

The primary crushing circuit at Lumwana includes a 4.5 km overland conveyor and had crushed and transported over 150,000 t of material to the fine ore stockpile at the copper concentrator by October 2008

Leading Lumwana



2009 sees the start-up of one of Africa's largest ever projects. Lumwana will produce an average of 170,000 t of copper each year for the first six years of production, as well as having the option of developing a significant uranium resource. **Daniel Gleeson** looks at Equinox Minerals' development of this titanic project

Having produced its first concentrate last year in December and ramping up to full production in the first half of this year, the Lumwana project is on course to become the world's largest new copper mine. It has total Proven and Probable reserves of 319 Mt at 0.7% Cu and an Inferred resource of 417 Mt at 0.6% Cu. These resources and reserves are complimented by the simple metallurgy of the ore. In terms of comminution, the ore contains very coarse sulphides and is easy to crush and grind. The ore floats easily and quickly and has a >95% recovery at coarse grind and its two deposits, Malundwe and Chimiwungo, produce copper concentrate grades of 41-45% Cu and 28-32% Cu respectively, with all these factors aiding flotation recovery.

Lumwana is important not only for its huge scale; it is also one of the only projects in the last 20 years to incorporate trolley assist technology into its mine plan. Siemens have supplied 4 km of trolley line and installed five

10 MW rectifier sub-stations for the line. This provides 4 MW of electric power to each truck when on the line, enabling the vehicles to climb out of the open pit at speeds up to 24 km/h. This will result in savings in operating costs by using electric power, which is less than the cost of diesel fuel, a reduced cycle time and reduced maintenance in comparison with diesel engine power alone. The first run of the line commenced in January, and will have a great positive effect over the coming months on production costs.

The copper mineralisation at Lumwana is hosted almost entirely within high-grade metamorphosed, intensely mylonitised, recrystallised muscovite-phlogopite-quartz-kyanite schists with disseminated sulphides (typically <5%) dominated by chalcopyrite and bornite. Of the two major deposits, Malundwe is smaller but has higher copper grade and discrete zones of uranium and gold mineralisation with occasional sporadic high cobalt (>0.1%). Chimiwungo is much larger

and lower in copper grade, but has higher overall cobalt mineralisation and contains a number of significant high-grade (>0.1%) cobalt zones plus some sporadic uranium mineralisation

The sheer size of the project is one of the key factors adding to its importance. Its two deposits could be joined eventually by development of a third resource, Kanga, which represents a southerly extension of Malundwe type mineralisation. The Lumwana Mining Licence (LML-49) covers 1,355 km², and apart from the two major deposits has 25 exploration prospects (Kanga included) with Equinox owning 100% of the licence. It is located in the north western Province of Zambia, 220 km west of the Copperbelt and 65 km west of the town of Solwezi.

Infrastructure includes a 330 kV power line from the Copperbelt to Lumwana with Equinox holding a 15 year supply contract with ZESCO which has reasonable power charges due to supply by hydro-electricity. By road, Lumwana

is connected to the Copperbelt by 220 km of the sealed Northwest Highway, with the Government having completed upgrading to the highway last year. The project has surplus water balance and dams are operational and constructed to International Commission on Large Dams (ICOLD) standard. A key reason Lumwana had not been mined earlier was the limited infrastructure in the region, which has since been partly rectified by the Government's upgrade, which now provides a reliable transport route.

Mining

At the Malundwe deposit, mining began in April 2007 with overburden stripping and civil works being carried out. In December the company confirmed that mining of the sulphide ore was well underway with 1.8 Mt of sulphide ore on the ROM pad. The mining rate is being ramped up from 4 Mt/month to 10 Mt/month.

These figures will be achieved by its substantial Hitachi fleet. The project now has seven Hitachi EX5500 hydraulic shovels; three diesel and four electric drive. These weigh 518 t, have a 27 m³ bucket and have a loading capacity of 4,000 t/h.

