

INTRODUCTION INTO MINING AND METALLURGY ON THE ZAMBIAN COPPERBELT

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ABSTRACT

This article gives a general review of technical practices in use at the Zambian copper industry from mining to refining.

Some statistics concerning ore reserves and production for 1970 are included.

INTRODUCTION

Before 1900 native tribes have mined and smelted copper and iron, probably for hundreds of years. These activities most likely reached their peak in the nineteenth century coinciding with the slave trade, when metals were traded to Arabs.

At the turn of the century the British South Africa Company, under the terms of its Charter of 1889, had obtained mineral and other concessions from the various tribal chiefs. The Company thus owned all mineral rights in what is now called Zambia, issued prospecting licenses and was paid royalties. The earliest mine started development in 1901.

In 1902 the lead and zinc deposits of Broken Hill were discovered. Zinc production started in 1906 and thus Broken Hill is the oldest mine in Zambia still in production. At about the same time the copper deposits of Kansanshi, Roan Antelope, Bwana Mkubwa and Chambishi were found, but only Kansanshi and Bwana Mkubwa were mined.

After the end of the first World War as Britain felt the need of copper supplies of her own, the British

South Africa Company started issuing prospecting rights over large areas to financially strong companies. This was probably the most important single step which led to the opening of the Copperbelt. Large scale scientific prospecting resulted in the discovery of the Mufulira and Nchanga deposits, which started production in the 1930's, together with the Roan Antelope and Nkana. Combined annual production of these four mines during the second World War was approximately 275 000 tonnes. The start of these mines and the formation of large companies to operate them started the present era of Zambian copper mining on a highly organized basis. After the second World War the sterling price of copper increased which led to the opening of Chibuluma in 1952 and Bancroft in 1957. Chambishi was opened in 1963.

The main change in recent times was brought about by the nationalisation in 1970 of the Zambian mining industry. This aspect is dealt with by D e V i e t t e r (this issue).

The total amount of copper produced in Zambia in 1970 was 684 225 tonnes (M i n d e c o, 1971).

MINING OPERATIONS

This section gives short descriptions of mining methods used. Where possible, the writer will refer to other articles in this issue.

N.C.C.M. Konkola Division

Approximately 350 000 m³ of water are pumped

¹⁾ Nchanga Consolidated Copper Mines, Chingola Division.

from this underground mine each day, which makes it one of the wettest in the world. Special problems involved in the planning and the execution of mining operations are discussed by R i j k e n and C l u t t e n (this issue).

N.C.C.M. Chingola Division

There are four orebody horizons, the upper- and lower-, intermediate- and footwall horizons. The intermediate orebody horizon is not worked at present. Parts of the lower- and upper orebody are worked by underground methods. In the lower orebody a continuous caving system is employed. In the upper orebody sublevel open stoping is applied. Due to the unconsolidated nature of the hanging wall, all development here has to be in the orebody itself. Recent developments in underground mining at Chingola include the introduction of raise borers, diesel powered rubber tyred loaders for haulage development and use in sublevel caving production and epoxy resin grouted bolt support.

In addition there are five open pits in operation. Data on these pits are given in table 1.

TABLE 1
Data on Chingola Division Open Pits.

	Orebody horizon	Appr. length and width in metres	Appr. depth in metres	Appr. overburden/ore ratio
Nchanga	Upper	2500 x 900	270	14 : 1
Chingola	Lower	1300 x 620	100	17 : 1
Mimbula	Footwall	660 x 600	110	11 : 1
Fitula	Footwall	1350 x 580	105	20 : 1
Riverlode	Lower	620 x 300	90	16 : 1

Shovels in use for ore- and overburden removal range in capacity from 2.3 m³ to 11.5 m³. In addition, a Bucket Wheel Excavator complex is used for overburden removal in Nchanga open pit. Its capacity is 1500 tonnes per hour. The ore is transported by 35- and 45 tons Euclid trucks, whilst for overburden transport 65- and 100 tons Haulpak and Dart trucks are used, in combination with 100 tons Lectrahauls.

