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1986

THE NON-FERROUS METALS INDUSTRY OF ZIMBABWE
For presentation to UNIDO Dec. 1985.
Paul Jourdan

CONTENTS

TABLES.

ABBREVIATIONS

AAC	Anglo American Corporation of South Africa.
BMR	Base Metals Refinery (RTZim)
BNC	Bindura Nickel Corporation (AAC).
BSR	Bindura Smelting and Refining (AAC).
CMZ	Chamber of Mines of Zimbabwe.
Cafca	Central African Cables.
Capco	Central African Power Corporation.
CSO	Central Statistical Office.
ESC	Electricity Supply Commission.
HPS	Hwange Power Station.
IDC	Industrial Development Corporation.
ITC	International Tin Council.
LSM	Lomagundi Smelting and Mining (ZMDC).
MCM	Mhangura Copper Mines.
MMCZ	Minerals Marketing Corporation of Zimbabwe.
PTA	Preferencial Trade Area.
RTZ	Rio Tinto Zinc Plc.
RTZim.	Rio Tinto Zimbabwe (RTZ).
RSA	Republic of South Africa.
SADCC	Southern African Development Coordination Conference.
USA	United States of America.
ZMDC	Zimbabwe Mining Development Corpoerstion.

Units:

Z$	Zimbabwe Dollars.
US$	United States Dollars.
UKP	United Kingdom Pounds.
Tons	Metric Tons.
K.	Kilo: 1,000.
M.	Mega: 1,000,000.
G.	Giga: 1,000,000,000.

OBJECTIVES OF THE STUDY

This study of the non-ferrous metals industry of Zimbabwe is part of a broader group of country studies commissioned by UNIDO in terms of implementing the recommendations of the Expert Group Meeting on the Non-ferrous Metals Industry (March, 1985), which in turn constituted the first step in the System of Consultations arising out of the Lima Declaration and Plan of Action.

The main objectives of the study are:

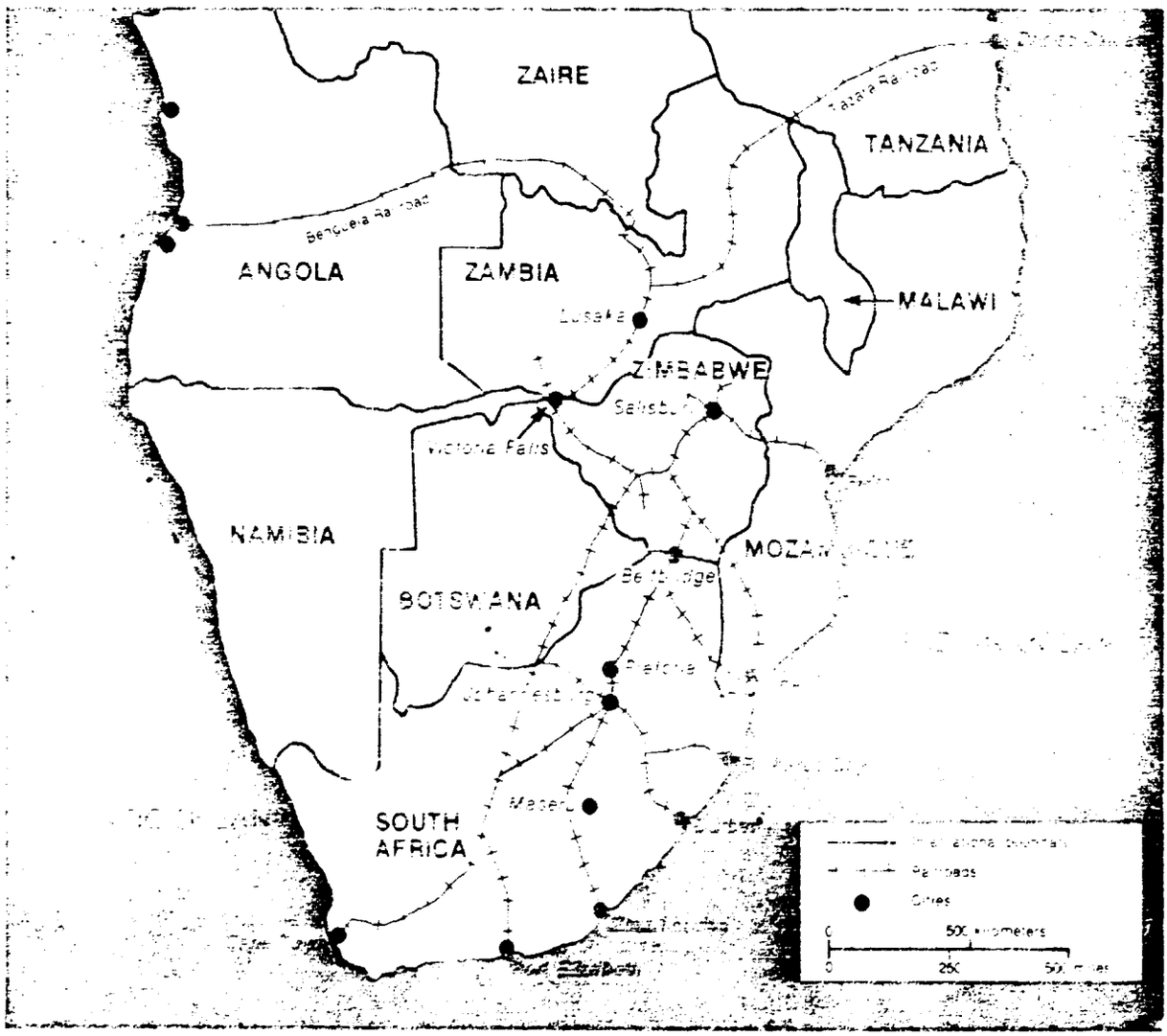
"(a). To make an analysis of the problems and main characteristics of the non-ferrous metals sector and its sectorial interrelations at the national and subregional levels;

(b). To propose strategies and policies of development for the non-ferrous metals industries that will permit the creation of a coherent national productive system;

(c). To propose areas and forms of cooperation at the subregional and regional levels that will contribute to a more integrated and self-reliant development of the non-ferrous metals industry." (UNIDO, 1985).

The detailed terms of reference of the study are to be found in Appendix I at the end of this report.

FIGURE 1.


ZAIRE
TANZANIA
ANGOLA
ZAMBIA
MALAWI
Lusaka
ZIMBABWE
Victoria Falls
NAMIBIA
BOTSWANA
SOUTH AFRICA
Railroads
Cities
500 kilometers
250

I. INTRODUCTION

I.i. BRIEF HISTORY OF MINING IN ZIMBABWE.

Mining has a long history in Zimbabwe. Iron ore has been mined and smelted in various locations over the last two thousand years, while first mention of gold mining in the area is made by Arab geographers in the tenth century, and gold from the mines of the Monomatapas was traded with the Portuguese in the sixteenth century. Most of the gold and copper mines opened this century were based on ancient mine sites. Over 1000 ancient gold workings, 133 copper workings, four gold and copper workings and one copper and tin working have been found (Summers, 1969).

European subjugation of the country, late last century, was not undertaken by an imperial state, but by a mining company, Cecil John Rhodes' British South Africa Company (BSAC), in search of the fabled mineral riches of the Great Monomatapa. These were thought to be on the scale of gold reefs of the Witwatersrand in South Africa. But gold deposits of this size were not discovered forcing the BSAC to embark on a policy of settler colonization in an attempt to finance the costs of conquering and maintaining the territory. Until early 1980 (independence) the police force of the rebel settler government was still called the British South Africa Police (BSAP).