The primary crusher is housed within the ROM pad, with the gyratory crusher crushing ore to less than 400 mm. This ore is then fed onto the conveyor, and the overland system takes the ore 4.5 km from the crusher to the mill. During commissioning this system crushed and transported 150,000 t and exceeded the crusher design throughput rate of 3,309 t/h. It has achieved a crushing rate in excess of 4,000 t/h which is equivalent to 30 Mt on an annual basis.

After the 4.5 km haul to the 11.6 m diameter SAG mill, drawing at 18 MW, the mills feed ground ore (280 µm) to cyclones and then onto two parallel trains of flotation rougher/scavenger cells. The concentrate then goes onto the cleaner cells, and oversize to the concentrate regrind mill. Flotation concentrate goes for dewatering through the concentrate thickener and then pressure filtration. A concentrate storage shed has been constructed to house the concentrate, ready for transport to the smelter. This process, to the end of December, had resulted in 20,046 t (dry) of concentrate at 40% Cu.

The project was delivered by joint venture EPC contractors Ausenco and Bateman International. A representative of the joint venture, noted, after the process plant handover in November, that: "the 20 Mt/y Lumwana copper concentrator has been designed around conventional flotation processing as metallurgical test work had indicated a greater than 95% recovery of

Equinox will have 27 Hitachi EH4500 trucks on site. These diesel-electric trucks are being set up with trolley assist. Each truck weighs in at 200 t, carries a 240 t load and develops 2,000 kW of power



copper using these methods". Worth some \$408 million, this EPC contract became effective in 2007. GRD Minproc was involved in the Front End Engineering Design program prior to the Ausenco-Bateman contract.

Strong finances

The outlay for this project is of course very large. The project budget was some \$758 million and the final pre-production capital expenditure was \$814 million, yet the company had been conservative in the way it has developed Lumwana. By 2007 it had already agreed offtake contracts for 100% of its copper concentrate production for the first five years of the mine life. A five year 'take and pay' contract has been agreed with Chambishi Copper Smelter Ltd, which was building a new smelter on the Zambian Copperbelt. It also has concentrate sale and purchase agreements with Mopani Copper Mines and Glencore International for a total minimum contractual 'take and pay' tonnage of 53,000 t of copper contained in concentrates or about 120,000 t of Lumwana concentrates annually.

At the end of the third quarter in 2008, the company also had \$52 million on hand as well as undrawn debt (including a \$45 million cost overrun facility) of \$152 million with only \$55 million in outstanding capital commitments. In a time when finance is at the forefront of every investor and shareholder's mind, Equinox's finances stand up to analysis.

Another important asset here is the uranium reserves and resources; the uranium mineralisation occur as discrete high grade zones within the copper orebody. These uranium zones are being selectively mined and stockpiled. The copper Lumwana produces has its qualities and profitability, but the uranium project, especially at this time, may involve more patient and selective processing. The uranium plant commissioning is not expected

until 2010, yet, with Indicated resources of 4.7 Mt at 0.10% U₃O₈ with 9.92 Mlb contained U₃O₈ and Inferred resources of 6.7 Mt at 0.05% U₃O₈ with 6.669 Mlb it still has a lot to contribute to Lumwana overall. Within the copper pits, uranium reserves and resources are Probable reserves of 3.3 Mt at 0.12% U₃O₈ with 9.006 Mlb U₃O₈ as well as an Inferred resource (within pits) of 2.4 Mt at 0.08% U₃O₈ with 3.476 Mlb U₃O₈. The key uranium feasibility study statistics showed a recovery rate of 93% as well as a pre-production capital, uranium and copper included, of \$200 million.

In December last year, the Zambian Government approved the Environmental Impact Assessment allowing Equinox to progress with the uranium project, however the company said in January that "due to current difficulty in international project financing as well as current market prices for uranium oxide, [it] believes it prudent to defer the implementation of this project until such conditions improve." The project would process some 1.0 Mt/y of uranium ore, producing about 2.0 Mlbs/y of yellow cake.

