

TRENDS IN SURFACE MINING

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The year 2000 heralded the start of the new millennium that presents new challenges and opportunities for the mining industry. For surface mining, the trend towards larger equipment continued, together with a technological push to improve efficiency and cut the cost of production. Mergers and acquisitions also featured prominently throughout the year with globalisation one reason for the activity.

On a positive note, the world saw new open-pit mines opened, such as gold operations at Geita, Tanzania, and Wallaby and Carosue Dam in Western Australia. Australia's first vanadium project opened at Windimurra in Western Australia.

Gold

The US dollar price of gold continued to

languish throughout the year, inhibiting exploration expenditure and subsequent development. The inevitable lag in the development of projects after exploration will see the full effects of the low price realised in the coming years as existing projects wind down and fewer new projects take their place.

Nickel

Lateritic nickel was prominent as the three Western Australian mines (Murrin Murrin, Cawse and Bulong) struggled to complete commissioning and ramp up to full production. The nickel industry waits on these developments, as success would pave the way for other operations and confirm the challenge to the sulphide producers. Already Inco Ltd of Canada has invested US\$50 million in a pilot plant at Goro in New Caledonia and this year announced its



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intention to proceed with a US\$1.4 billion commercial plant. In Papua New Guinea, the owners of the Ramu project have completed a feasibility study and have received environmental approval from the PNG Government. The Ravensthorpe project (Western Australia) is well advanced in its metallurgical testwork and the Gag Island project (Indonesia) took on Falconbridge Ltd as project manager during the year to complete a feasibility study.

However, at the end of 2000, the Cawse operation was the only one of the Western Australian lateritic nickel projects to be close to full production, and the jury was still out on how much impact laterites will have on the nickel industry.

Copper

The Escondida mine in Chile is to be expanded a fourth time to increase production to 1.2 Mt/y of copper in concentrate. To supply the expanded plant, the existing daily mine output of 127,500 t of ore will be expanded to meet the needs of a new concentrator which will have a daily milling capacity of 110,000 t. Ore to this concentrator will be fed via a new in-pit crusher and conveyor system, and there will be an increase in the mining fleet. Other expansions in copper are planned at El Teniente, Radomiro Tomic, Toquepala, Los Pelambres and Cananea.

Iron Ore

Robe River Iron Associates gave approval to mine the West Angelas iron ore project in the Pilbara region of Western Australia. The project, however, was not advanced very far before the joint venture's major shareholder, North Ltd, was the target of a takeover from Rio Tinto. The action was opposed by the Japanese steel mill owners and Anglo American proffered an alternative bid during battle for control. Rio Tinto won the day and success in the bid meant that the West Angelas deposit could be developed using some of the existing railway infrastructure at Rio Tinto's Hamersley operations, thereby

obviating the need for a new 340 km railway. The move will lift Rio Tinto's Western Australian iron-ore shipments to about 80 Mt/y.

Mineral Sands

The mineral sands industry pushed ahead with developments in KwaZulu-Natal in South Africa and in the Murray Basin of south-eastern Australia. There is also interest in the developing industry in India with several proposals under consideration.

Iscor and Sons of Gwalia/RZM opened new operations in 2000. Iluka Resources and Murray Basin Minerals announced resources in the Murray Basin with production expected to lift the profile of the area. Infrastructure planning is also well under way in the Murray Basin as the number of potential operations increases. These mine developments and associated downstream processing could inject in excess of A\$6,000 million into the economics of the Murray Basin.

Coal

Changes were also afoot in the coal industry, with Shell reducing its presence in Australia and Anglo American extending its coal interests into Australia and Venezuela. Billiton plc was also prominent, with its purchase of coal resources at Carbones del Cerrejón in Colombia.

Expansions were offset by the news that the UK coal industry continues to decline. Increased environmental pressures resulting from the introduction of new controls in England and Scotland caused a reduction in interest in opencast resources. Total production from underground and opencast mines fell by 9% over the year.

Oil Sands

In the oil business, Syncrude Canada Ltd opened the Aurora Mine in August (*CIM Bulletin*, September 2000). This is the first oil sands mine to be remote from an upgrading plant. The mine highlights the advances in technology, with high-quality oil sands being

accessed without relocation or construction of new upgrading facilities. The sands are partially processed on site and the resulting bitumen froth is transported by pipeline to the upgrading facilities.

Aurora ore is mined by shovel and Cat 797 haul trucks (330 t capacity). The interim product means that ore can be mined from further afield and piped to the central processing facility. It is likely that the technological advances will increase resources and lower the cost of production. Many companies have recognised this potential, with investment of C\$7,000 million since 1996 and expansion at four times this level planned for the future.

