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Interrelated solutions

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Huge success

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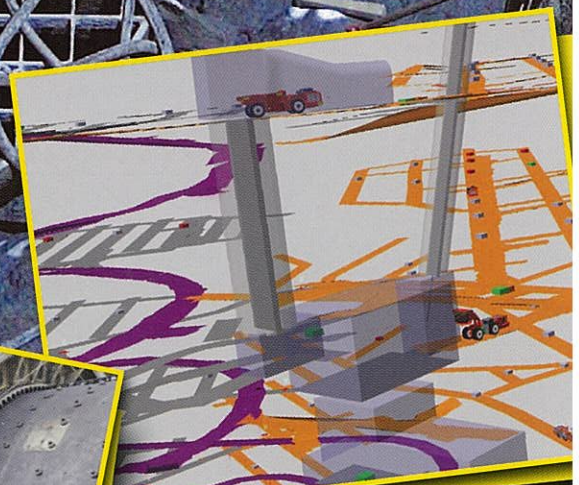
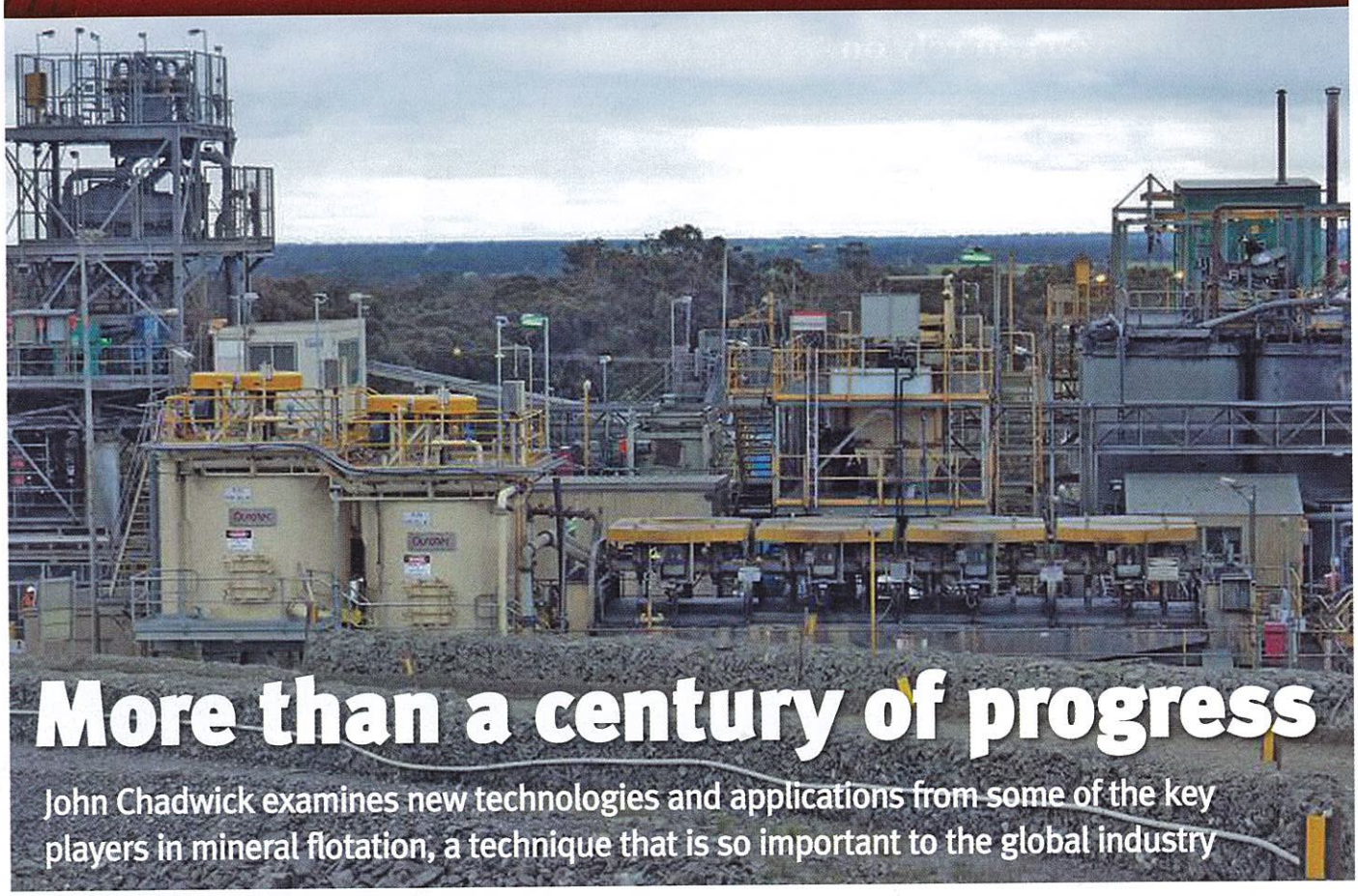
Sinking internal shaft