Further enhancements

Equinox's ambitions for the project extend even further. The company views the process plant rating as conservative at 20 Mt/y throughput and Equinox engineers believe that, by optimising and 'de-bottlenecking' the plant, throughput could potentially, at limited additional capital cost, be increased by 20% to about 24 Mt/y, increasing copper output to above 200,000 t/y. There is also an option, given the very large resource and long mine life at Lumwana, to further expand throughput to about 30 Mt/y, increasing copper production further. This would require significant additional capital cost and completion of a feasibility study.

The project has had a great impact on the



A truck on a siemens trolley line; similar to the technology used at Lumwana



It is also supporting commercial agriculture/aquaculture projects including:

- Floriculture – protea farming
- Vegetable farming and marketing
- Jatropha plantations – bio diesel (JV with BP)
- Commercial fishery.

Social infrastructure has been contributed to as well with the Lumwana Trust Fund helping:

- Construct six local schools with 30 classroom blocks and four teachers houses
- Three local clinics
- Two women’s development centres
- One community library.

Local employment has also been fuelled by the company with jobs for some 1,000 people as well as offerings of scholarships and apprenticeships.

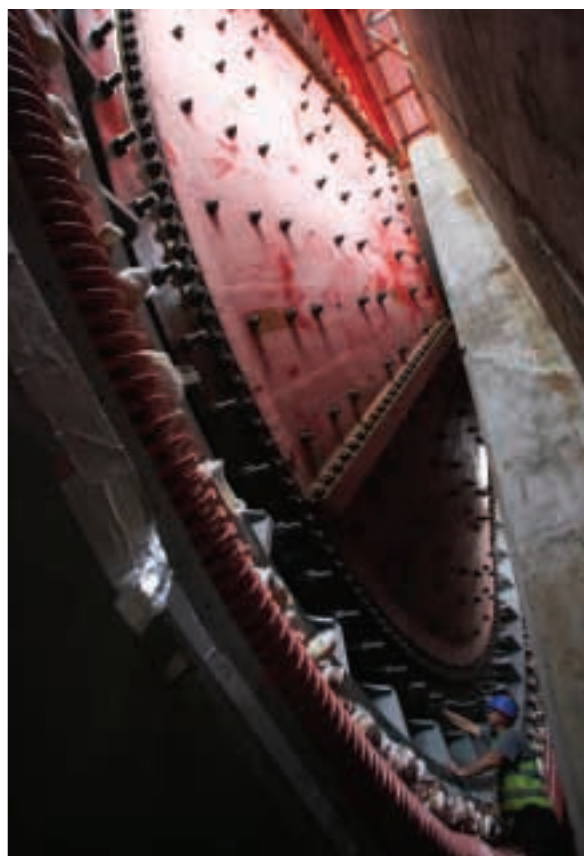
Equinox expects the local community to feel the positive impact the Lumwana project has had on the area for not just the entire mine life, but for at least 50 years after the mine is exhausted. By developing a strong bond with the three local chiefs and their chiefdoms, primarily through offering them employment on a priority basis it has ensured that the local community is considered at every stage of this huge project, delivering a sustainable future for the community. **IM**

Lumwana region. Equinox is building a town that will provide housing for some 1,000 permanent employees and their families, with over 450 houses completed as of January and 120 of these already allocated to local staff under a home ownership mortgage program. The town will include a shopping centre, school, clinic and also sporting facilities. Equinox expects that the town itself will become an important regional centre for the north western Province of Zambia. The

commencement and establishment of schools as well as specific commercial and retail developments are expected to be operational this year, making the town a self-sustaining modern living environment.

The project is also contributing to the community in other ways. Equinox is helping local business development, with small-medium business development including:

- Crafts, textiles, sample bags tailoring
- Community and market days.



Lumwana Pride

Ausenco Minerals is an award winning provider of innovative and high quality engineering and project management services to the global resource industry. We are proud to have worked closely with our client Equinox Minerals on the Lumwana Copper Project in Zambia, Africa’s largest copper concentrator.



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