Recently 5 200 tons Lectrahaul trucks have been ordered, which will be used in the Nchanga open pit (Truck tonnages in short tons.).

N.C.C.M. Rokana Division

The division operates three underground mines all of which employ conventional sublevel stoping with modifications as required by local conditions. Where possible stope drilling drives are positioned within the orebody and the ore extracted from the stopes by gravity. If the orebody is weak drives are made in the waste hanging wall; in flat dip areas scraping is applied and the stopes are split to reduce the scraping distances. Folded areas are mined by variations of the sublevel stoping method.

Since working areas are increasing in depth (below 1350 metres) special problems are being encountered with high rock stresses and temperatures. The solution of these problems is being sought in the application of mechanized mining methods, employment of raise borers and a research program into micro climate conditioning. Refrigeration is already widely used at Rokana. An active rock mechanics research program is being carried out.

N.C.C.M. Broken Hill Division

The lead-zinc ore deposits occur as pipelike bodies

within a massive featureless dolomite (K o r t m a n, this issue). At the outcrop the orebodies are completely oxidized whilst in depth they consist of a core of sulphides surrounded by silicates. The contacts between sulphides and silicates are highly irregular. This, and the fact that the orebodies are frequently intersected with irregular mud filled fissures, calls for a high flexibility in operations. Sublevel stoping is the standard method of extraction. Wherever possible development is sited within the sulphides as they are less heavily fissured than the silicates. The ore is removed from the stopes by scrapers.

R.C.M. Mufulira Division and Luanshya Division

Both divisions employ underground mining methods with a high degree of mechanization. For a description see *Collinson* (this issue).

R.C.M. Chibuluma Division

The deposit consists of two orebodies, approximately 2600 metres apart on strike. The North orebody dips 38°, the South orebody is in the same horizon in a system of complex plunging folds. Mining methods used are open stoping and shrinkage or back stoping. Stopes are filled with classified concentrator tailings.

R.C.M. Chambishi Division

Down to a level of 70 metres from surface the mineralisation consists mainly of copper oxide minerals with bornite and chalcopyrite at lower levels. Mining is carried out by open pit methods.

Ore reserves and grades

Table 2 gives a listing of ore reserves and grades for mines on the Copperbelt and the N.C.C.M. Broken Hill Division. Reserves for N.C.C.M. properties are as per 31st March 1971, those for R.C.M. mines as per 30th June 1971.

TABLE 2. Ore reserves and Grades.

<u>Mine</u>		<u>Total ore reserves in tonnes</u>	<u>Grade % Cu</u>	<u>Grade % Co</u>
Konkola	Division	94 053 900	3.53	
Chingola	Division	234 887 500	3.91	
Rokana	Division	124 598 900	2.55	0.16
Mufulira	Division	132 523 000	3.16	
Luanshya	Division			
(including Baluba)		130 271 000	2.71	
Chibuluma	Division	5 979 000	4.81	0.20
Chambishi	Division	39 901 000	2.93	
			<u>Grade % Pb</u>	<u>Grade % Zn</u>
Broken Hill	Division	3 193 400	11.0	24.8

CONCENTRATION

Each division operates its own concentrator. Table 3 summarizes main equipment used on each plant. Table 4 gives production figures for 1970.

SMELTERS

N.C.C.M. Rokana division and R.C.M. Mufulira and Luanshya divisions each operate a smelter. Short descriptions of these plants are given below.

Rokana Division Smelter

The Rokana smelter, the biggest on the Copperbelt, comprises of five 32 m x 11 m reverberatory furnaces, each equipped with two waste heat boilers and two air heaters. In addition, there are six 3.9 x 9 m Pierce Smith converters with 43-49 5 cm. tuyeres. Converter air is supplied by four steam blowers and one electric blower with a combined capacity of 1960 m³/min. at a pressure of 1.03 bar. There are three 3.9 m x 9 m anode furnaces of 250 tonnes capacity and three 22 mould casting wheels.

