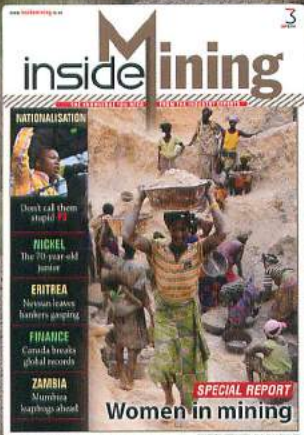




Mining inside

THE KNOWLEDGE YOU NEED FROM THE INDUSTRY EXPERTS

WOW!
PICA Cover of the Year P3



COMMODITIES

The ever-resourceful Kalahari Kid

SHEQ

Putting mines on critical life support

Coal reserves derailed

COPPER

The Kalahari Kid

Botswana is arguably the richest per capita country in Africa. Besides queen diamond, a bit of gold and nickel, recent years have seen amazing developments in coal and base metals. **BY WILLEM SMUTS**

Traditionally, Botswana was viewed as a country with a big front door and little back door hatches to Namibia and Zimbabwe. Everything and anyone of significance came and went via its big all-powerful neighbour, South Africa. However, in recent years moves have been afoot to change that situation and other SADC countries are increasingly looking at ways to get out of the shadows of big brother South Africa. Incidents like

the Eskom crises and the huge transport bottlenecks for bulk commodities have helped to speed up the drive for getting more self sustainable. We now see a significant drive to expand infrastructure across the subcontinent outside of South Africa.

Consultants were hard at work last year undertaking a pre-feasibility study into the proposed 1 500 km Trans-Kalahari Railway (TKR) with preliminary findings said to look "positive".

The World Bank's public private infrastructure advisory fund was expected to help pay for the pre-feasibility study. The World Bank is involved at the preliminary technical stages of the line's development. Private sector entities interested in the project include Hana Mining, whose Ghanzi copper-silver project has impressive resources in copper and silver. Plans for commercial production in 2015 are dependent on a cost-effective route to an Atlantic port.

Australian company Discovery Metals Limited (DML), which is developing its Boseto Copper Project, would also use the proposed line as an export route. It foresees producing 3 million tonnes of copper annually, starting first concentrate sales in the first half of 2012. Similarly, this line would be critical to a successful poli-metals development on Tsodilo Resources' project in northern Ngamiland.

CIC Energy (soon to become JSW Energy) hopes to produce between 16 million and 17 million tonnes of export-quality coal for the European market. Using Walvis Bay instead of South African ports will present cost benefits to European customers. But, without the rail link, this export venture would simply be a non-starter as nobody would let this coal through South Africa.

State of play on the base metals front

In the last few years, a number of Australian and Canadian junior miners have been hard at work, each in their own patch, rolling back the frontiers of science and developing a new world-class copper district in Botswana. As a result of hard work and dedication, these companies now

LEFT Discovery Metals continues to explore across the 14 prospecting licences and 1 300 km of prospective strike length in north-western Botswana and continues to generate both new discoveries and new drill targets

Credit: Discovery



TABLE 1

Feasibility study summary			
Highlight	Units	Bankable feasibility study	Development plan
Evaluated operating period	Years	5	15
Annual throughput (flotation)	Million tonnes	3	3
Copper production	Tonnes Cu pa	34,400 ^{1,2}	36,400 ²
Silver production	Moz Ag pa	1.0 ²	1.1 ²
Average C1 cash costs	US\$/lb	1.28 ²	1.23 ²
Capital expenditure	US\$ millions	175	175 ¹
Copper/silver price	US\$/lb US\$/oz	3.00/17.00	3.00/17.00
Operating surplus	US\$ millions	390	1,142
Project NPV10	US\$ millions	251	375
Internal rate of return	%	32%	32%
Payback (after production commences)	Years	1.7	2.0

¹ US\$40 million funded from operating cash flow in 2012 and 2013
² During debt repayment period July 2012 to December 2014

find themselves located in the Kalahari Copper Belt, a previously poorly explored extension of the world-renowned and lucrative Zambian Copper Belt. In years to come, the 'Kalahari Kid' will no longer refer to miles and miles of nothing.

Boseto – Discovery Metals

Discovery Metals' Boseto Copper Project is located within a belt of significant copper-silver mineralisation that extends from the well-known and more highly developed Zambian Copper Belt across north-west Botswana and into Namibia. The poorly explored and undeveloped portion of this belt in north-west Botswana is known as the Kalahari Copper Belt.

Copper in the Boseto Project area occurs predominantly in chalcocite, with minor amounts of bornite and other copper sulphides present. At shallow depths, malachite and chrysocolla exist in significant proportions within some areas of the mineral resource.

