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Feature

Red Lake just hitting its stride

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The twin gold mines Red Lake and Campbell in Balmertown, Ontario share a deep, high-grade orebody. The former poor sister of the two–the Red Lake (*a.k.a.* Arthur White/Dickenson) mine–has come on strong over the last four years, developing into what 100%-owner Goldcorp Inc. of Toronto calls the “richest gold mine in the world”. The Red Lake mine produced a record 552,000 oz Au in 2004 at an average grade of 77.1 g/tonne (2.25 oz/ton) Au; the cash cost was estimated at US$92/oz sold, with a total cost of US$126/oz.

It took the first 50 years of operation to produce 3.15 million oz Au, but the Red Lake mine has produced more than 2 million oz in the last four years, pouring its five millionth ounce on May 6, 2004. Red Lake is on track to reach 10 million oz by 2012.

To a large extent, the recent good fortune of the Red Lake mine is based on the 1995 discovery of the deep High Grade zone (HGZ), defined while the mine was shut down by a bitter strike from 1996 to 2000. When the mine reopened in August 2000, a rich new orebody awaited, to be processed in a new mill (see *CMJ* October 2000).

The extremely high ore grade is the reason for the low cash costs, and the profits have rolled in, providing US$12 million/year for exploration among other things. As of the end of 2003, total reserves at the mine were 2.883 million tonnes grading 42.2 g/tonne Au (4.9 million contained ounces). Of this, 4.4 million oz of gold is in the HGZ and the rest is in various sulphide zones. This is up considerably from

the 2.3 million oz of gold in reserves in 2000.

As critical as good ore is, there are other factors in making a mine successful. In the early days of January, *CMJ* spoke with Goldcorp vice-president projects Mike Hoffman and the mine's general manager Claude Lemasson about some of the smart things being done at the Red Lake mine.

Expansion project

The main activity at the mine is the US$100-million expansion project, approved by the Board of Directors in January 2003. Construction began the next month, and is scheduled for completion in 2007.

The existing mine consists of No.1 shaft from surface to 23 level, and No.2 shaft 1,000 m away, which is a winze from 23 to 37 level (1,680 m). (Levels are 46 m apart.)

These two shafts will be replaced by a new main shaft and adjacent ventilation shaft, which will allow ore production to expand from 590 to 907 tonnes/day. The 6.55-m-diameter cement-lined circular shaft will extend from surface to 2,180 m. A 2,290-m shaft pilot hole drilled 10 m away in 1998, gave a good idea of the rock conditions.

The expansion project includes development work, which has largely been completed from the existing mine to the new shaft stations on the 16, 23, 30, 34 and 37 levels. About 900 m away from the new shaft, a ramp is being driven basically following down the HGZ from 37 (the last main level of the existing mine) to 43 level; it has almost reached 42 level. When the new shaft reaches 43 level, the shaft mining contractors will drive across to meet the ramp.

Level 43 will be the first main production level, and the next will be 47 level. The loading pocket will be at 48 level (2,160 m). An ore and waste pass system will be driven from 48 up to 37 level, thus linking the existing mine with the new project; all ore and waste will be dumped down to 48 for hoisting.

The shaft passes through historical sulphide zone ore near 30 level. It was collared on the only nearby outcrop and initially it was thought that the Hangingwall (HW) lenses of the HGZ would be about 900 m away from the shaft on 47 level. Recent exploration results have intercepted Footwall zone (FW) ore (part of the HGZ) between the shaft and the HW ore.

The production and service hoists were purchased from the Magma mine in Arizona while the Maryann (auxiliary) hoist came from a mine in New Mexico. They have been automated, with new Lebus shells on them, and the motors have been reconditioned. There is a double-drum production hoist, 4.6-m diameter with a 4,470-kW motor. The service hoist is its twin, but with a single drum. The double-deck cage will accommodate 120 people at a time, compared with the 12 who can ride in the cage in the old facility. The auxiliary hoist is 2.4-m diameter with a 540-kW motor; 12 will be able to ride in the double-deck auxiliary cage.

Various consultants have contributed to the job including McIntosh Engineering (mine design), AMEC Earth & Environmental (permitting), Wardrop Engineering (dewatering system and truck dump/conveyor design), Mine Ventilation Systems (ventilation design and climate simulations), Merit Consultants (project management), Trow Consulting (surface geotechnical) and PL Tiley (hoist). Cementation Canada is the main contractor, handling the headframe and shaft engineering and shaft-sinking.

Other key contractors/suppliers include Ken Anderson Electric (electrical installation), Bob Turgeon Mechanical (hoist installation), Minesteel (shaft steel, bin supply and installation), Lafarge (cement), Western Explosives (shaft explosives), RC Moffat Supply (ground support), Behlen (buildings), Waiward Steel (headframe supply and installation), Riverview (truck dump and conveyor supply and installation), Lakehead Installation (headframe and bin cladding and insulation) and MLA Northern (earthworks and cranes).