In 1969 it was decided to install a 540 tonnes per day oxygen plant in order to increase smelting capacity without having to build another reverberatory furnace and to proceed towards a direct smelting technique in the converter operations.

Copper production is approximately 312 000 tonnes per year.

Adjacent to the smelter are two acid plants where converter gasses are used to produce 98% sulphuric acid. Combined production is approaching 300 tonnes per day. Most of the acid produced is sent to

Chingola Division for use in the Leach plant.

Mufulira Division Smelter

The plant consists of three reverberatory furnaces, approximately 36 m x 10 m and are equipped to fire

TABLE 3 (first part)

Mine	Mineralisation	Crushing	Grinding	Flotation	Recovery	Monthly throughput tonnes
N.C.C.M. Konkola Division	Bornite, Chalcosite, Malachite.	Primary with Allis Chalmers gyratory and Blake jaw crusher. Secondary and tertiary with Symons standard- and shorthead crushers. Since ore is extremely sandy it is washed on a double deck screen prior to crushing and the sands dewatered.	80% – 200 mesh in 2.7 m x 2.4 m ballmills in closed circuit with cyclones. One 3.3 m x 4.2 m ball-mill is used as well	1. Sulphide flotation with Na-isopropylxanthate as collector, followed by one stage cleaning. Wemco 1+1 mechanisms are being incorporated. 2. Oxide flotation with soft soap and NaHS followed by one stage cleaning.	Sulph. 93% Ox. 64 %	150 000 Konkola ore. 106 000 Chingola ore.
N.C.C.M. Chingola Division East Mill	Chalcosite, Malachite, and non-floatable oxide minerals (which will be treated in tailings leachplant).	Primary circuit incorporates a 137 cm x 180 cm Allis Chalmers Superior gyratory crusher. (only 5 crushers of this size operate in Africa.) Secondary with Symons standard crushers.	50% – 200 mesh in 3.3 m x 4.2 m rod mills each in open circuit with a 3.3 m x 4.2 m ballmill Products are pumped to West mill.			456 000 (includes 106 000 tonnes to Konkola)
N.C.C.M. Chingola Division West Mill		Primary with Gates and Superior Mc Cully crusher. Secondary and tertiary with Symons standard and shorthead crushers.	50% – 200 mesh in 2.7 m x 2.4 m ballmills in closed circuit with cyclones.	1. Sulphide flotation with Na-isopropylxanthate as collector, followed by one stage cleaning; 8.4 m ³ Fagergren cells will be used. 2. Oxide flotation with Palm kernel-Diesoline and NaHS; followed by cleaning.	Sulph. 91% Ox. 78 %	695 000 (includes East mill production).
N.C.C.M. Rokana Division	Bornite, Chalcopyrite, Carrolite, Co-pyrites.	Primary mostly with Mc Cully gyratory crushers. Secondary and tertiary with Symons standard- and shorthead crushers.	66% – 200 mesh in 2.7 m x 3.6 m rod mills each in open circuit with 2.7 m x 3.3 m ballmills. Ballmills in closed circuit with cyclones.	1. Bulk flotation of Cu and Co in Forrester airlift cells with Na-isopropylxanthate as collector. 2. Cu cleaned in 4 stages, whilst Co is depressed with NaCN. 3. Reflotation and subsequent cleaning of Co. Wemco 1+1 mechanisms have been incorporated.	Cu 93% Co 70%	460 000

TABLE 3 (second part)

