TECHNO-ECONOMIC EVALUATION

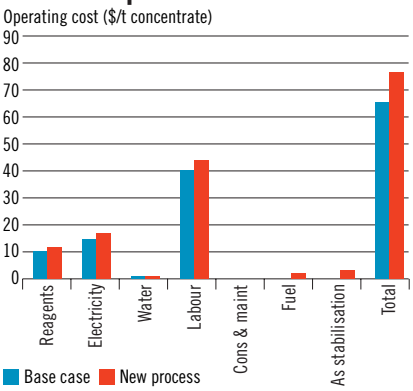
Numbers add up for untapped copper ore deposits

By REBECCA THYER

A NEW PROCESS to extract value from Australia's undeveloped copper ore deposits may be the most economically and environmentally feasible option for using this untapped resource, a Minerals Down Under Flagship evaluation has found.

Although significant amounts of undeveloped copper ore deposits exist in Australia and overseas, many of these contain arsenic at levels smelters consider too high to use. However, a CSIRO-developed process could change this, adding value to this resource and bringing environmental benefits.

Comparison of operating costs for a base case and new copper extraction process



The proposed flowsheet separates copper minerals that are high in arsenic from other copper minerals via a two-stage flotation process and an extra roasting stage. It has fewer environmental impacts – because of reduced arsenic emissions and dispersion to the biosphere – than existing processes, but requires new capital (a roaster and extra flotation units) and additional operating costs. However, these costs are offset by eliminating the arsenic penalty that would otherwise be imposed on the concentrate.

To gauge the economic viability of this new process, CSIRO research scientists Dr Nawshad Haque and Terry Norgate, working through the Cooperative Research Centre for Sustainable Resource Processing, undertook a techno-economic evaluation.

Techno-economic evaluation combines estimates for materials, energy inputs and outputs and capital, with variables – including labour – to determine the total cost of a production process.

Dr Haque says that it is important to undertake techno-economic evaluation at all stages of process development, that is, after initial laboratory test-work, then larger-scale tests and finally for commercial viability of the process.

By identifying where in a production chain technical innovation could bring a significant saving or return on investment, "techno-economic evaluation calculates the true cost of production processes," Dr Haque says.

Using information from CSIRO's constantly updated database, he found that the new process was economically feasible with the potential to use underdeveloped copper deposits and significantly reduce the penalty for arsenic content in copper concentrates.

"Also, if a smelter cannot accept concentrates with arsenic levels above 5000 parts per million, the economics of the new process means it could be the only option for using this ore."

Being able to remove arsenic from the flotation circuit during processing, stabilising it and safely storing it, also brings additional environmental and operational benefits.

Dr Haque says it is important to consider new processing ideas using techno-economic evaluation and life cycle assessment tools. "It helps to compare new processes with existing ones to find out what the actual improvement is, in terms of technical, economic and environmental impacts and performance."

CONTACT
Nawshad.Haque@csiro.au
+61 3 9545 8931

SUSTAINABLE DEVELOPMENT

Minerals, metals and sustainability

Work is under way on a new book that uses a sustainability framework to examine the nature of mineral resources, the role that minerals and their products play in society, and the science and technology of the minerals industry. The book, which has the working title *Minerals, Metals and Sustainability*, is being written by Dr John Rankin, former chief scientist of CSIRO Minerals.

Dr Rankin says that while many books have been written on ores and mineralogy, and on mining and the processing of ores, they are usually written from a relatively narrow perspective. "This book will have a multidisciplinary approach that integrates the physical and earth sciences with social sciences, ecology and economics," he says.

The book is being written for a diverse audience, including students, practising engineers, geologists, scientists, government professionals, and non-technical professionals working in the minerals industry or sectors servicing the industry. It will bring together recent knowledge and understanding of the role of minerals in modern society and the implications of sustainable development on the minerals industry. No prior specialist knowledge is assumed, other than an elementary knowledge of chemistry and physics. To make the book accessible for readers, it will be possible to read groups of chapters as relatively independent, free-standing blocks if desired.

"The early chapters, for example, focus on the nature of materials, particularly those derived from the Earth's crust. This leads to a survey of the concepts of sustainability and its measures and then to the implications of sustainability for non-renewable resources," Dr Rankin says. "The later chapters survey the ways the minerals industry can respond to the challenges of sustainability and how society can adapt to the reality of finite resources."

The book, which is likely to be completed by the middle of 2010, is being written on behalf of the Minerals Down Under Flagship, with support from industry sponsors including Alcoa, BlueScope Steel, BHP Billiton, Hatch, OneSteel, Rio Tinto and Xstrata, through the Cooperative Research Centre for Sustainable Resource Processing.

CONTACT
John.Rankin@csiro.au
+61 3 9545 8754