In early January 2005, the shaft was at 16 level (700-m deep), and stations had been completed on levels 8 and 16. “We’re shooting for over 300 feet [90 m] a month,” says Hoffman. “The progress in 2004 wasn’t quite what we wanted.” Problems revolved around manpower shortage and maintenance issues, but Hoffman decided to stick with the contractor, Cementation. Murray & Roberts (the new owner of Cementation) has sent some expertise from South Africa, including a mechanic/operator to train people to operate and maintain the mucking clam. Says Hoffman: “During January, we seem to be getting some consistent advance, but we will see what happens moving forward.”

Goldcorp is targeting shaft completion at the end of 2006, with the total project completed during 2007. As the shaft reaches a steady sinking rate and gets deeper, the company will be able to estimate the final completion date with more precision. “Project completion will effectively be when ore from 37 level is hoisted from the 48 level loading pocket,” says Hoffman.

Much of the surface work for the expansion has already been completed. The headframe has been built as have adjacent 900-tonne ore and waste bins. Ore will be trucked from the new shaft to a truck dump and conveyor, which should be complete during summer 2005.

The mill will be expanded from its current 590 to 907 tonnes/day, with annual gold production increasing to 725,000 oz. Hatch Associates is completing the capital cost estimate, and the detailed engineering should begin shortly. About US$7 million will be spent to add a tower regrind mill for extra capacity, adding some CIP tanks and upgrading pumps.

Goldcorp has built an 11-km-long powerline from the Hydro One Red Lake Transformer Station to a new 20-MW substation at No.3 shaft, to bump up the available power. The mining company has built a new waterline from the highway to the site. Two additional 70-m3/min compressors have been purchased for use during the shaft-sinking, and four of the existing 70-m3/min compressors will be moved from the existing site to the new site after the project is completed for better distribution efficiencies and power availability.

Hoffman is eager to complete the expansion. “The miners are doing an absolute fantastic job operating the mine as is, but everything’s maxed out,” he says. The benefits of using the new shaft will be many.

***** Travel time for underground production miners will be cut from 1.5 hours to 30-45 minutes each way, significantly increasing work time and productivity.

***** A better ventilation system, and more compressed air and power will allow for more eff
icient work, cutting costs.

***** The single-lift, larger shaft will make materials-, personnel- and equipment-handling much easier, requiring fewer people.

***** The Maryann cage will allow for flexibility of moving staff any time, particularly useful for technical people, supervision and management.

***** A new exploration drift will be established on 43 level, allowing for cheaper and more accurate exploration drilling of the HGZ at depth.

***** The new hoists will open up options. The production planned is 1,600 tonnes (900 tonnes of ore plus 700 tonnes of waste) from 48 level (2,160 m). However, the capacity will be more than double that (3,600 tonnes/day), so ore production could be increased to 2,250 tonnes/day from 48 level. If the shaft were deepened to 3,000 m, the hoists could handle 2,500 tonnes/day. Using the new South African hoist regulations that the Ontario government has adopted, the new facilities could in theory hoist from 4,270 m at a rate of 2,270 tonnes/day at little additional cost.

Payback for the new shaft is estimated to be only 1.2 years, with an internal rate of return of 48% at a US$400/oz gold price.

The Red Lake mine shaft project is currently employing 60 people at the site, 50 with Cementation Canada, five management staff from Merit Consultants, three at the onsite Lafarge concrete batch plant and one explosives contractor.

There are more than 500 operations employees at the mine site, mostly contractors. Goldcorp site employees number only 135, comprising the staff, management, administration, engineering, geology and mill operations. The company employees have had an excellent safety record, completing four years since the January 2001 official full production start without a lost-time accident.

Richmond Hill, Ont.-based Dynatec Corp.’s Mining Services Division has handled the mining operation since the mine reopened, and that contract was renewed for another three years until late 2006. There are about 300 Dynatec employees working at the site. This will probably decrease by 15 when the expansion is complete.

The other large contract is with Major Drilling Group of Moncton, N.B, whose 60 on-site employees do all the drilling–exploration, definition and delineation–from surface and underground. This contract was renewed for another two years, to the end of 2006. There are about 30 other contractors at Red Lake, who handle security, camp and cleaning services, and waste and concentrate haulage.

Remediation includes bio-leaching at Cochenour

In the late 1990s, Goldcorp purchased the Cochenour Wilanour mine, 6 km from the Red Lake mine. Cochenour was a former gold producer on care-and-maintenance, with a valuable land package. There were some ongoing environmental issues at the mine.