Mine	Mineralisation	Crushing	Grinding	Flotation	Recovery	Monthly throughput tonnes
R.C.M. Mufulira Division	Bornite, Chalcosite, Chalcopyrite.	Primary with Blake type —, Superior Mc Cully- and Wedag crushers.	55% – 200 mesh in 3.3 m x 1.8 m conical ballmills in closed circuit with classifiers.	Roughing, scavenging and cleaning, collectors are Na- ethyl xanthate & K – amyl xanthate.	91%	620 000
R.C.M. Luanshya Division	Chalcopyrite, Bornite, Chalcosite, Pyrite.	Primary with Superior Mc Cully crushers. Secondary and tertiary with Symons standard- and shorthead crushers.	65% – 200 mesh in 2.7 m x 2.4 m ballmills in closed circuit with cyclones.	Roughing, and scavenging, collector is Na-isopropylxanthate. Recently 8.4 m ³ Fagergren cells were installed.	90%	546 000
R.C.M. Chibuluma Division	Chalcopyrite Bornite, Chalcosite Covellite, Carollite, Pyrite.	Primary with Blake crushers. Secondary and tertiary with Symons standard- and shorthead crushers.	42% – 200 mesh in 3.3 m x 1.8 m conical ballmills in closed circuit with cyclones.	Co is depressed with NaCN. Cu-sulphide roughing. Collectors are Na-isopropyl xanthate & Cyanamid S 3501. Then roughing and cleaning of cobalt. Collector is Na-isopropyl xanthate.	Cu 96% Co 72%	55 000
R.C.M. Chambishi Division	Bornite, Chalcopyrite, Chalcosite, Cu oxide minerals	Primary in Wedag- and Mc Cully crushers. Secondary and tertiary with Symons standard- and shorthead crushers.	83% – 200 mesh in 3.2 m x 4.9 m ballmills in closed circuit with cyclones.	Roughing, cleaning and scavenging. Collectors are Na-isopropyl xanthate K – amyl xanthate.	92%	87 000

TABLE 3

Summary of concentrator plants.

Remarks:

1. For data ore Broken Hill Division, see Barlin (this issue).
2. East mill receives ore ex Nchanga open pit and varying quantities of the other open pits.
3. Part of the secondary crusher product of Chingola East mill is sent to Konkola Division concentrator for treatment.
4. West mill receives all underground ore and varying quantities of open pit ore except Nchanga open pit.
5. East- and West mill employ washing circuits for primary crushed products to reduce the load on the secondary crushers and the grinding plant. Sand fractions are dewatered on Wedag dewatering screens with electromagnetic vibrators.
6. Konkola's oxide copper ratio is 20-25% total copper in ore, for Chingola the ratio is appr. 75%.

Mine	Ore milled in 1000's tonnes	Grade % Cu	Grade % Co	Cu concentrates prod. tonnes	% Cu	Co concentrates prod. tonnes	% Co
Konkola	1867	3.15		150 394	33.04		
Chingola	9693	3.65		399 185	39.09 ¹⁾		
				1194 623	10.92 ²⁾		
Rokana	5478	1.93	0.11	283 363	33.28	50 973	3.76
Mufulira	5554	2.47		273 835	46.18		
Luanshya	6590	1.75		356 914	29.52		
Chibuluma	622	3.96	0.21	58 010	33.65	27 789 ³⁾	
Chambishi	1087	2.58		61 611	44.30		
		Grade % Pb	Grade % Zn	Pb concentrates	% Pb	Zn concentrates	% Zn
Broken Hill	126	11.0	29.1	25 784	39.3	28 108	58.6

TABLE 4

Production figures 1970, per concentrator (Mindeco, 1971).

Notes:

¹⁾ Smelter concentrate.

²⁾ Leach concentrate.

³⁾ Includes 6 880 tonnes low grade copper cobalt concentrate at grades of 3.17% copper and 5.20% cobalt and 22 909 tonnes of high grade copper cobalt concentrate at grades of 17.55% copper and 2.49% cobalt.

either pulverized coal or fuel oil. Combustion air is preheated by waste heat exchangers.

There are six 3.90 m x 9 m converters with 50 tuyeres of 5 cm. diameter served by four Brown Boveri blowers, each having a capacity of 850 m³/min. at a pressure of 1.03 bar.

In addition, there are four anode furnaces of 250 tonnes capacity. The anode casting section consists of two 22-mould wheels each capable of casting 40 tonnes per hour.

Average smelter production is 175 000 tonnes of new copper per year.

