite Haib Copper deposit in Namibia. Resource estimates for the Haib Copper Project have been reported as 300 million tonnes of ore at 0.41% copper, or approximately 1,000 million tonnes at 0.19% copper. The studies could lead to a 25 year project life producing in excess of 100,000 tonnes of copper cathode per annum via treatment of the leach solutions by conventional solvent extraction and electrowinning. Previous studies of the Haib Project have involved treatment of concentrates by roast//leach/SX/EW.



***Titan Resources' former Radio Hill Operation in WA***

## ***GeoBiotics Move On to Copper and Zinc Ores***

GeoBiotics are extending their gold GEOCOTE technology to copper and zinc. In their approach to heap bio-leaching, flotation concentrates are coated onto an inert substrate which enables a permeable heap to be constructed. Low pressure blowers supply air via perforated pipes under the heaps. For copper they are undertaking an extensive test program for the treatment of chalcopyrite concentrates at temperatures up to 70°C using thermophile bacteria, to develop an alternative to smelting. For zinc they have an agreement with Kumba Base Metals of RSA for treatment of lower grade zinc concentrates at the Rosh Pinah mine in Namibia. The GEOCOTE technology for gold is moving to commercial operation at Agnes Gold Mine in RSA for African Pioneer Mining. GeoBiotics also market the BIOPRO Process for low grade sulphide gold ores, which was developed by Newmont and successfully demonstrated at Carlin, USA. Heap bio-oxidation is followed by leaching with thiosulphate solution for gold recovery. Titan Testing Nickel and Copper Chalcopyrite Ores Following the successful 5000 tonne trial of their BIOHEAP technology on nickel/copper disseminated sulphide ore at Radio Hill, WA, Titan are now moving towards the commercial application of BIOHEAP for a number of projects. They are testing nickel ores from their own Carr-Boyd and Widgiemooltha prospects as well as from joint venture partners the Jinchuan Group (China) and WMC. BIOHEAP utilises proprietary bacteria which directly oxidise primary sulphide minerals assisted by air injection, and operates at moderate to high temperatures ranging from 45°C to 60°C. In the Radio Hill trial program, an auxiliary heap formed from inert waste rock, and using different bacteria, was used to oxidise ferrous iron to ferric to facilitate the downstream processing of the leach solution. Titan are moving on to apply BIOHEAP to chalcopyrite copper ores, with testwork underway on samples from a three mining companies. Other companies have also expressed interest.

With a significant proportion of world's copper resources occurring in low grade chalcopyrite ores, it is increasingly becoming a target for heap bio-leaching research and development programs. Satellite dump leaching operations have been operated in the past, but copper recoveries have been low and leach kinetics very slow, possibly due to an accumulation of reaction products at the mineral surfaces. Approaches being adopted include the development of new bacteria cultures, the use of nutrients, the application of higher temperatures and the use of air injection.

As an example of the growing interest, copper giants Codelco and Nippon Mining have formed a joint venture company, Biosigma, to develop bio-technology, for which the bio-treatment of low grade ores will be a major focus. The objectives range from the optimisation of current bio-leaching processes through better operational control, to more complex technologies such as identification, characterisation and subsequent cloning of proteins and bacteria.

Titan have brought the commercialisation of heap bio-leaching for low grade nickel sulphide ores closer, and the GeoBiotics and Newmont technologies are likely to accelerate the application of heap bioleaching to refractory gold ores. The future could also see commercialisation of heap bio-leaching technology for other metals such as zinc and cobalt.

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