The interests of the BSAC were later taken over by the Anglo American Company of South Africa which is today the largest foreign enterprise in the country with extensive interests not only in mining but also in agriculture, manufacturing, services

and finance. The old BSAC exists today as Charter Consolidated PLC in London which is owned by Minorco in Bermuda, which is in turn controlled by Anglo American and De Beers in South Africa.

I.ii. OVERVIEW OF MINING IN ZIMBABWE.

Although Rhodes failed to find a second Witwatersrand a variety of mineral deposits have been exploited since then. Today a wide range of minerals are mined in Zimbabwe. In 1984 the most important by value were gold (214.1MZ$), asbestos (80.8MZ$), nickel (59.7MZ$), coal (58.3MZ$), copper (33.8MZ$), chromite (29.7MZ$), tin (18.5MZ$), iron ore (14.5MZ$) and silver (9.0MZ$). The total value of mineral production in that year was 546.5MZ$, excluding quarrying and it contributed 8.0% of the GDP in 1983 (see Table 1.).

Table 1.
MINERAL PRODUCTION: 1975, 1979 AND 1984.

	Value(KZ$)			Volume(Ktons)		
Mineral*	1975	1979	1984	1975	1979	1984
Gold(tons)	31956	80912	214120	11.3	12.0	15.3
Asbestos	41701	65864	80778	261.5	259.6	165.3
Nickel	9121	45077	59704	9.1	14.6	10.3
Coal	18677	25843	58264	3300	3188	3109
Copper	24686	35149	33764	47.6	29.6	22.6
Chromite	22056	16139	29719	875.7	541.8	476.4
Tin(tons)	3971	9946	18510	997	967	1209
Iron ore	3033	7587	14532	1246	1202	925
Other	12144	28484	34713			
Total	177838	314801	546467			

* See Appendix II. for a detailed breakdown of mineral production.

Mineral and metal exports totalled 504.3MZ$ in 1983 the most important of which were ferrochrome (116.2MZ$), gold (104.3MZ$), asbestos (68.6), raw iron and steel (61.2MZ$), nickel (33.68MZ$) and copper (33.7MZ$). Mining and refining contributed 49% of total domestic exports in the same year (see Table 2.).

Table 2.
MINING AND REFINING: EXPORTS 1983. (MZ$)

Crude Minerals:			
magnesite	0.54	(0.43)*	
asbestos	68.59	(74.04)	
lithium ores	2.32	(5.11)	
precious metal waste	0.34	(2.82)	
copper slimes	13.95	(11.82)	
tungsten ores	0.12	(0.53)	
tantalum ores	0.12	(0.97)	
antimony ores	0.18		
other ores & concentrates	0.16		
metallic waste & scrap	1.28		
granite	0.03		
quartz	0.16		
mica	0.04		
building material (sand, etc)	0.36		
coal	3.56	(5.20)	91.80
Refined Minerals:			
ferro-chrome:	116.18	(154.94)	
iron and steel:	61.21	(55.80)	
copper metal	33.68	(31.06)	
copper alloys	1.02		
nickel metal	67.77	(63.03)	
tin metal	6.40		
cobalt metal	0.36		
coke	12.85	(11.22)	
cement	4.44	(7.58)	
gemstones	4.20	(3.75)	
silver	0.04		308.15
Gold:			104.30 (159.6)
GRAND TOTAL for mining and refining:			504.25
Total Domestic Exports:			1150.20 (1453)
% Mining & Refining:			43.8%

* 1984 figures in brackets. Source: CSO, 1984.

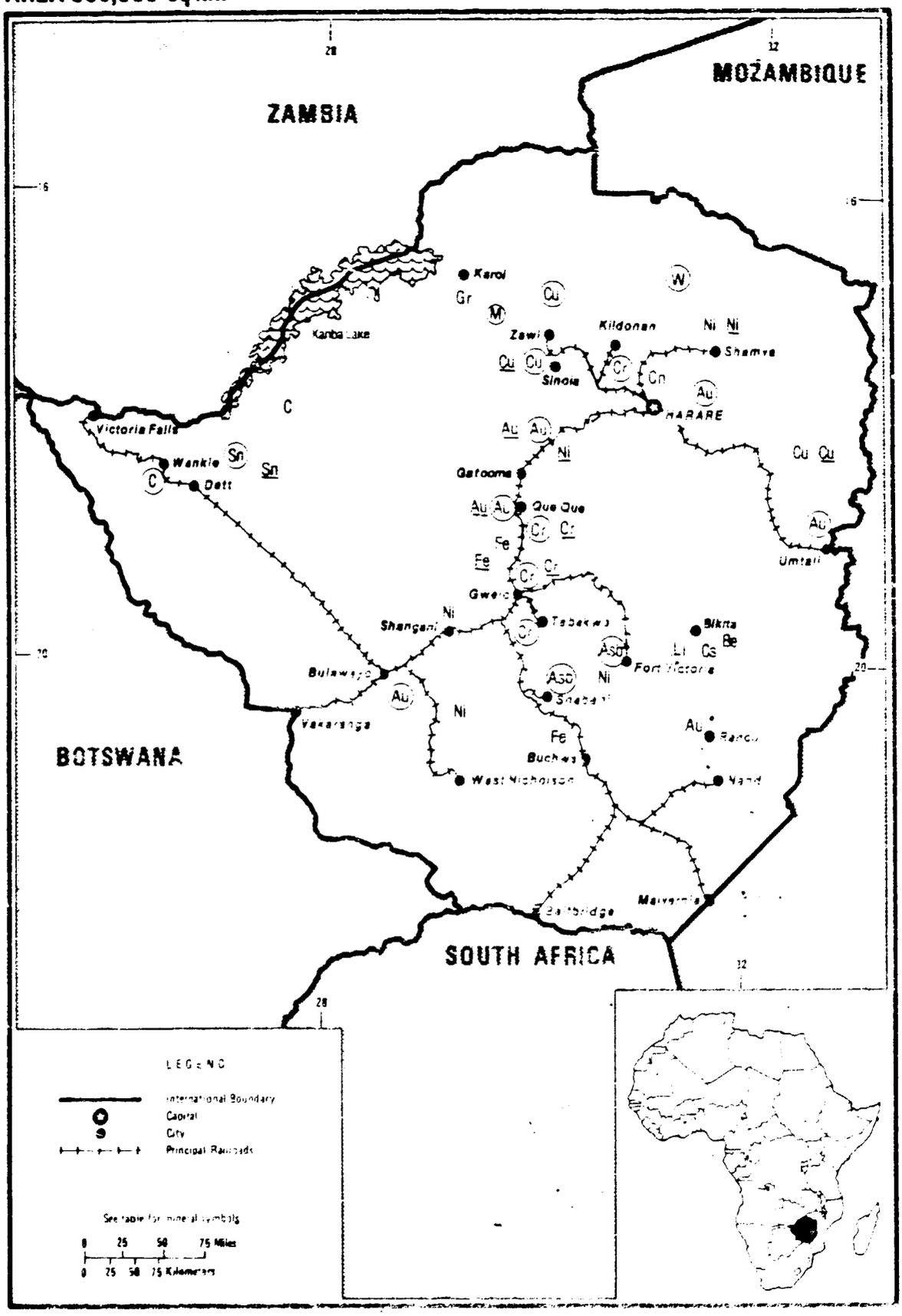
The mining industry is largely in the hands of the mining transnational companies, the most important being Anglo American Corporation (AAC) of South Africa (nickel and ferrochrome), Union Carbide Corporation of the USA (ferrochrome and gold), Rio Tinto Zinc PLC (RTZ) of the UK (gold), Lonrho PLC of the UK (gold and copper) and Turner Newall PLC of the UK (asbestos).