Diamonds

Further corporate action was seen in the open pit arena through De Beers' and then Rio Tinto's takeover bids for Ashton Mining, minority owner of the Argyle Diamond mine in Western Australia. Rio Tinto emerged the victor in the battle, bringing the Argyle mine 100% under its control.

Corporate

The year 2000 witnessed a 'dotcom' phenomenon. This mania had the effect of drawing capital from the 'old world' (including mining) sectors into a speculative bubble. There were some unsustainable gains for companies with little prospect of return. Many resource companies jumped on the bandwagon, changing their names and focusing on the 'new world'. The bubble was bound to burst and by the year's end, a return was evident to the 'old world' stocks where tangible prospects of a return exist.

Contract Mining

On the contract front, 2000 saw several mines extending mining contracts, eg BHP at its Yandi iron-ore mine in Western Australia. However, elsewhere in Australia, several mines moved from contractor mining to owner mining. Pacmin at Tarmoola followed the lead of the Kalgoorlie Super Pit (gold) and Murrin Murrin (lateritic nickel) to move back to owner

mining, citing improved economics and benefits to the operation as a whole. While suitable for some operations, owner mining is not universally the best option and employing contractors can still provide advantages.

Equipment

Equipment manufacturer P&H Mining Equipment formed a new alliance with GE Industrial Systems. The terms of the alliance provide for P&H to become the principal global distributor and service provider for GE motors, electrical systems and spare parts for all large drilling and excavating equipment used in surface mining.

The alliance follows the trend for consolidation of equipment suppliers.

A major efficiency boost for open-pit coal mines was the development of new dragline technology to reduce the weight of bucket rigging by more than half. The resultant productivity increase is estimated at 25% by the developers of the system, Australia's Co-operative Research Centre for Mining Technology and Equipment (CMTE). This system is an excellent example of how industry, manufacturers and research groups can co-operate to produce major benefits for the producers.

Waste stacking at the Grasberg mine in Indonesia took a new twist with the installation of a Krupp Fördertechnik overburden handling system. The system includes one of the largest gyratory crushers and crawlers in the world, producing 10,000 t/h. The 160 m long stacker dumps the overburden to a depth of 400 m into a valley. Building and servicing costs for the semi-mobile system have been reduced through a 50% reduction in the stacker boom support structure weight. The size of the unit allows it to be operated in the same position for a number of days without having to be slewed or relocated.

MINExpo in Las Vegas provided several companies with the opportunity to unveil new,

and often larger, equipment. Caterpillar officially launched its 330 t payload 797 truck, Terex showed the new 327 t payload Unit Rig MT5500, while Liebherr showed its T282, now rated at 364 t payload, complete with a Cummins QSK78 engine that delivers full power of 2,610 kW, even up to an altitude of 3,660 m.

To load such trucks, Bucyrus International announced the introduction of its 795B electric shovel, which provides up to 125 t of capacity per pass, enabling it to three-pass load 327 t and 360 t trucks.

Le Tourneau announced the 1,715 kW L-2350 wheel loader. Clearly the world's largest, it features a 40.5 m³ bucket, a 7.3 m lift height and 3.8 m reach. The loader features a larger drive and master system manager to control and monitor the machine.

Tyre developments required to support the new equipment were also featured. Bridgestone showed off its 46/90R57 VELS low-profile haulage tyre, while Michelin showed its low-pressure technology in the 44/80R57 XDR. Goodyear showed a new two-piece tyre that allows operators to change tyre and body package separately in the field.

Atlas Copco released the new COP2550, 25 kW top-hammer rock drill for use in conjunction with its ROC F9 crawler rig. The new drill provides increased impact power. The company also achieved ISO 14001 Environmental Management Standard accreditation for the company's Orebö facilities in Sweden. The accreditation includes development, manufacture and marketing of its surface and underground equipment.

Production records were claimed at various mines during the year. P&H claimed that one of its 4100 x PB shovels set a production record of 8,528 t/h over a 12 -hour shift with a peak production rate of 10,886 t/h. The

shovel is working at a coal mine in Wyoming, US.

Technology

A long list of major international companies have joined the 'Quadrem' e-procurement exchange to take advantage of synergies from industry-wide co-operation. Industry leaders have joined forces to form the independently managed exchange which will provide a marketplace for practically everything required to operate in the mining industry. Suppliers will also register their sources with the aim of putting buyers and sellers together to mutual advantage.

The system will be world-wide, web-based and able to service the entire purchasing cycle through confidential on-line data services. Other systems were also announced during the year, notably Free Markets.com, Matrax Ltd with a focus on African Mining, and BHP's alliance with Metiom.

GPS technology continues to improve with the latest product from Trimble enabling centimetre accuracy over distances up to 50 km. Developed by TerrainSat, Virtual Reference Stations (VRS) consist of software and a network of Trimble GPS receivers communicating with a control centre. Error corrections are calculated and transmitted to users within the area. This reduces errors and the usual need for a high-precision base station to be within 10 km.