The total mineral resource for the Boseto Copper Project, reported in accordance with The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (The JORC Code, 2004 Edition) at a cut off of 0.6% Cu, is: 102.8 Mt @ 1.4% Cu and 17.3 g/t Ag containing 1.4 Mt Cu metal and 57 moz silver consisting of:

- indicated mineral resources of 18.5 Mt @ 1.4% Cu and 17.8 g/t Ag
- inferred mineral resources of 80.3 Mt @ 1.4% Cu and 16.9 g/t Ag.

(See table 1).

The bankable feasibility study on the Boseto Project was completed in the third quarter of 2010 and production of first concentrate is planned for the first half of 2012.

Ghanzi – Hana Mining

Hana Mining is focused on the development of the Ghanzi Copper-Silver Project in north-western Botswana where the company's recent exploration activities have outlined a significant mineralised area extending 152 km in length.

Hana Mining has announced the results of a NI 43-101 technical report, which estimates that the project has a global resource of 4.5 billion pounds of copper and 68.5 million ounces of silver from 233.9 million tonnes. The resource is based on a 0.30% Cu cut-off and averages 0.87% Cu and 9.1 g/t Ag. At a cut-off of 0.75% Cu, the resource totals 102.9 million tonnes containing 3.3 billion pounds copper and 55.0 million ounces silver with an average grade of 1.46% Cu and 16.6 g/t Ag. No adjustments have been made for mining recoveries or production yields.

North Ngamiland – Tsodilo Resources

Gcwihaba Resources (Tsodilo subsidiary) has been granted 20 prospecting licences for metals, covering an area of some 15 000 km². The prospecting licences are located within the nascent Okavango Rift System, which is part of the East African Rift System. The Okavango Rift System

PRELIMINARY RESULTS AND MODELLING SUGGESTS AN IRON OXIDE – COPPER – GOLD

An IOCG-type deposit might be best suited to the type of mineralisation that has been discovered to date. This type of deposit encompasses a wide spectrum of ore bodies, often polymetallic and of significant size, which may notably produce iron, copper, gold, silver, uranium, manganese, nickel, PGE, cobalt and REE. The best known IOCG deposit is Olympic Dam in Western Australia, one of the largest known deposits in the world. Also affiliated with this group is the Bayan Obo Deposit in China, currently the world's largest REE producer. The deposits typically contain an iron-oxide nucleus of magnetite and/or hematite.



"We continue to be amazed by the diverse mineralisation in our core, base and precious metals including gold and now uranium and rare earth elements. The geology and associated mineralisation are exciting new frontiers in this part of Southern Africa and we look forward to completing phase 1 of our programme and reviewing the results," states Dr Mike de Wit, president and COO of Tsodilo Resources

Credit: W Smuts

takes advantage of the pre-existing structures of the northeast trending Neo-Proterozoic Pan African Orogenic Belt known as the Damara Belt. A total of 44 holes have been drilled for a total depth of 8 148.3 m since 2008. Target selection was based on magnetic anomalies in 2008 and from 2009 targeting was based on the use of airborne electromagnetics and magnetic data sets.

Samples from borehole L9680/11 and L9670/9 were subjected to detailed mineralogical studies at the University of Barcelona using a scintillometer, optical microscopy on thin/polished sections

employing transmitted and reflected polarised light and a scanning electron microscope with coupled energy dispersive spectrometer (SEM-EDS).

The preliminary results of these studies indicated the presence of gold accompanied by altaite, hessite and bismuth tellurides. In addition, the presence of rare earth elements ('REE') phosphates in the sulphide veins suggests that these are hydro-thermal in origin. They accompany fluorapatite and the early carbonates and quartz. Monazite (Ce) is very common and is enriched on the light rare earth elements ('LREE') elements, whereas xenotime (Y) is enriched in the heavy rare earth elements ('HREE') minerals. REE carbonate calcioancylite (Ce) minerals are spread through the veins and the host rock. Finally, the presence of REE silicates, fluorcalciobriholite (Ce) and yttrialite (Y) in the metasomatised host rock and in vein infilling, and a pseudomorph after other minerals respectively, have been established. These minerals can also contain significant amounts of radioactive elements.

A 3m intersection of 90 ppm uranium has been obtained from coarse-grained meta-pelites directly underlying a sequence of black shales. The discovery of uranium in core is significant in that from 1977 to 1980 a joint venture comprising Union Carbide and British Nuclear Fuels (CEGB) conducted an extensive exploration effort for uranium in these licence blocks in north-west Botswana. Their findings concluded that uranium was concentrated in the calcretes and lignites located in the palaeo-drainages but their exploration was not successful in locating the uranium source rock. Detailed geomorphological studies are in progress to link the uranium in these palaeo-channels to potential source areas, such as the uranium-bearing meta-pelites intersected in hole L9640/4.