Since independence (1980) there has been a considerable incease of state participation in the mining industry, but generally on a "willing buyer, willing seller" basis. The state

FIGURE 2.

ZIMBABWE

AREA 389,000 sq km **POPULATION 7.4 million**



has the largest shareholding in coal mining (Wankie Colliery), though the AAC still provides management and technical services. The state also controls the iron and steel industry (ZISCO), and tin mining (Kamativi).

In 1984 the newly formed state mining enterprise, the Zimbabwe Mining Development Corporation (ZMDC) bought out the local mining interests of the Messina (Transvaal) Development Company Ltd. (MTD) of South Africa giving it control of most of the national copper production (Mhangura Copper Mines). The state has also set up the Minerals Marketing Corporation of Zimbabwe (MMCZ), which handles all mineral and metal exports with the exception of gold, which is bought by the Reserve Bank of Zimbabwe.

II. BACKGROUND

Zimbabwe gained independence in 1980 after a protracted liberation struggle against the rebel minority settler regime, which had declared UDI from Britain in 1965. This period of settler government, along with the sanctions imposed in the seventies by the UN, developed a mining industry in an essentially different manner to that of other colonies. Zimbabwe's development was not purely in the interests of the imperial country as a source of raw materials and a market for fininshed goods, but was developed in the interests of a national bourgeoisie, albeit a minority settler one. The settlers had effective control of government from the twenties which resulted in a self-sufficiency (import substitution) type of economic development more similar to that of South Africa than for instance, Zambia or Zaire. The imposition of sanctions also had a profound effect on the mode of development by way of forcing national self-sufficiency in a wide variety of processes and products.

These factors gave rise to several strategies regarding the mining industry both in terms of upstream and downstream development. The shortage of foreign exchange, sanctions and the landlocked position of the country provoked a downstream development of the mining industry in order to increase value and decrease weight/volume. Most of the major minerals mined are reduced to their pure form before export. Examples are copper cathodes, nickel cathodes, ferrochrome, high-grade tin and iron

and steel products. Processing and refining of minerals was also necessary for import substitution of the metal inputs to local industry (e.g. copper for wire and cables). Several minerals are also mined on a small scale purely as inputs to local industry such as pyrites for sulphuric acid, bauxite for aluminium sulphate and phosphate rock for fertilizers. A wide variety of inputs to the mining industry are manufactured locally such as explosives, ball mills, conveyors, rail and rolling-stock, pumps, headgear, ventilation ducting and electrical equipment.

Another effect of sanctions was that during UDI the TNC's had difficulty in repatriating their profits, which meant that the surplus generated by the mining industry was often re-invested in the industry or other parts of the economy. This also had the effect of increasing the overall control of the TNC's over the economy as a whole. The major transnational mining houses today have significant holdings in other sectors of the economy. For instance, the AAC has interests in manufacturing, farming, services and finance, Lonrho also has holdings in vehicle manufacture, forestry and textiles, while RTZ has a local subsidiary manufacturing agricultural equipment (Tinto Industries).

III. NON-FERROUS MINING, SMELTING AND REFINING.

III.1) INTRODUCTION.

a). Production.

The three non-ferrous metals produced in Zimbabwe are nickel, copper and tin. Due to the depressed prices of coppper and nickel over the last few years there has been a contraction of these industries. Copper production has steadily declined from 52 Ktons in 1973 to 22.6 Ktons in 1984 (-56%), while nickel production has fallen from a high of 16.7 Ktons in 1977 to 10.3 Ktons in 1984 (-38%). Tin production, on the other hand, increased slightly from around 1000 tons/an. in the '70s to 1200 tons in 1984, due to the increase in real price of tin until late 1985. Since the collapse of the ITC, the outlook for tin mining in Zimbabwe is bleak.

Both copper and nickel production showed a slight increase from 1983 to 1984 in respo se to the marginally improved world market situation, but their longer term price decline is expected to resume in 1986.

Production volumes and values for the period 1960 to 1984 is presented in the following table:

Table 3.
NON-FERROUS METAL PRODUCTION: 1960-1984

	Copper		Nickel		Tin	
Year	Ktons	MZ$	Ktons	MZ$	Tons	MZ$
1945	0.2	*	-	-	200"	0.1
1950	0.1	*	-	-	105"	0.1
1955	1.2	0.5	0.2"	*	334"	0.5
1960	15.1	5.1	0.1"	*	724	1.0
1961	15.0	5.3	0.3"	*	807	1.1
1962	15.2	5.5	0.4"	*	795	1.4
1963	18.5	6.5	0.6"	*	591	0.9
1964	16.5	8.3	0.8"	0.1	520	1.3
1965	18.0	12.6	4.2"	0.4	511	1.4
1966	16.0	13.7	4.0"	0.5	689	1.7
1967	22.2	16.1	3.2"	0.2	875	2.0
1968	21.0	15.1	0.3"	0.3	928	2.0
1969	28.7	24.5	5.8	9.4	972	2.4
1970	30.0	24.8	8.6	16.5	1094	2.5
1971	34.4	20.5	9.3	16.7	1118	2.5
1972	46.5	25.8	10.1	17.7	990	2.2
1973	51.9	39.9	10.9	18.4	1138	2.5
1974	47.5	45.8	10.7	20.5	1089	3.8
1975	47.6	24.7	9.1	19.6	997	4.0
1976	41.3	29.5	14.6	35.2	915	4.9
1977	34.8	22.0	16.7	42.8	920	6.2
1978	33.8	23.0	15.7	39.5	945	8.2
1979	29.6	35.2	14.6	45.1	967	9.9
1980	27.0	35.4	15.1	55.6	934	9.9
1981	24.6	27.9	13.0	51.7	1157	11.3
1982	24.8	26.8	13.3	49.8	1197	11.6
1983	21.6	32.9	10.2	43.1	1235	16.2
1984	22.6	33.8	10.3	59.7	1209	18.5
1978-84	184.0		92.2		7644	

" concentrates. * less than 0.05 MZ$. Sources: CSO, 1985a; MMCZ, 1985.

Figures for the industry as a whole only exist up to 1982. From 1975, the net output of the industry increased steadily to 78.7MZ$ in 1980, but declined to 39.0MZ$ in 1982. The value of stocks rose from 25.9MZ$ in 1975, to 64.1MZ$ in 1982 (Table 4a). It should be borne in mind that these are current Z$, the value of which declined significantly over the period. Employment increased from 13.6 thousand persons in 1975 to 14.3 thousand in

1981, but decreased to 12.7 thousand in 1982 (Table 4a).

Table 4a.