Recently a 36 MVA electric smelting furnace was commissioned.

Luanshya Division Smelter

There are three reverberatory furnaces, approximately 34 m x 9 m each fired by six pulverized coal burners.

The smelter possesses four 3.90 m x 9 m Pierce Smith converters, each with 52 5 cm. tuyeres. Converter air is supplied by three 850 m³/min electric blowers and two steam blowers having a capacity of 425 m³/min at a pressure of 1.03 bar. x The casting section consists of two 9 m x 3.90 m rotary

The casting section consists of two 9 m x 3.90 m

rotary anode furnaces of 200 tonnes capacity and one 22-mould casting wheel.

Average smelter production is approximately 110 000 tonnes of new copper per year.

Recently a sulphur burning plant was commissioned for production of acid. Sulphur is burnt and the ensuing SO₂ gas passes over four masses of vanadium pentoxide catalyst and is converted to SO₃. The conversion efficiency is more than 99%. SO₃ gas is absorbed in 98% sulphuric acid. Daily production is 220 tonnes of 98.5% strong acid. Most of the acid is sold to the Chingola Division Leach plant.

N.C.C.M. ROKANA DIVISION T.O.R.C.O. PLANT

The Torco plant treats 500 tonnes/day of re-factory ores which are not treatable by conventional methods. The material is crushed, rod milled and heated to 760°C in a fluosolids roaster fuelled with pulverized coal. The heated ore is mixed with salt and coal, and the segregation reaction then produces particles of metallic copper on the coal. This copper is recovered by flotation to give a concentrate of 50% grade, which is subsequently treated in the smelter reverberatory furnaces.

REFINERIES

There are three refineries on the Copperbelt, at R.C.M. Mufulira Division, at N.C.C.M. Rokana Division and the R.C.M. Ndola Copper Refinery.

Mufulira Division Refinery

The refinery comprises of two main sections, the electrolytic tankhouse, consisting of 1656 cells with a deposition cycle of 12-14 days, and the refined copper casting plant. Production capacity is approximately 15 000 tonnes a month of high purity cathode copper.

Two 310 tonnes coal fired reverberatory furnaces and two 14-mould casting wheels are used for melting and processing the cathodes which are converted in the casting plant to cast shapes, mainly wire bars.

This refinery is experimenting with Periodic Current Reversal.

The Ndola Copper Refinery

This refinery, which receives the majority of its copper from R.C.M. Luanshya Division, also consists of a electrolytic tankhouse (1048 cells) section and the refined copper casting plant. It produces approximately 11 000 tonnes of copper a month. The casting plant consists of an ASARCO vertical shaft melting furnace in conjunction with a 20-mould casting wheel and produces high purity electrolytic wire bars.

Rokana Division Refinery

The electrolytic tankhouse consists of 64 sections each having 26 cells. Deposition cycle is 12 days. Tankhouse production is 16 200 tonnes per month.

The casting section consists of two 16.8 x 4.8 m reverberatory melting furnaces, each of 500 tonnes per day capacity, in conjunction with two 30-mould casting wheels. In addition there is one Birlec 3 phase arc furnace with a capacity of 200 tonnes per day, also in conjunction with a casting wheel. The furnace section, which also treats cathodes ex Chingola Division Leach plant, produces 26 000 tonnes per month.

The tankhouse capacity will be increased in 1973 by introduction of Periodic Current Reversal.

OTHER HYDROMETALLURGICAL PLANTS

N.C.C.M. Chingola Division Leach Plant

This plant is described by B o s s e (this issue).