More than a century of progress

John Chadwick examines new technologies and applications from some of the key players in mineral flotation, a technique that is so important to the global industry

Flotation has been at the heart of the mineral processing industry for over 100 years, addressing the 'sulphide' problem of the early 1900s, and continues to provide one of the most important tools in mineral separation today. The realisation of the effect of a minerals hydrophobicity on flotation all those years ago has allowed us to treat oxides, sulphides and carbonates, coals and industrial minerals economically, and will continue to do so in the future.

There have been a number of important changes in the industry over the years as flotation technology and equipment have advanced. Xstrata Technology considers "the most noticeable has been the increase in sizes of the flotation machines, from the multiple small square cells that were initially used, to the 300 m^3 round cells used today that are the norm in large scale plants.

"Other changes have been more subtle, but equally as important. One of these has been the design of the flotation circuit to make the most of the liberation and surface chemistry effects of the minerals. In a lot of these situations it is not a matter of 'bigger is better', that will make the process work, but being smarter in the application of flotation technology."

Xstrata Technology is one company that believes the smarter use of flotation machines can deliver big improvements in plant performance. Through its use of the naturally aspirated Jameson Cell, Xstrata Technology has been making inroads into the processing of more complex ores. Having a small footprint, and using the high intensity mixing environment of slurry and naturally induced air in a simple downcomer, the Jameson Cell provides an ideal environment for the separation of hydrophobic particles and gangue, it says. The small footprint of the cells also makes them ideal to retrofit into a circuit especially where space is tight.

While the cell has been included in some flotation applications as the only flotation technology such as coal and SX-EW, the main applications in base metals have seen the cell operating in conjunction with conventional cells. The combination of the two technologies enables the Jameson Cell to target the quicker floating material, while the conventional cells target the slower floating material. "Such a combination provides a superior overall grade recovery response for the whole circuit, than just one technology type on its own," Xstrata Technology says. Below are some of the duties for which the Jameson Cell can be used.

Jameson Cells in a scalping operation target fast floating liberated minerals, and produce a final grade concentrate from them. The wash water added to the Jameson Cell assists in obtaining the required concentrate grade due to washing out the entrained gangue. Scalping can be done at the head of the cleaner (also known as pre cleaning), or at the head of the rougher (also known as pre roughing), and minimises the downstream flotation capacity using conventional cells needed to recover the slower floating minerals.

Stawell gold mine in co-operation with Outotec Services completed a flotation circuit upgrade on time and on budget last year that, instead of the projected 3.5% improvement, resulted in an increase of 4.5% since the project was completed. Payback was also impressive, occurring within less than four months.

Sometimes deleterious elements found in the orebody are naturally highly hydrophobic, and need to be removed at the start of flotation, otherwise they will report with the valuable minerals to the concentrate and effect concentrate grade. Mineral species such as talc, carbon and carbon associated minerals, such as carbonaceous pyrite, can all be difficult to depress in a flotation circuit. On the other hand, floating them off in a prefloat circuit before the rougher is an easier way to handle them. Jameson Cells acting as a prefloat cell at the head of a rougher circuit, or treating the hydrophobic gangue as a prefloat rougher cleaner, is an ideal way to produce a 'throw away' product before flotation of the valuable minerals, minimising reagent use and circulating loads.