FINANCIAL PROFILE: NON-FERROUS METALS. [KZ$]

Year	Gross Output[a]	Net Output[b]	Wages & Salaries	Stocks [c]	Net Capital Expenditure	Employment[d]
TIN (e)						
1975	4077	2844	1301	1136	1078	1136
1976	4738	2902	1628	1269	1153	1675
1977	6908	4640	1978	1345	938	1735
1978	8046	5006	1757	1278	904	1836
1979	11600	9229	2595	2550	698	1829
1980	12225	9577	2780	2277	1223	1870
1981	13157	9727	4159	3699	2798	1848
1982	12304	7901	5560	3869	3245	1903
COPPER & NICKEL (e)						
1975	70837	37250	12847	24857	18869	12457
1976	89400	45883	14408	27184	20134	12133
1977	89168	37773	15555	32475	9545	11632
1978	84854	37790	15216	33908	7960	10186
1979	103624	54715	17139	35717	37884	10046
1980	126395	69101	23148	39400	14043	11100
1981	115129	53987	34653	60228	37083	12417
1982	95349	31142	33917	60228	3792	10301

(a) Gross Output: Excluding sales of goods not produced on premises.
(b) Net Output: Gross Output less purchases and change in stocks.
(c) Stocks: Total at end of year.
(d) Employment: Average number employed during the year.
(e) Includes mining, smelting and refining.
Sources: See Table 4b.

Net capital expenditure peaked at 39.9MZ$ in 1981, before falling to 7.1MZ$ in 1982 (Table 4a.), although, that for tin increased from 1977 through to 1982. For tin, capital expenditure as a percentage of net output fell to a low of 7.6% in 1979, before recovering to a high of 41.1% in 1982, presumably due to the improved real price of tin over this period. For copper and nickel capital expenditure as a percentage of net output fell to an all-time low of 12.2% in 1982, due to the depressed world market (Table 4b.). The value of stocks as a percentage of net output increased for both copper/nickel and tin, and stood at 49% for tin and 193% for copper/nickel in 1982 (Table 4b.).

Table 4b.
RELATIVE FINANCIAL DATA: NON-FERROUS METALS

Year	Production per Employee [tons]	Stocks as % of Net Output	Capital Expenditure as % of Net Output
TIN			
1975	0.88	39.9	37.9
1976	0.55	43.7	39.7
1977	0.53	30.0	20.2
1978	0.52	25.5	18.1
1979	0.53	27.6	7.6
1980	0.50	23.8	12.8
1981	0.63	38.0	28.8
1982	0.63	49.0	41.1
COPPER & NICKEL			
1975	4.55	66.7	50.7
1976	4.61	59.2	43.9
1977	4.43	86.0	25.3
1978	4.86	89.7	21.1
1979	4.40	65.3	69.2
1980	3.79	57.0	20.3
1981	3.03	111.6	68.7
1982	3.53	193.4	12.2

Sources: CSO, 1985c, 1985d

Production per employee between 1975 and 1982 remained fairly static for tin but declined for copper/nickel. It should be noted that the aggregated figures for copper/nickel mining, smelting and refining conceal the different performances of these two metal industries, and the performance at the various stages of production (mining, smelting and refining). This is dealt with company by company later in the report.

b). Exports.

Export figures for the period 1978 to 1984 are presented in Table 5. Both copper and nickel declined to 21.5 Ktons and 11.3 Ktons respectively in 1984, although a surprising 16.2 Ktons of nickel were exported in 1983, but this was due to held-over stocks and nickel refined from Cu-Ni matte from Botswana (3 Ktons). Table 5 also gives exports as a percentage of production for each year and for the whole period. This is not a good

indicator of local consumption due to held-over stocks, but the figure for the whole period gives a better indication, namely that virtually no nickel is consumed locally, about 10% of copper and a similar percentage of tin goes into local industry.

Table 5.
EXPORTS OF NON-FERROUS METALS: 1978-1984

	Copper			Nickel			Tin		
Year	Ktons	MZ$	%[a]	Ktons	MZ$	%[a]	Tons	MZ$	%[a]
1978	35.9	26.5	106	16.5	36.5	105	748	6.3	79
1979	26.6	31.3	90	13.9	37.9	95	865	8.5	90
1980	22.7	24.6	84	14.5	52.8	96	891	8.6	95
1981	17.9	18.3	73	11.7	46.8	90	950	8.3	82
1982	22.7	21.7	92	12.0	45.5	90	1030	9.2	86
1983	24.9	33.7	115	16.2	67.8	159	1094	na	90
1984	21.5	31.1	95	11.3	63.0	110	981	16.6	93
1978-84	172.2		94	84.8		104	6559		88

(a) Exports as a percentage of production (volume).
Sources: CSO, 1985a and 1985b; MMZ, 1964; MMCZ, 1985; CMZ, 1970.

III.ii). NICKEL

In 1984 nickel was the third mineral by value both in terms of production and exports (59.7 and 63.0MZ$). Exports stood at 3.6% of total exports in 1975 and rose to 4.3% in 1984 (5.9% in 1983). Production was 1.6% of world output in 1983. In 1984 employment in nickel mining was 9% of the total mining labour force of 50,542.

Nickel mining in Zimbabwe is based on very low grade ores which makes the industry very susceptible to fluctuations in the world market price and to increases in running costs. Nickel mining and refining tends to be more capital intensive, utilizing medium to high technology, than for example gold mining.

Presently all nickel mining is controlled by the Anglo American subsidiary Bindura Nickel Corporation (BNC), but until 1983 it was also mined by Rio Tinto Zimbabwe (Empress Nickel Mine). The RTZ refinery (Eiffel Flats) is still running on matte from Botswana (BCL Ltd.).

a) Bindura Nickel Corporation Ltd. (BNC).

The BNC is 34% owned by Charter Consolidated PLC in London which is in turn owned by Minorco in Bermuda which is controlled by Anglo American-De Beers of South Africa. Another 47% of the equity is held directly by Minorco. Anglo American Services (Zimbabwe) Ltd. supplies management and technical services to the company.

