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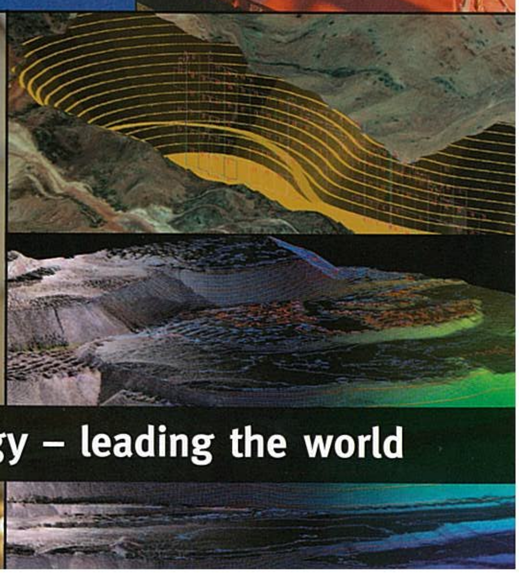
Barges, transshipment, container tipplers

Miners finding alternatives to traditional ports and shiploaders



Special AIMEX feature: Australian mining technology – leading the world

A beautiful fine grinding solution for MIM

When MIM was confronted with hard to process, finer grained deposits in the early 1990s it turned to a German pigment grinding solution used in the cosmetics industry. Brenton Burford of Xstrata Tech, owner of the technology since 2003, fills the *AJM* in on the saga of the IsaMill.

As MT ISA MINING'S (MIM) operations ground on into the 1990s, the company's zinc/lead ore bodies became increasingly fine-grained. More complex mineralogical textures, which require finer grinding to improve liberation, were occurring regularly also, compounding the problem.

Contemporary technology was insufficient to economically produce finer grinds. An alternate solution was sought. A bulk sulphide concentrate was the next best solution. This was a profitable strategy – up to the mid 1980s. But in the 90s, margins dropped and more of the zinc and lead was recovered to the bulk concentrate as the ore became more complex.

At this time, at MIM's McArthur River deposit in the Northern Territory, a similar issue was brewing. Despite ongoing investigations ever since its discovery in 1955, saleable concentrates were still not feasible due to the deposit's fine-grained mineralogy.

Burford, business manager for Xstrata Tech – now owners of the IsaMill business – said MIM did not turn to the mineral processing industry for a solution. Instead the company looked at pigment grinding for cosmetics, paint and paper.

"While the mills used for this industry were tiny, compared to existing mills used in mineral processing, the thing that stood out was the fineness of the grind the mills achieved.

"One of the key players in this industry was Netzsch-Feinmahltechnik GmbH (Netzsch), a German producer of stirred bead mills," he said.

MIM asked Netzsch to assist its search for fine-grinding technology. The companies collaborated on "trial grinding using small scale bead mills of lead/zinc samples. Not only did the mills achieve the required 7um grind-size, but the power efficiency of the machines was encouraging."

Burford said a larger bead mill was installed at the Mt Isa pilot plant in 1992. The 100 litre unit achieved similar results to the initial test work, reducing feed from 30um to 7um. Also, it managed to highlight some of the wear and blockage issues that would need to be overcome for use in the minerals industry.

More test work followed using a standard design 500 litre bead mill. "A collaborative agreement between MIM and Netzsch undertook modifications of the bead mill to make it more robust for mineral processing, and the first large scale IsaMill was born, with 1500 litre capacity," said Burford. "Trials on the modified mill began in 1993, which now included an innovative product separator that eliminated both the need for glass beads and screens traditionally used to retain media.

The modified mill, dubbed the M3000 IsaMill, with 3,000 litre capacity and a 1.12 megawatt motor, was a success. It began work at MIM's lead/zinc concentrator in 1994. Four similar units were then installed at McArthur River.

Burford said that by the turn of the century, eight M3000 units were installed at Mt Isa and by 2001 six were operating in the regrind circuits at MacArthur River. The mills at Mt Isa operated with screened slag from the lead smelter, while the operations at MacArthur River operated with screened SAG discharge (fine pebbles).

Burford ran through the nitty gritty of the IsaMills components: "It is a horizontally stirred mill, consisting of a series of discs rotating around a shaft inside the mill shell, all driven through a motor and gearbox,"

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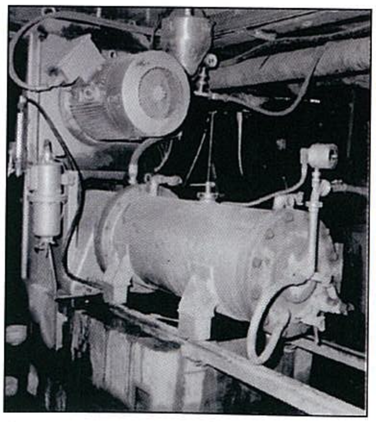
(bottom – from left to right) Early days: the M100 Netzsch Bead Mill in MIM's pilot plant. MacArthur River's IsaMills. One of Anglo Platinum's 17 IsaMills. (top) More IsaMills.