N.C.C.M. Rokana Division Cobalt Plant

This plant treats Cu/Co sulphide concentrates ex Rokana and Co-hydroxides ex Chambishi. Concentrates are slurry-fed into a Dorr fluo-solids roaster of 6 m diameter. Autogenous roasting takes place under a temperature of 710°C. Calcine is repulped and submitted to a three stage filtration. Two Eimco belt filters and one Fraser and Chalmer filter are used. Repulping of calcine is done with secondary filtrates and extra acid. Primary filtrates are clarified and sent to the copper tankhouse, for electro winning of copper. The spent electrolyte is mixed with Chambishi Co-hydroxides and the pH of the solution increased in three stages for purification as follows:

- Stage 1: pH 4.6 under air oxidation for removal of iron. Filtration on a Oliver Bateman filter. Residues are sent to secondary filters.
- Stage 2: pH 7.1 for removal of copper, iron, nickel and zinc. Residues are thickened and returned to stage 1, since approximately 50% of the Co co-precipitates.
- Stage 3: pH 8.4 for precipitation of Co-hydroxide.

The Co-hydroxide is thickened, filtered and the cake is repulped with spent electrolyte from the cobalt tankhouse. The residue from this process, which contains CaSO₄ and some cobalt, is thickened and filtered and sent to the primary filters whilst the solution is sent to the cobalt tankhouse for electro winning of cobalt. Lead anodes and stainless steel cathodes are used. The cathodes are stripped and the stripped metal crushed to 2.5 cm and degassed for removal of hydrogen prior to packing, weighing and export.

Monthly production is approximately 200 tonnes finished Co and 300 tonnes of copper. The latter is sent to the smelter.

R.C.M. Chambishi Division Leach Plant

This plant treats the following products:
8000 tonnes a month of crushed oxide ore from

Chambishi open pit at a grade of 3.2% T.Cu and 3.1% A.S.Cu.

4000 tonnes a month of Cu/Co sulphide concentrates from Chibuluma at a grade of 12% Cu and 3% Co.

a varying amount averaging 1000 tonnes of oxide concentrates from N.C.C.M. Chingola Division at a grade of approximately 17% T.Cu and 14% A.S.Cu.

The oxide ore is leached in batches of 850 tonnes in a vessel (volume 630 m³). The leaching medium is spent electrolyte from the tankhouse. Each batch is leached in approximately 10 immersions; the total leaching time being 160 hours. The ensuing advance electrolyte is sent to the tankhouse for electro-winning of copper. The tankhouse consists of 200 cells each containing 27 cathodes and 28 anodes. Current density is 120 Amps/m², current efficiency is 70%, 82% of the A.S. copper is recovered from the ore.

Sulphide and oxide concentrates are slurry-fed into a fluo-solids roaster at a temperature of 700°C. Calcine is quenched with spent electrolyte, thickened and submitted to two stage filtration. The filtrates go to the tankhouse as advance solution. Recovery of copper from concentrate is 91%.

The majority of the spent electrolyte is used as leaching- and quenching medium, the remainder is bled off and sent to the stripping section of the tankhouse to remove all copper.

The next step is to remove impurities by increasing the pH in two stages:

Stage 1: pH 4.1 for removal of part of the iron under air oxidation. Residues are thickened and filtered on an Eimco belt filter and discarded.

Stage 2: pH 5.5 for removal of the remainder of the iron and the copper. Since a proportion of Co co-precipitates the residues are thickened and returned to stage 1.

The last step is then to increase the pH to 8.2 to precipitate the Co as hydroxide. Production of Co-hydroxide is 50-100 tonnes per month, which is sent to N.C.C.M. Rokana Division Cobalt Plant.

TABLE 5

Total finished production 1970 (Mindeco, 1971).

Producer	Total finished production in tonnes
N.C.C.M. Ltd.	395 511
R.C.M. Mufulira Division	130 191
R.C.M. Luanshya Division	96 532
R.C.M. Chibuluma Division	24 082
R.C.M. Chambishi Division	28 106
R.C.M. Kalengwa Mine	9 803

Note:

N.C.C.M. Ltd. includes Konkola, Chingola and Rokana mines.

TABLE 6

Expatriate and local personnel strength.

Mine	Expatriate strength	Local strength
N.C.C.M. Konkola Division	403	4 644
N.C.C.M. Chingola Division	804	9 066
N.C.C.M. Rokana Division	1018	11 292
N.C.C.M. Broken Hill Division	321	2 197
R.C.M. Mufulira Division	725	7 879
R.C.M. Luanshya Division	653	7 871
R.C.M. Chibuluma Division	512	3 394

FINISHED COPPER PRODUCTION

Table 5 gives total finished production figures for 1970.