The mine is now moving toward closure. A major portion of the buildings have been razed. There was a crown pillar about 12 m thick supporting the mine excavations under and around the town of Cochenour, which had the potential to deteriorate, with the back eventually heaving in. The company collapsed the pillar by blasting, and refilled it with wasterock up to surface.

The other outstanding issue was that the final water discharge from historic roaster tailings contained arsenic on the order of 0.5 ppm, which is the current acceptable upper limit for mine discharge.

Goldcorp's environmental group has adapted a biological treatment technology to treat the discharge for arsenic. The technology was developed by Salt Lake City, Utah-based Applied Biosciences Corp., but the bio-treatment plant at Cochenour Wilanour is the first in the world to treat arsenic, and is the first in Canada to treat tailings discharge. (Goldcorp is using an earlier version of this technology at its Wharf gold mine in South Dakota to successfully treat selenium and nitrates.)

The Cochenour Wilanour plant was built in 2004 and is being commissioned during the first half of 2005. Sulphate-reducing bacteria that naturally occur in the tailings facility are cultured in 163,000-l tanks, each filled with 60,000 kg of activated carbon as a substrate to which the bacteria attach. There are six such tanks arranged in two parallel circuits, and they can process about 750 m3/day of tailings water.

The bacteria are fed molasses, the only "reagent" in the system. Tailings water containing dissolved arsenic is pumped to the first tanks. The bacterial culture has created an anaerobic environment and emits H2S gas in the tanks. The gas attaches to the dissolved arsenic and precipitates out of the water column as solid arsenic sulphide. The process is repeated in the two downstream tanks. Water retention time in the system is 12 hours, after which the arsenic content of the final treated water is less than the detectable limit (0.005 ppm). The arsenic sulphide sludge will be back-flushed annually and the resulting solids stored underwater in the tailings management area.

The final stage is to remove surplus nutrients by passing the water through a second aerobic bacterial culture, and to mechanically agitate the water over a serrated surface to restore oxygen levels. The water is then ready for discharge to the environment.

Goldcorp has developed this system to further protect the environment, moving toward the Fisheries Act limit of zero discharge of deleterious substances. Its work is advancing arsenic treatment technology, which will hopefully be applied in treating the arsenic-bearing discharge from Balmer Lake, which contains the tails from the Red Lake and Campbell mines, as well as other sites around the world.

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Eyes wide open with virtual reality

Think of the marvel of an ultrasound, which can provide a real-time image of babies growing in a woman's womb. Without the use of this technology, an obstetrician is working in the dark.

Transfer this image to a complex, old, deep underground mine like Red Lake. There is a lot of information but, without the application of virtual reality (VR) visual technology, those data sets cannot be visually appreciated. Different, sometimes competing departments, such as production, engineering, geology and head office (think multiple births), are making decisions that impact on each other. Those impacts can be more easily understood if the groups can meet in a studio (think small, warm and dark) where they can see all the relevant information from different angles and truly understand all the issues.

Although VR has become a widely-used technology in many fields, the first such facility was opened at a mine site in early 2004. Laurentian University's MIRARCO teamed up with Goldcorp Inc. and Placer Dome Inc. to build the VR studio at the Red Lake mine in Balmertown, Ont., to be shared by the two companies. The high-end projection, advanced edge-blending and Gocad software immerse viewers in a seamless 3-D stereographic image, as they look at the flat screen.

Having the studio onsite has made a great difference to the way the companies work. The mine engineers and managers use it on a regular, weekly basis. Staff can visualize information and make appropriate decisions without resorting to elaborate mathematics or expensive trial and error. In this way, the technology very quickly saves money and time.

Mirarco's startup director, Andrew Dasys, says his organization is trying to create a network to link the existing VR studios in Sudbury, Red Lake and Thunder Bay, plus build new ones in Timmins and Kirkland Lake, and possibly a mobile one. Through such a network, people in different locations could videoconference and discuss the same imagery, without having to travel.

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Success not gone unnoticed

The profitability of the Red Lake mine, which is Goldcorp's main asset, is probably responsible for the current ownership struggle. On Dec. 6, 2004, Goldcorp and Wheaton River Minerals Ltd. of Vancouver announced plans for an amicable combination. Ten days later ca me word that Reno, Nev.-based Glamis Gold Ltd. was launching a hostile takeover attempt of Goldcorp, as an alternative to the Goldcorp/Wheaton River deal. At a special meeting in early February, Goldcorp shareholders will have a chance to vote on whether to combine with Wheaton River.

Comments Lemasson: "How we operate on site is dictated by the site itself, so corporate changes should have minimal effect here. Not knowing what will be the corporate entity in the future gives us a certain level of anxiety, which we will have to live through. But, with our ongoing success, I would be very surprised if our mode of operation changed much in the future."