ANGLO AMERICAN CORPORATION: MINING INTERESTS IN ZIMBABWE

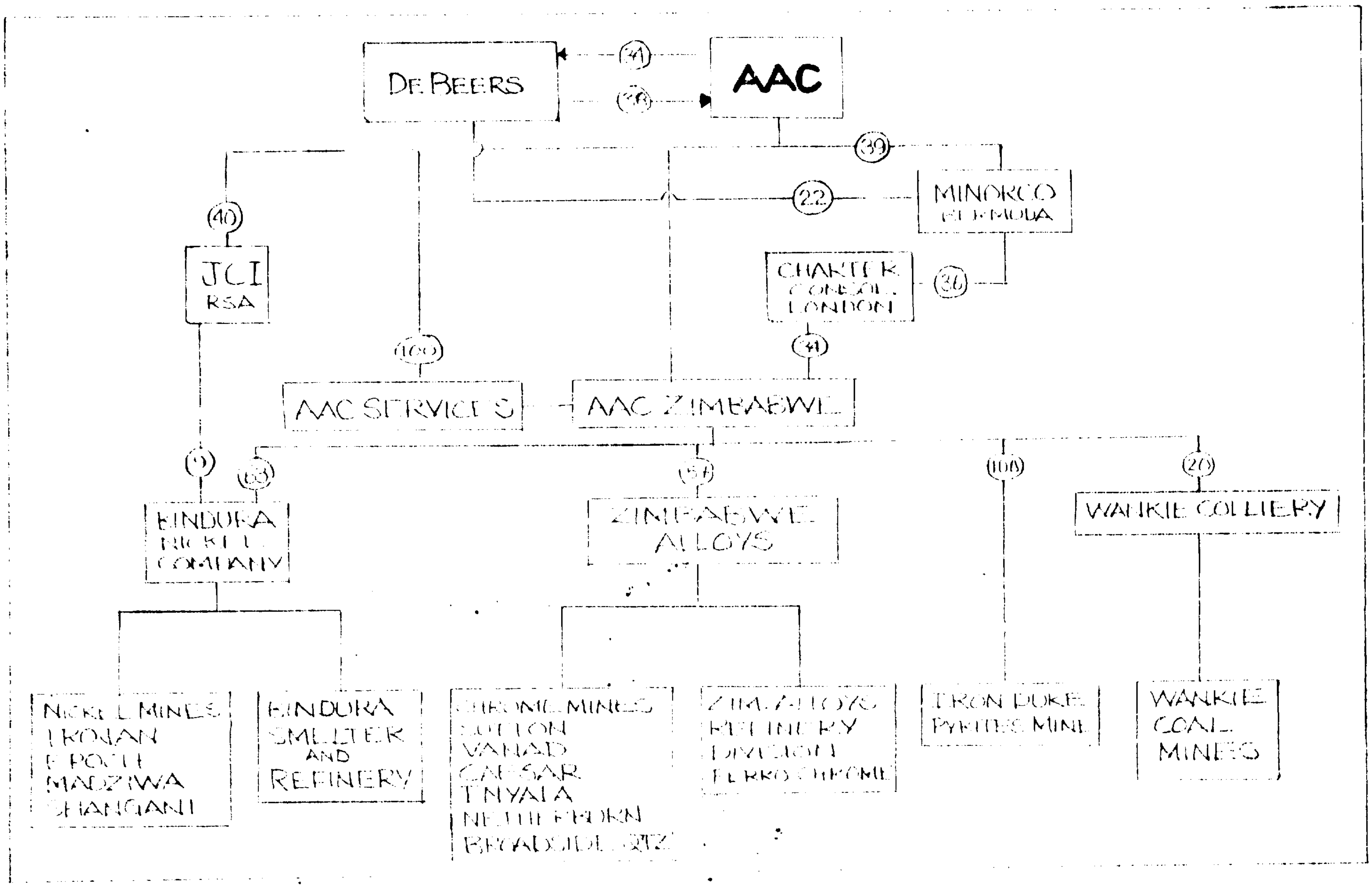


FIGURE 4.

Table 6a.
BINDURA NICKEL CORP. (AAC): FINANCIAL PROFILE (MZ$)

Year *	Capital Employed	Turnover	Profit [loss]	Tax	Dividends Paid	Fixed Assets	Debts [a]
1975	32.9		2.3	0.0	1.7	26.1	9.6
1976 b)	47.8		2.0	0.002	1.2	36.9	15.6
1977	62.0		3.6	0.001	1.7	45.2	17.5
1978 c)	67.1		1.7	0.0	0.7	46.2	15.8
1979	78.5	30.9	6.1	0.003	0.7	46.4	9.0
1980	76.2	41.6	9.3	0.0	3.4	46.3	4.0
1981	118.3	32.6	3.6	0.0	5.5	72.7	18.6
1982	131.3	37.2	(6.3)	0.0	2.4	75.1	39.8
1983	163.6	73.7	(15.4)	0.0	0.0	116.2	53.0
1984	178.6	76.9	(9.9)	0.0	0.0	116.9	56.6

* 1975-78: year ended 31 March; 1978-84: year ended 31 Dec.
a) Medium- and long-term loans.
b) Uprating of BSR (8.9 MZ$) smelter and refinery.
c) For 9 months ending 31 Dec. 1978
Source: BNC, Annual Reports.

In 1984 the total capital employed by the company was 178.6 MZ$, turnover was 76.9 MZ$, and an after-tax loss of 9.9 MZ$ was made, 15.4 MZ$ being carried over from 1983. The debt burden of the company has increased drastically since the onset of the world recession; from 4 MZ$ in 1980 to 56.6 MZ$ in 1984, representing 48% of fixed assets (Table 6a). Virtually no tax has been paid by the company since its inception, as by the time its tax grace period had finished, the world recession with low nickel prices had set in, leaving very little or no taxable profit.

BNC operates two mines in the north-east of the country (Trojan and Madziwa) and two in the south-west (Epoch and Shangani). Shangani was acquired from another Anglo American subsidiary, Johannesburg Consolidated Investment Company (JCI) in 1981. BNC also has a smelting and refining subsidiary BSR Ltd. at Bindura.

Trojan Mine: Mining operations were started in 1964 by Trojan Nickel Mine (Pvt.) Ltd. (a locally owned company). In 1966 Anglo purchased 85% of the equity for 1.74 MZ% and took control. In 1984 942.5 Ktons of ore were milled with a grade of 0.61% Ni, from which 3.94 Ktons of Ni in concentrates were produced which went to BSR for refining. At the end of 1984 proved reserves stood at 1,191 Ktons grading 0.66% Ni.

Madziwa Mine: In 1966 Shamva Nickel (Pvt.) Ltd. was formed to start mining these claims and in 1967 Anglo American acquired the claims for 0.6 MZ$. In 1984 343.87 Ktons of ore grading 0.59% Ni were milled which gave 1.61 Ktons of Ni in concentrates, all bound for the BSR smelter. In the same year proved reserves stood at 1.35 Mtons of ore grading 0.62% Ni.

Epoch Mine: This ore body was discovered by AAC geologists in 1970. In 1974 it was decided to develop the deposit at a cost of 6.4 MZ$ and mining commenced in 1976 when an uprate of 374 KZ$ was completed. In 1984 517.02 Ktons of ore (0.54% Ni) were milled, from which 1.93 Ktons of Ni in concentrates were produced for the BSR smelter. At the end of the same year proved reserves were 1.09 Mtons of ore (0.65% Ni).

Table 6b.
BINDURA NICKEL CORP. (AAC): PRODUCTION PROFILE.

Year	Reserves [Ktons][a]	Ore Prod. [Ktons]	Ni Prod. [Ktons]	Cu Prod. [Ktons]	Co Prod. [Tons]
1978 b)c)		1342.0	7.39	0.82	29.7
1979 c)	25.4	1849.3	6.52	0.99	47.7
1980	26.2	1765.0	8.25	1.15	62.2
1981 d)	39.1	2543.3	7.61	0.90	60.8
1982	37.6	2488.5	10.31	1.36	101.1
1983	27.1	2512.9	10.13	1.21	88.8
1984	27.7	2585.5	10.17	0.99	100.6

a) Proven reserves in Ktons of nickel contained (ore x grade)
b) For 9 months ended 31 Dec. 1978.
c) BSR smelter down for two weeks at the end of 1978.
c) BSR smelter down for 2 months (Jan. & Feb.).
d) Shangani Mine was acquired 1 Nov. 1981.
Source: BNC, Annual Reports.

Shangani Mine: JCI Ltd. started mining in 1975 and milling and flotation commenced in 1976. In 1978 AAC Services were appointed as secretaries, buyers and technical advisors and at the end of 1981 the mine was acquired by Trojan Nickel Mine Ltd. (BNC). 782.1 Ktons of ore (0.59% Ni) were milled in 1984 producing 1.61 Ktons of Ni in concentrates for the BSR smelter. At the end of 1984 proved reserves of ore were 0.76 Mtons (0.58% Ni).