3D Laser Mapping released its LR1 long-range laser scanner. The unit is capable of providing detailed mapping data to an accuracy of 25 mm from a maximum range of 2,000 m. Benefits of the system include the ability to map steep and inaccessible high walls and continuously monitor slopes from remote locations. The system can also be used to generate data quickly for topography, vegetation and existing infrastructure.

Laser control features on Leica Geosystem's Dozer 2000 GPS-based machine guidance

system. The system enables operators to see long-section and cross-section slopes of the machine as it works. Design files can be transmitted to the system via existing radio networks to ensure accurate downloading of data.

Iridium Satellite Telecommunications LLC, which operated a satellite system comprising 66 low earth orbit satellites for remote telecommunications, ran into financial problems at the end of 2000. Its assets were subsequently acquired by Iridium Satellite Telecommunications LLC in March this year and commercial services have been relaunched. The technology has made a significant contribution and will continue to do so in the future.

Computing

During the year, Surpac Software International released its latest product, SURPAC Vision. It incorporates the functionality of Surpac 2000, but adds a new interface to facilitate the integration of network and Internet technology in a new 'client server architecture'. It also possesses an advanced 3D graphics system, and a web element is being developed which will enable users to plug into the 3D graphics sessions of others.

Vancouver-based software specialist Gemcom has released Gemcom Desktop Edition Version 4.0. The version provides new CAD facilities, and enhanced solid and surface modelling tools. In addition, Microsoft's Visual Basic for Application is also embedded in the software.

Laptop computers have been designed that will withstand all mining conditions. Opentec Pty Ltd has developed Openfire Series II laptops. Initially intended for the Australian Armed Forces, to withstand a range of harsh conditions including desert, tropical and marine environments, the laptops are ideal for the exploration team working in out-of-the way places.

During the year Whittle Technology announced the release of its 'Blending Pit Optimiser' and 'Blending Scheduler'. Both products aim to improve the economics of bulk-commodity mining operations such as iron ore, coal, bauxite and nickel laterite. The software will, however, only be available through use of Whittle consulting agreements, which exclude purchase or leasing of the software.

Rock Fragmentation

Several systems have been developed in 2000 for non-explosive rock fragmentation. Brandrill Ltd continued development of its penetrating cone fracture (PCF) technology. While most trials are currently conducted in the underground environment, the PCF system is useful for civil and open-pit applications where vibrations from blasts can be a problem.

In Spain, CBA Expansions SL is producing an expanding cement for rock breaking. The cement is for use in areas that are close to buildings, sensitive equipment or explosive atmospheres.

Orica has not been idle either. It has released the new digital energy blast control system, termed I-kon. The system is light and easy to use with the blast design generated on a PC or laptop with Shot Plus software. The fully programmable detonators offer delays of zero to 8,000 milliseconds in one millisecond increments. Each detonator is programmed by an I-kon logger. Each I-kon logger can handle 200 detonators and up to 8 loggers can be controlled by the I-kon blaster. Hence, up to 1,600 detonators can be controlled using the system, with the blaster controlling the firing via a special digital key. The system provides more accurate delay timing to reduce overbreak, improve fragmentation, reduce vibration and allow more complex blasting sequences.

Environmental

The year 2000 opened with the news of the Baia Mare mine tailings spill in Romania.

About 100,000 m³ of water containing 50-100 t of cyanide and an unknown quantity of heavy metals was released into the local river system. Extensive stretches of downstream river systems in Hungary and Yugoslavia were reported to have been contaminated. As a result of the spill and the UN investigation, proposals have been put forward to ban the use of tailings ponds for the storage of cyanide and other dangerous substances. Such substances would have to be removed before tailings are deposited.

The Grasberg mine in Irian Jaya also suffered problems during the year as a waste dump slippage caused a surge of water and material to overtop a dam at Waragon Lake. The incident resulted in four deaths and forced changes to the mine plan.

Both incidents can be viewed against the backdrop of continuing concern over BHP's

Ok Tedi mine in Papua New Guinea. BHP has been considering the sale of its 53% stake in the mine to another company, or placing its holding in a trust for PNG land-owners. The mine is due to close in 2009, but the rising cost of environmental measures associated with the management of waste rock and tailings may result in early closure, possibly within five years.

On the positive side, Peabody's US operations and affiliates were awarded six of twelve 'Excellence in Surface Mining' awards by the US Department of the Interior. The mines were recognised for extensive reforestation, as well as reclaiming mined land for grazing and wildlife habitat. Programmes like these are gradually changing the perception of the public towards mining, though more spectacular disasters can wipe out the positive work overnight.