When De Beers Consolidated Mines sold Finsch, Barend Petersen, Chairman of DBCM said: “We are particularly pleased to have been able to conclude this transaction with Petra. Their track record as a hard rock underground diamond miner bodes well for the long-term sustainability of Finsch going forward.” The acquisition was completed on September 14 last year.

Finsch mine is located South Africa’s Northern Cape some 165 km west of Kimberley. It is a major resource of 43.7 Mct, including 25.8 Mct in reserves and 2.5 Mct in tailings. Petra’s expansion program aims to take production from ±1.5 Mct/y to just under 2 Mct/y. The current 1.5 Mct/y is roughly comprised of 900,000 ct ROM and 600,000 ct from tailings.

The current mining operation employs a panel caving operation producing in the order of 16,000 t/d. Over 302 production drawpoints are located within 11 extraction tunnels and diamond bearing ore is also remucked from four undercut ore passes. Sandvik LHDs tram the loaded ore to five designated split level transfer points located on the perimeter of the ore body after which the ore is dumped into Sandvik 50-t capacity 50D trucks – a fleet of nine units. These trucks run without operators on the Sandvik AutoMine system and haul the ore and dump into the primary crusher located at the shaft which is located about 800 m away from the orebody. The mixed Sandvik LHD fleet comprises two 006 machines delivered in 2005, eight 007s delivered between 2004 and 2007 and four LH410s – two delivered in 2009 and two in 2010.

Commissioning of the AutoMine Stage 1 system at Finsch mine commenced during the middle of 2005 and was completed during December 2006. (IM, January 2008, pp14-25). This system was planned to be implemented in various implementation stages. During the first stage only the dump trucks were automated and in addition location and production tracking of all the production loaders in Block 4 was included with the system. This manual tracking was considered a very important aspect in the operation and management of this 100 m block cave.

Under De Beers, Stage 2 would involve the automation of only a few loaders together with the automated dump trucks and finally Stage 3 will be the automation of all loading and hauling resources underground in the block cave. A single semi-automated Sandvik TORO 007 loader was added to the system during 2007 and operates on the undercut level of the mine. Based on the performance of the semi-automated loader, a decision was to be made on the commencement of stage 2 which would see the introduction of semi-automated loading on the extraction level of the mine. These plans may now change under Petra and much of the greater levels of automation may be held over until Block 5 mining starts up.

The Finsch kimberlite pipe is a near vertical intrusion with a surface area of 17.9 ha, elliptical in outline. It is a Group II kimberlite pipe with an age of 118 Ma that was emplaced through a...
thick sequence of Transvaal Supergroup sedimentary rocks comprising dolomites, banded iron formation and shales that overlie the Western part of the Kaapvaal craton. The pipe is made up of eight kimberlite facies, two of which make up majority of the main pipe and are currently being mined. There is significant potential for mining at least one of the precursor kimberlite bodies attached to the main pipe.

The current life of mine plan extends for 18 years, but the orebody remains open-ended at depth so there is potential for a much longer life. Petra is currently mining Block 4 at 630 m at a rate of 3.2 Mt/y at some 35 ct/100 t; expected to be depleted by FY 2015. The future mine plan is to open up new cave in Block 5 - Probable reserves of 22.1 Mct at 47.6 ct/100 t. The mine will maintain production levels during the transition from Block 4 to Block 5 by developing smaller sub-level caves within the Precursor orebody at Block 4 level and within Block 5. This will enable Petra to maintain underground production at around 3.2 Mt/y, ramping up to 3.5 Mt/y by FY 2018 once the Block 5 cave is fully operational.

At the end of 2011, the operating costs (OPEX) were estimated to be R130/t (total) treated – 46% of which was labour, 23% 'stores', 12% power and 19% 'other'. Ongoing OPEX issues being addressed:

- The rising cost of electricity through effective design, maintenance and management of new and old infrastructure
- Designs to cater for appropriate levels of automation
- Advancement of a group procurement strategy to yield benefits related to economies of scale.

1961 Finsch Diamonds founded by Fincham & Schwabel
1964 All shares and rights of Finsch Diamonds acquired by DBCM
1967 Official opening of Finsch, as an open pit, and establishment of original plant
1978 First stage of underground mining with start of decline and construction of shaft
1980 Extensive modification of treatment plant
1990 Open pit mine operation ceases; opening of decline and start of underground production
2001 ISO14001 certification achieved
2003 Processing of pre-79 tailings commences
2005 Commissioned world’s first fully automated underground trucking system
2007 6.0 million fatality free shifts
2008 Undercutting of the block cave for Block 4 is completed
- Treatment plant upgrade is completed (cost of ~$100 million)
2011 Acquisition by Petra Diamonds – completed 14 September

GREAT MINES

CARLTON MINE

Sandvik truck being loaded under AutoMine control. MMD sizers reduce the kimberlite to – 300 mm for transport to the shafts and hoisting to surface

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The new plant

The Finsch Mine Treatment Plant Upgrade (FMTPU) was one of the last investments made by De Beers to improve diamond recovery at the operation. The FMTPU project was completed by Bateman Engineering in 2008 and had the objective of improving overall diamond recovery efficiency as well as improving the value of the diamonds recovered by implementing available ‘diamond friendly’ liberation processes that reduce diamond damage.

As a result of the upgrade, the feed rate from various feed sources to the plant increased from 960 to a maximum of 1,260 t/h and the capacity of the plant was increased by some 25% to process an additional 1.4 Mt/y of tailings material. This meant an increase in total plant capacity to 7.2 Mt/y.

Finsch is currently treating pre-1979 tailings at a grade of about 18 ct/100 t. These are expected to be treated at a rate of approximately 3.5 Mt/y until depleted in FY 2015. Post-1979 tailings are to be treated thereafter, at a lower estimated grade of some 10 ct/100 t. Diamond recovery from tailings is expected to cease in FY 2020. A program to increase tailings throughput to achieve 3.5 Mt/y by FY 2014 is progressing well and could be achieved ahead of schedule.

The objectives of the upgrade was to improve overall diamond recovery efficiency levels, and importantly, to improve the value of diamonds recovered by liberating diamonds from the kimberlite, in carefully designed ‘diamond friendly’ processes developed and implemented by the De Beers’s technical project team. The new plant includes the installation of high-pressure roller crushers to replace the relatively dated rod milling process used before, and two new secondary crushers, replacing the older...
technology cone crushers. The capacity of the plant rose from 5.8 Mt/y of kimberlite to 7.2 Mt/y. The efficiency improvements were achieved with the addition of a coarse Dense Medium Separation (DMS) Plant and by converting the existing DMS plant to a fines DMS plant, thus allowing for a more efficient DMS process. This feeds correctly prepared diamond bearing kimberlite to a new final recovery plant that includes the latest X-ray diamond recovery technology. Much of the technology installed at Finsch was developed by DebTech, the De Beers Group’s technology research and manufacturing division based in the south of Johannesburg.

The scarcity of water in the region was another important consideration in the design of the more-efficient plant. A new thickener and associated infrastructure was added to the plant to improve the internal water recoveries. This led to a lower volume of water used per tonne of kimberlite processed.

In addition, new technology was required to make it viable to retreat the tailings deposited prior to 1979.

The FMTPU was one of the largest diamond contracts ever awarded to Bateman. IM