BSR Ltd.: The smelter and refinery started operations in 1968 using blast furnaces and Pierce-Smith converters to produce a leach alloy. An Outokumpu process was used for the leach and purification stages before final refining by electro-winning. In 1975 the plant was uprated, at a cost of 8.9 MZ$ to handle concentrates from Shangani and Epoch. The blast furnaces were replaced by an electric furnace and a third converter, additional leach reactors and filters were installed. The uprate was locally designed but with foreign inputs of equipment. The whole plant

is locally maintained.

The present capacity of the plant is 13 Ktons of high-grade nickel/an. (99.98% Ni). In 1984 production was 10.17 Ktons of nickel, 989 tons of copper and 101 tons of cobalt in cake. In the second half of 1985, an agreement was reached to toll-refine 2.9 Ktons of copper/nickel (1:1) matte from BCL Ltd. n Botswana. The matte will be toll-refined for an agent in Switzerland. This will still leave the plant with some excess capacity (about 2 Ktons Ni) and further toll-refining arrangements are being sought.

Before 1983 marketing was done by the AAC, through agents in Europe. Up to 1981, price was determined by the nickel TNC producer price, but after that the price was based on the LME. The nickel is exported as one or two-inch "squares" of high-grade nickel (99.98% Ni). The precious metal slimes are shipped to Europe for refining.

Since 1983, metal marketing has been done by the MMCZ, but the previous agents are generally still used. The toll refined production goes directly to the Swiss contractors. The nickel is railed to South African ports before shipment to the buyers.

Table 6c.

BINDURA NICKEL CORP. (AAC): LABOUR FORCE, OUTPUT PER WORKER

	Mining		Smelting & Refining	
Year 31 Dec.	Labour Mines	Tons Ore per Worker	Labour BSR	Tons Ni & Cu per Worker
1979	2637	701	744	10.1
1980	2814	627	765	12.3
1981	4075	624	796	10.7
1982	4036	617	766	15.2
1983	3906	643	757	15.0
1984	3715	696	717	15.6

Source: BNC, Annual Reports.

From Table 6c. it is apparent that while output per worker for the mining operations in 1984 has shown little change from

1979, productivity at BSR has increased 56%, the largest increase being registered from 1981 to 1982.

The main inputs consumed by BSR are silica, coke (Wankie Colliery), and sulphuric acid (Zimphos). Electricity charges constitute 20% of production costs, and have increased considerably since 1982. The main inputs for mining are explosives, steel balls and reagents.

A very small amount of nickel is sold to local foundries at a slight discount on the world market price (about 8%) in lieu of the lower transport costs, compared to overseas buyers. A poject to produce nickel wire is under consideration. Initially it is envisaged that 50 to 100 tons/an of 5mm wire will be produced with a view to decreasing the radius progressively and increasing the tonnage. If viable, the project will be locally financed.

b). Rio Tinto Zimbabwe Ltd. (RTZim.).

RTZim. used to own a major nickel producer, the Empress Nickel Mine. The mine was established in 1967 as the first significant nickel producer in the country. At that time ore reserves were estimated to be 14.33 Mtons grading 1.43% Ni+Cu. Production started in 1969 and was expected to continue for twenty years. However, in 1981 the mine declared reserves for three more years. This decrease in the life of the mine was due to an increase in operating costs, to difficulties in mining the significant reserves locked in pillars, to a failure to discover any extensions to the original body and to the steady decline in the real price of nickel in 1982.

The mine closed at the end of 1982, and the Base Metals Refinery (BMR) at Eiffel Flats shut down in September 1983 after

matte supplies from BCL Ltd. in Botswana ceased. The refinery re-opened in August 1985 to toll-refine 4.5 Ktons of nickel and 5 Ktons of copper in Ni-Cu matte/an. from BCL Ltd. The matte is toll-refined for an agent in Switzerland, Centametall. The Empress Nickel Mine became a wholly-owned subsidiary of Rio Tinto Zimbabwe in 1980, when the other shareholders in the company were given R.T.Zimbabwe Ltd. shares in exchange for their Empress Nickel Mining Co. Ltd. shares.

Table 7a.

THE EMPRESS NICKEL MINING COMPANY Ltd. (49% RTZim. [c]): FINANCIAL PROFILE (MZ$).

Year 31 Dec.	Capital Employed	Sales	Profit a] [loss]	Tax	Dividends Paid	Fixed Assets	Debt [b]
1973	10.27	12.54	2.94	0	na	na	na
1974	9.44	7.97	2.01	0	1.84	9.7	5.38
1975	9.77	12.40	0.69	0	0.53	9.5	6.32
1976	11.57	16.14	2.56	0	1.61	9.3	5.24
1977	11.91	16.52	1.36	0	0.44	9.2	5.00
1978	12.11	15.33	1.04	0	0.44	8.8	5.00
1979	12.65	19.62	2.97	0.16	2.20	8.3	5.00
1980 c]	9.89	19.26	1.20	1.14	na	na	na
1981	na	16.59	(1.16)	0	na	na	na
1982 d]	na	na	(8.80)	0	na	na	na

a] Profit after tax.
b] Debt including debentures and redeemable notes.
c] The Empress Nickel Mining Co. became a wholly-owned subsidiary of Rio Tinto Zimbabwe on 31 Dec. 1980.
d] Mine closed down end Dec. 1982.
Sources: See Table 7b.

Table 7a. gives a financial summary of the company for the years 1973 to 1982. In that time virtually no taxes were paid as the end of the grace period coincided with the demise of the mine. The escalating debt during the final two years of the mine is not reflected as by this time it was a wholly-owned subsidiary of RTZim which handled the loans. In 1982 the government supplied RTZim. with a loan of 2.7 MZ$ repayable any time up to 1987 at which date it would have the right to convert the unpaid

balance into equity. By the end of 1984 this loan stood at 3.43 MZ$. The total medium and long term debt of the mother company was 29.3 MZ$ in 1982, 25.1 MZ$ in 1983 and 22.4 in 1984.

Table 7b.

THE EMPRESS NICKEL MINING CO. (RTZ): PRODUCTION PROFILE.

Year 31 Dec.	Reserves [Ktons]a]	Ore [Mtons]	Nickel [Ktons]	Copper [Ktons]	Cobalt [tons]
1975	50.5	1.03	3.65	3.10	
1976	76.3	1.02	5.05	4.27	
1977	87.6	1.02	5.08	4.52	
1978	96.1	1.01	4.73	5.10	17
1979	89.7	0.99	3.76	3.64	14
1980	54.6	0.87	2.87	2.65	4
1981 b]	41.5	0.84	2.73	2.60	4
1982 c]	38.8	0.66	2.45	2.36	na
1983 d]	nap	nap	2.86	3.16	na

a] Proven reserves in Ktons of contained Cu and Ni (ore x grade).
b] Contract to refine 4.2 Ktons of BCL matte/an.
c] Empress mine and smelter closed down.
d] Eiffel Flats refinery shut down Sept. 1983.
Sources: RTZim. Ltd. Annual Reports. The Empress Nickel Mining Co. Ltd., Annual Reports.

Table 7b. gives a production profile for the mine and for the BMR from 1975 to 1983. Nickel ore was also produced from the Perserverance mine (RTZim.) until 1976 then again in 1980/81. The 1982 reserves appear to be significant, but most of these were locked into pillars and could not be economically mined. Production averaged at about 3 Ktons of Ni and a similar amount of Cu per annum, peaking in 1977 at 5.08 and 4.52 Ktons respectively.