PERSONNEL

Table 6 gives present expatriate and local personnel strength of each operating division.

RESEARCH AND DEVELOPMENT

Both companies operate well equipped Research and Developments departments. The organisation of N.C.C.M.'s Research and Development department is described by Timmers et al. (this issue) who also gives a full description of test work involved in the design of Chingola Division's solvent extraction plant.

INFORMATION ON NEW PROJECTS

N.C.C.M. Rokana Division

a. *Bwana Mkubwa*. — In 1968 the decision was taken to bring this long known deposit back into production. The concentrator was commissioned in May 1971 and produces 8750 tonnes of oxide concentrates per month at a grade of 20% Cu.

Mining is by open pit methods.

Estimated reserves are 5 586 000 tonnes at a grade of 3.31% Cu.

b. *New Open Pits*. — It has been decided to extend mining operations to oxide zones overlying the central and Mindola North orebodies. A production rate of 95 000 tonnes of ore per month is scheduled as from November 1973.

c. *New Acid Plant*. — In view of increasing acid commitments due to the extensions at Chingola Division, an additional acid plant utilising some of the remaining converter waste gasses is being designed. Output will be 500 tonnes per day.

N.C.C.M. Chingola Division

The cementation plant, which is part of the extensions to the Leach plant, was commissioned in October 1971. This plant treats Leach plant residues and stock piled low grade oxide concentrates. (app. 2% T.Cu) Scheduled production is 2000 tonnes of copper per month.

In 1974 the solvent extraction plant, which is the second part of the extensions, will be commissioned. Design work is well advanced and some construction work is already in progress.

N.C.C.M. Konkola Division

Kansanshi, administered by Konkola Division. This is another long known deposit, situated 160 km N.W. of the Copperbelt. It was last mined in 1957 and since maintained on a caretaker basis. It is scheduled for reopening in late 1973. Investigations are continuing into various treatment methods, in particular the use of solvent extraction at Chingola. Estimates indicate that this scheme appears more favourable than the Torco scheme originally planned.

Ore transport to Chingola will be either by pipeline or by road.

R.C.M. Chibuluma Division

a. *Chambishi*. — This mine, presently worked by open pit methods, is to be extended underground. Shaft sinking commenced in May 1971. Mining will as much as possible be done with trackless diesel powered equipment. Contracts have been awarded to start extensions on the concentrator.

b. *Kalengwa*. — The concentrator of this small, high grade property, some 320 km West of the Copperbelt, started production during March 1971. Mining is by open pit methods. Reserves stand at approximately 1 557 000 tonnes at a grade of 8.53% Cu.

R.C.M. Luanshya Division

Baluba. — It has been decided to develop this orebody, 13 km. North West of Luanshya, into an operation with an annual production of 50 000 tonnes copper metal. Ore reserves are approximately 60 000 000 tonnes at a grade of 2.71% Cu and 0.17% Co. Mining will be by open stoping methods and ramps from surface will be used as access roads for large diesel loaders. Concentrator extensions will include 2.5 m x 3.4 m ballmills and 8.4 m³ Fagergren cells.

R.C.M. Mufulira Division

Following the major accident caused by an inrush of tailings, which occurred in September 1970, good progress is being made in securing the underground workings with concrete plugs in the affected areas, dewatering the flooded portion of the mine to the 810 m level and in general rehabilitation of the Peterson shaft section.

The sinkhole area on No 3 tailings dam was protected with a rock bund and has been pumped dry.

ACKNOWLEDGEMENT

The author wishes to thank the Managements of Nchanga Consolidated Copper Mines Ltd. and Roan

Consolidated Mines Ltd. for their permission to publish this paper.

REFERENCE

Mindeco Mining Yearbook of Zambia 1970. Published 1971.