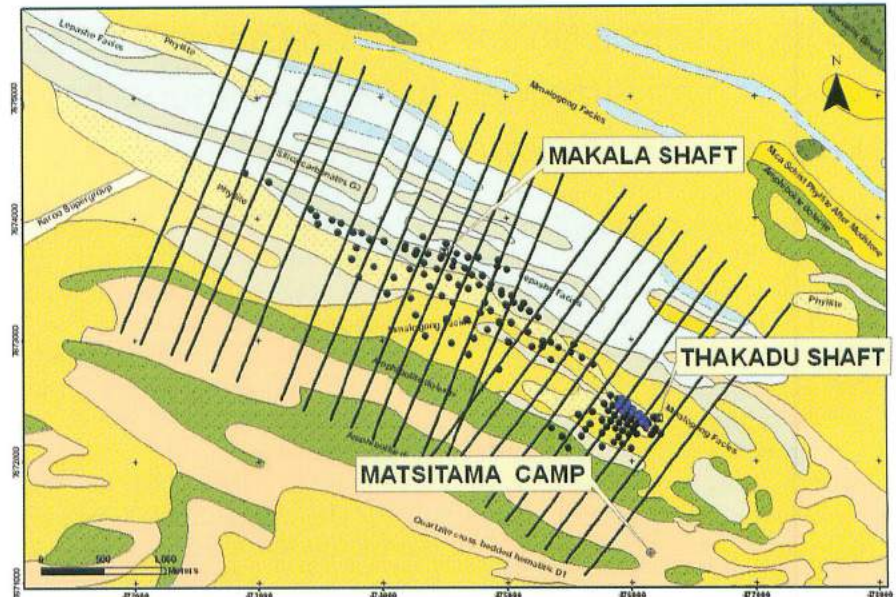
African Copper – take two

Leading the base metal campaign in Botswana, in mid-December African Copper received the mining licence for its Thakadu Copper-Silver Deposit some 80 km from the company's Mowana Mine from the Botswana government.

The mining licence has been granted on condition that the area declared as an archaeological site is restricted to underground mining processes to avoid disturbing the archaeological site contained within the approved mine lease area. All

The Thakadu deposits are sediment-hosted strataform disseminated sulphide zones in a poly-deformed and metamorphosed sequence of volcanic, volcanoclastic and clasticsedimentary units. The primary sulphide minerals are chalcopyrite (85 to 90%) and bornite (10 to 15%) with minor pyrite adjacent to the copper bearing material. The upper approximately 50 m of the deposits are characterised by secondary zones of oxidation in which the primary sulphides are replaced by chalcocite, malachite and cuprite-tenorite together with traces of native copper and marcasite

Credit: African Copper



other areas not declared as archaeological sites or national monuments can be mined using open-pit mining. It is anticipated that the current interim open pit cut design will allow for the extraction of approximately 1.4 million tonnes of ore.

The issued mining licence allows full commercial mining to start while awaiting further consultations on mining out the ore reserve directly underneath the Thakadu archaeological site. On successful conclusion of consultations among relevant Botswana government authorities, an update to the issued mining licence will be sought by the company to release the Thakadu archaeological site for open-pit mining as well.

Thakadu's high-grade mineral reserve will be developed in an initially small scale (and relatively low-cost) operation with low pre-strip mining requirements, and will share the Mowana Mine infrastructure and management. The principal operational requirement will be to establish sustained transport between the locations and the company is currently finalising longer-term transportation plans for the project. A project manager was appointed at the start of March 2010 and an initial mining contract was awarded to a Botswana company, Strata Mining, until end March 2011. Full mining activities have begun with a progressive increase in mining volumes anticipated. Production

is expected to start ramping up in line with the long-term mine planning strategy within the next two months.

SAMREC-compliant proven and probable in-pit mineral reserves, at a 0.5% Cu cut-off, as at 31 March 2010 were:

Category	Tonnage (Mt)	Copper contained (%)	Metal (Tonnes Cu)
Proven reserves	Nil	Nil	Nil
Probable reserves	2.77	2.15	59 477
Sub total	2.77	2.15	59 477
In-pit inferred resources	Nil	Nil	Nil

Commenting on this, Jordan Soko, acting chief executive of African Copper, said: "The development of Thakadu provides significant economic benefits to our mining operations in Botswana. We will be able to increase capacity utilisation of the enhanced infrastructure substantially at Mowana and take our total production to a new higher level. I am delighted that we have been able to announce a further successful plank in our business strategy. We can now switch our development focus to the nearby Makala Deposit and look forward to increasing the resource/reserve base in African Copper's highly prospective licence areas." 35