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he said. The void space inside the shell around the disc is filled with the grinding media, while the discs operate at tip speeds of 21 to 23 metres per second, resulting in high energy input intensities of up to 300 kilowatt/m^3, significantly higher than any other commercially available grinding equipment.

"As the shaft rotates inside the mill, the space between each disc acts as a discrete grinding element, acting in series with the disc before and after it. Feed is pumped into the feed end of the mill, and the particles pass towards the discharge end of the mill through the rotating media. The rotation of the disc radially accelerates the media and particles towards the shell," explained Burford.

"Between the discs however, the media is not subject to the high outwards acceleration forces as at the disc face, and the media is forced back in towards the shaft – creating a circulation of media and particles between each set of discs. Minerals are ground as a result of the agitated media, the predominant mechanism being attrition grinding. As a result of having a number of grinding chambers in series, short circuiting of mill feed to the discharge is virtually impossible.

"The energy intensive environment within the mill can use media as fine as 1mm to obtain grind sizes down to 7um. Grinding media is retained in the mill without the need for screens, by a patented product separator consisting of a rotor and displacement body at the end of the grinding chamber (driven by the same shaft as the disc).

"The design and position of the separator with relation to the last disc, enables the separator to centrifuge media to the outside of the mill before pumping it back towards the feed end thereby retaining the media in the mill. The balance of the product, essentially the

> *MIM did not turn to the mineral processing industry for a solution. Instead the company looked at pigment grinding for cosmetics, paint and paper.*

ground product, exits the mill through the displacement body. This unique mechanism means that screens or cyclones are not required, simplifying the circuit and enabling it to operate in open circuit, while over grinding is minimised, creating a very sharp product distribution."

MIM was now ready to commercialise its product, but it did not hit the hustings with its new technology. Burford said that between 1999 and 2003, marketing was limited. The mill was "only installed in a small number of operations that were outside the lead/zinc industry that posed no perceived competition to the existing MIM lead/zinc business."

In 2003, a combined effort from MIM, Netzsch and Anglo Platinum brought the M10,000 into the world. It offered the same benefits as the smaller M3000, but with a 10,000 litre capacity and a 2.6 megawatt motor.

In 2003, too, Xstrata took over MIM, for the bargain basement price of $2.9bn. The acquisition included MIM's Process Technology business which had been established to develop the IsaMill. Thus, Xstrata Tech was born.

The technology has continued to develop and spread across the world. "From the initial development of the first model to the latest project, technology has continuously progressed and trialled through research and design programs on small scale as well as full scale units," Burford said.

The M50,000, with an eight megawatt motor and 50,000 litre capacity, has been produced and a new media charging system, known as the IsaCharger, is in production. "It was trialled in late 2009, and is now included on all installations. It was a big improvement from screening and auguring systems that had been developed, and eliminates all moving parts," Burford said.

There are over 90 IsaMills, of varying size, installed worldwide – in Canada, the U.S, Peru, Ecuador, Mexico, China, Kyrgyzstan and Germany, among others.

Burford said "Magnetite projects are assessing the use of IsaMills in this new industry, in Australia and overseas. The first IsaMill treating magnetite is due to be installed at Ernest Henry in 2011. The need to grind large tonnages down to sizes of 40um or less for some deposits, makes it an ideal candidate to provide an energy efficient solution for these isolated mining operations." □

Contact: www.isamill.com

Whittle's transition from software to consultancy

The Whittle family took a bold gambit in 2001, offloading its programming business – on which it had made its name – and re-focussing as a more financially-oriented consultancy. Whittle managing director Gerald Whittle spoke to Mike Foley.

Gerald Whittle.

WHITTLE CONSULTING was born when Jeff Whittle sold the family's pioneering software business to Gemcom Software International in 2001. Jeff's son Gerald, who had a background in finance, joined the business in 1999 and was instrumental in changing the focus to enterprise optimisation consultancy.

Gerald Whittle related the story of how his father Jeff started the business, and took it to the point where it was sold to Gemcom.

"Whittle Programming was started in 1984 by my father Jeff Whittle. He was the first person to write a commercially available software package that applied the Lerchs Grossman algorithm, which was a pit optimisation technique that was actually designed in the 1980's, but wasn't able to be computed on a practical basis until 1984."

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