Table 7c.
EMPRESS NICKEL MINE (RTZ): LABOUR FORCE, OUTPUT PER WORKER

Year [a]	Total Labour 31 Dec.	Mining Labour [a]	Mining Ktons Ore per Worker	Smelting & Refining Labour [a]	Smelting & Refining Tons Ni & Cu per Worker
1975	1353	1451	0.71	na	nap
1976	1357	1374	0.74	637	14.6
1977	1284	1344	0.76	639	15.0
1978	1279	1253	0.81	582	16.9
1979	1293	1282	0.73	604	12.3
1980	na	1195	0.73	585	9.4
1981	na	1133	0.74	554	9.6
1982	na	885	0.75	422	11.4

a] The production figures (Table 7b.) are for the year ended 31 Dec. and the labour for the year ended 31 March. Hence the labour figures for the following year have been used, vis: production 1975 over labour 1976.
Sources: RTZim. Ltd. and Chamber of Mines of Zimbabwe (CMZ).

The production per worker data (Table 7c.) for mining shows little change for the period 1975 to 1982, while for smelting and refining there is an apparent drop from 1978 to 1979, but this could be due to incompatibility in the data, the source of which changed in 1979.

All marketing used to be done by RTZim. through agents in Europe. The toll-refined production, which recently came on stream, is marketed by the contractors in Switzerland (Centametall), by-passing the MMCZ.

Of the total nickel exports marketed by the MMCZ of 10,742 tons in 1984, about 54% went to Europe, 24% to the USA, 20% to Japan and 0.25% to the RSA. The refined metal is railed by the National Railways of Zimbabwe (NRZ) and the South African Transport Services (SATS) to the South African port of Durban. The transport and port charges to f.o.b. are approximately 91.6 US$ per ton, 2.08% of the f.o.b. value of the nickel.

III.iii) COPPER

The value of copper production has fallen from being the premier mineral in 1974 (45.8 MZ$) to fifth place in 1984, due both to a drop in production (-25 Ktons) and a drop in real value (-60%). In 1984 employment in copper mining was 8.7% of the total mining labour force and in the same year exports of copper metal constituted 2.5% of total domestic exports (1978: 4.7%).

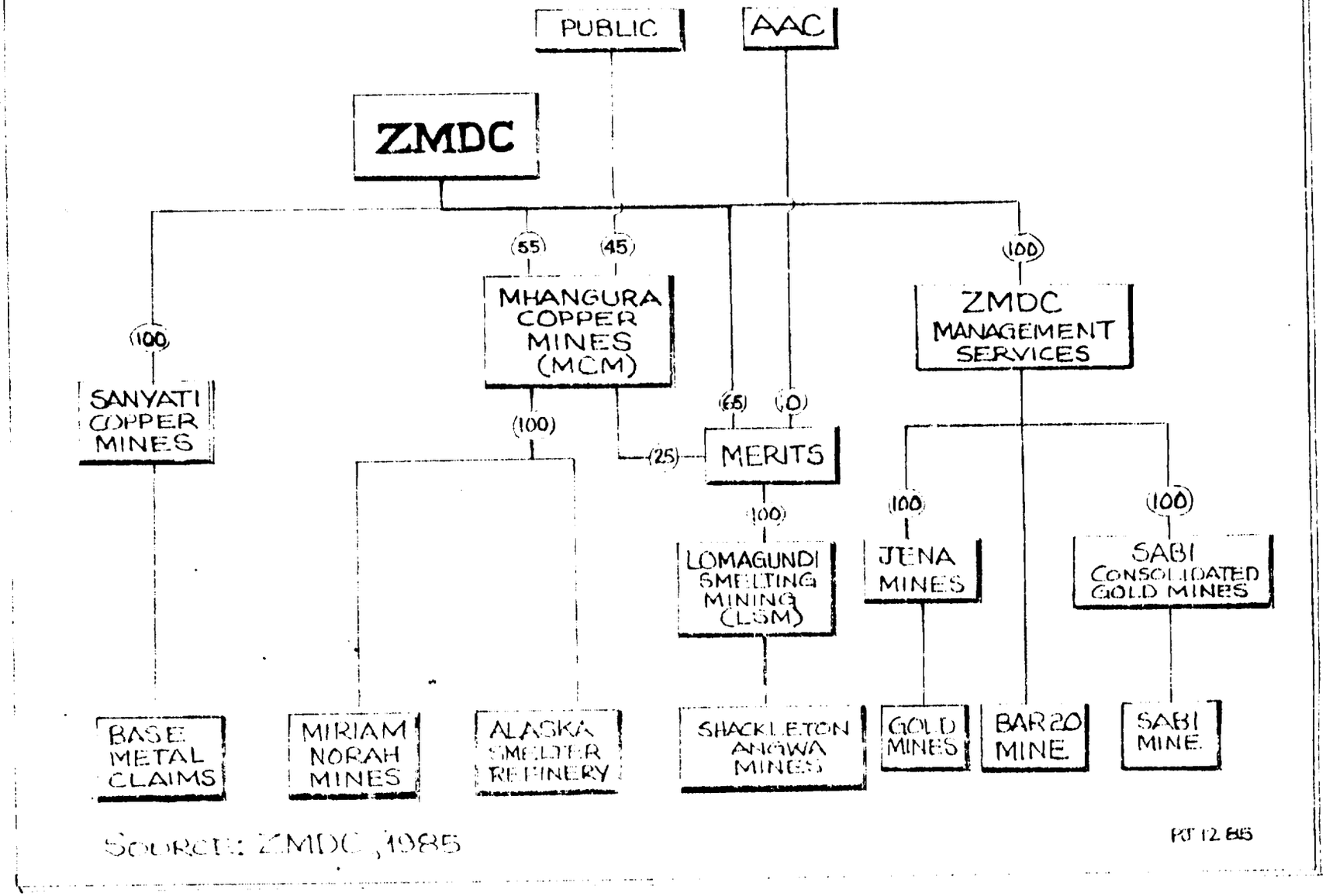
Most of the country's copper production comes from mines under the parastatal, the ZMDC, with smaller amounts coming from Lonrho (Inyati) and as a by-product of nickel mining.

a) The Zimbabwe Mining Development Corporation (ZMDC).

The ZMDC was established in terms of the Zimbabwe Mining Development Corporation Development Act of 1982 to invest in the mining industry and to plan, coordinate and implement mining development projects on behalf of the state. It commenced operations in Nov. 1983. In Nov. of the following year it took over the Zimbabwean copper mining interests of The Messina (Transvaal) Development Company Ltd. of South Africa (Messina). These were: MTD Management Services Ltd., 100%; MTD (Mangula) Ltd., 55% (copper mining); MTD (Sanyati) Ltd., 100% (base metal claims); Messina Zimbabwe Investments Ltd., 65% (Merits: mining finance and investment) and Lomagundi Smelting and Mining (Pvt.) Ltd. (LSM), which was owned by Merits.