Jameson Cells can be used in cleaning circuits to produce consistent final grade concentrates. The ability of the cell to keep a constant pulp level, even with up stream disturbances or loss of feed, enables a constant grade to be obtained.

Xstrata Technology concludes: "Importantly in a lot of these circuits, it is not the selection of one type of technology that produces the

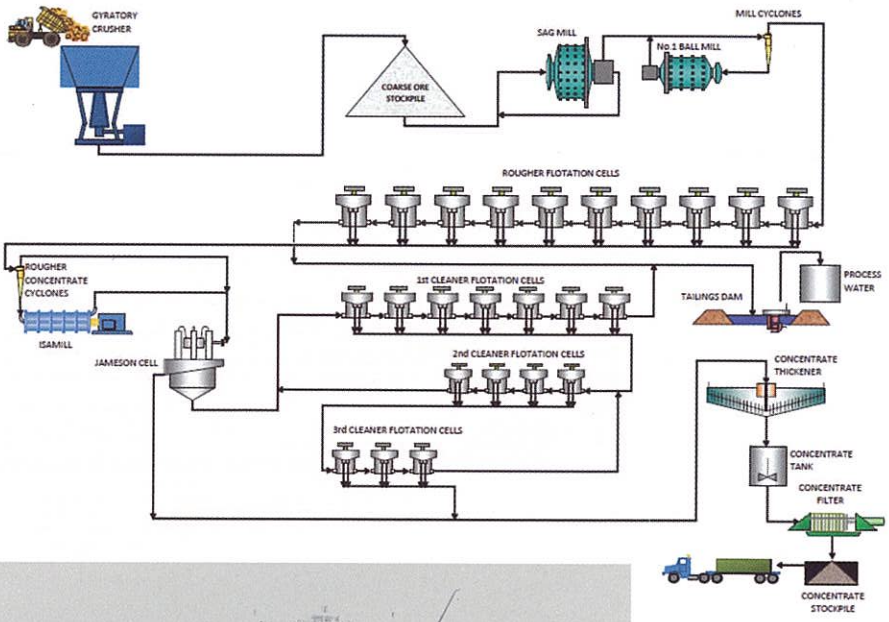
required grade and recovery, but the selection of several technologies to get the best results. The interaction of slow floating and fast floating minerals, entrainment, hydrophobic gangue and a myriad of other variables make it rare for just one type of technology to prevail, but the combination of different flotation machines can achieve the required outcome more efficiently, as well as make the circuit robust enough to handle variations in feed quality."

The Jameson Cell has benefitted from over 20 years of continuous development. Early this year, the 300th cell was sold into Capcoal's Lake Lindsay coal operation in the Bowen Basin of Australia. Around this time there were a number of coal projects taking in new Jameson Cells, including expansion projects for Wesfarmers' Curragh and Gloucester Coal's Stratford operations (both in Australia), Riversdales' Benga project in Mozambique and Energy Resources' Ukhaa Khudag coking coal project in Mongolia.

Le Huynh, Jameson Cell Manager, said the interest for coal preparation plants has remained strong, where operators needed dependable and reliable technology to treat fine coal, an important source of revenue. During 2010, the Jameson Cell business also found success in other applications, including recovering organic from a copper raffinate stream at Xstrata-Anglo American's Collahuasi copper SX-EW plant in Chile.

Le said the consistent generation of very fine bubbles and the high intensity mixing in the Jameson Cell, was ideal for recovering very low concentrations of organic from raffinate streams, typically less than several hundred ppm. High throughput in a small footprint, simple operation and extremely low maintenance due to no moving parts in the cell are distinct advantages in this application.

The cell is designed with features specific to suit such hydrometallurgy applications including specialist materials, a flat-bottomed flotation tank with integrated pump box and tailings recycle system, and large downcomers. The Collahuasi cell was the first of its type in Chile, though there are many other large cells installed in SX-EW plants in Mexico, USA and Australia to treat both raffinate and electrolyte streams.



Jameson Cell in a cleaner scalping duty at Phu Kham, Laos, producing final grade copper concentrate prior to conventional cleaning circuit (flowsheet presented in May at Austmine 2011, Brisbane)