Mining was first started in 1947 by Rhodesia Copper Ventures Ltd. and the first Messina interest was acquired in the early fifties. By 1956 Messina had a majority shareholding and the name was changed to MTD (Mangula) Ltd. The LSM smelter started up in 1959 and in 1970 Messina Rhodesia Investments Ltd. (Merits) was launched. The refinery (MTD) started operations in 1980 after an

ZIMBABWE MINING DEVELOPMENT CORPORATION: STRUCTURE



SOURCE: ZMDC, 1985

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investment (local) of 5 MZ$. In 1983 the Alaska smelter (LSM) was transferred to MTD (Mangula) and in 1985 MTD changed its name to Mhangura Copper Mines Ltd. (MCM) and MTD (Sanyati) to Sanyati Copper Mines Ltd. The present structure of the group is presented in Figure 5.

Table 8a.
MHANGURA COPPER MINES LTD (MCM):
FINANCIAL PROFILE (MZ$).

Year 30 Sept.	Capital Employed	Turnover	Profit a) [loss]	Tax	Dividends Paid	Fixed Assets	Debt [b]
1975	27.3	12.3	4.3	1.3	3.8	22.2	
1976	27.8	15.0	6.0	2.1	5.0	22.6	
1977	28.0	17.6	3.5	0.3	2.8	23.3	
1978	28.3	17.1	3.0	1.1	2.2	23.5	
1979	29.4	26.1	6.5	3.6	5.4	28.5	
1980	31.1	30.8	9.2	3.3	7.6	32.3	
1981	34.6	32.1	(1.5)	0.03	0.0	34.2	5.0
1982	31.1	28.7	(8.0)	0.001	0.0	30.3	9.6
1983	37.1	41.0	3.4	0.0	0.0	30.4	12.2
1984	34.3	46.2	(0.6)	0.0	0.0	33.6	10.0
1985 c]	35.2	36.3	1.6	0.0	0.0	33.6	9.2

a) Profit after tax. b) Long term debt. c] 9 months ended 30:06:85
Source: MCM, Annual Reports.

Mhangura Copper Mines (MCM): The MCM mines are Miriam and Norah. In 1973 they had proved reserves of 202.8 Ktons of contained Cu which had been reduced to 170.6 Ktons of contained Cu by 1985. Ore production for the year ended 30 June 1985 was 902 Ktons (0.93% Cu) for Miriam and 373 Ktons (0.82% Cu) for Norah compared to 1,335 (1.17% Cu) and 253 (1.09% Cu) respectively in 1973. The third mine Silverside, ceased production in 1977.

LSM (Merits): MCM also provides management and technical services to the Merits operations. Merits is 25% owned by MCM and 65% directly by ZMDC. In Table 8b. the Merits production is included with that of MCM. Merits has only one mine left, Angwa, but the old Shackleton shaft is used to hoist its ore. In 1985 it

had proved reserves of 11.5 Ktons of contained copper and milled 239 Ktons of ore grading 1.06% Cu. Merits has been running at a substancial loss for several years and in mid 1985 the accumulated loss stood at 18.1 MZ$. The operations can only continue with a significant subsidy from government (roughly 1.5 MZ$/an.).

Table 8b.
MHANGURA COPPER MINES LTD (MCM):
PRODUCTION PROFILE (including Merits Ltd)

Year	Reserves [a]	Ore [Mtons]	Copper [Ktons]	Silver [Tons]	Gold [Kg]	Stocks [Ktons]
1975	260.5	2.64	20.1			8.6
1976	243.4	2.46	16.5			6.4
1977	235.5	2.20	15.1			3.9
1978	242.4	2.36	17.4			5.9
1979	231.9	2.27	16.6			5.2
1980 b)	234.2	2.18	14.5			4.4
1981	209.4	2.18	12.7			2.3
1982	226.5	2.15	17.6	28.9	172	2.2
1983	208.2	2.22	18.7	24.0	281	3.1
1984	191.4	2.16	18.5	25.5	258	2.9
1985 c)	182.0	1.51	12.6	19.0	197	2.6

a) Proven reserves in Ktons of copper contained.
b) Alaska refinery commissioned.
c) For 9 months ended 30:06:85.
Source: MCM, Annual Reports.

The Alaska smelter started up in 1959 and receives copper concentrates from the MCM and Merits mines, and some gold concentrates from Renco (RTZim.) and Jena (MCM) and, at times, copper slags (31% Cu) have been imported from the RSA (Messina, 1983). The contract for the purchase of 600 tons of concentrates (21% Cu) from the Mundunguara mine in Mozambique is under negociation.

The reverberatory furnace is fired with pulverised coal from Wankie and is fed with a mix of copper concentrates, dolomite and pyrites from Iron Duke mine (AAC). The 55% copper matte produced then goes to three converters (two in use) with silica flux and

refining scrap. From there it goes to the two coal fired anode furnaces, before being cast into anodes, ready for the refinery.

Until 1980 the copper was exported as blister (98% Cu%). In Nov. 1980 the refinery was opened with a capacity of 20 Ktons/an. high-grade cathode copper. The copper from the anodes is electroplated onto pure Cu starter sheets in sulphuric acid cells. The copper anode slimes containing Ag (58%), Au (0.6%), Pt, Pd and Se, are airfreighted to Johnson Matthey in the U.K. Local separation of the slimes was attempted but the recovery was lower than that paid for by Johnson Matthey.

Table 8c.

MHANGURA COPPER MINES LTD. (INCL. MERITS LTD.): LABOUR FORCE, OUTPUT PER WORKER

	Mining		Smelting & Refining	
	Labour	Ktons Ore	Labour	Tons Cu
Year	[a]	per Worker	[a]	per Worker
1975	4299	0.61	na	na
1976	4059	0.61	na	na
1977	3580	0.61	481 b]	31.4
1978	3266	0.72	294 b]	59.2
1979	2993	0.76	151 b]	109.9
1980	3256	0.67	159	91.2
1981	3660	0.60	181	70.2
1982	3561	0.60	218	80.7
1983	3397	0.55	234	77.0
1984	3230	0.67	257	72.0

a] Production data is for the year ended 31 Sept. and labour for the year ended 31 March.
b] Alaska smelter only.
Sources: MCM, Annual Reports, and Chamber of Mines.

The output per worker data (Table 8c.) shows little change for the mining operations, but there appears to be a steady decline for the smelter/refinery from 1980.

b] Corsyn Consolidated Mines Ltd. [Lonrho]

Inyati copper mine is owned by Corsyn Consolidated Mines Ltd. which is a wholly-owned subsidiary of Coronation Syndicate Ltd. registered in South Africa, which is in turn owned by Lonrho

PLC of the U.K.

Inyati is a small mine situated in the east of the country near Rusape. In 1984 2.9 Ktons of copper, 1.7 tons of silver and 66 Kg of gold were produced from 111 Ktons of ore. Proven reserves stood at 412 Ktons grading 2.86% Cu compared to 1,292 Ktons (2.01% Cu) in 1973. A small amount of copper is also produced as a byproduct from Corsyn's gold mine, Muriel (300 to 400 tons/an.).

Table 9a.
INYATI COPPER MINE: FINANCIAL SUMMARY (KZ$*), OUTPUT/WORKER (Tons).

Year 30 Sept.	Gross Revenue	Operating Profit	Capital Expend.	Mining Labour	Mining Output[a]	Smelting & Refining Labour	Smelting & Refining Output[b]
1970	3468	1531	1760	na	na	na	na
1975	9751	551	1439	1991	201.9	195	33.1
1976	8652	15	1272	1724	183.3	217	21.6
1977	7830	(907)	985	964	311.2	214	21.1
1978	5379	137	390	1119	169.8	146	21.6
1979	7286	1630	859	1227	158.1	138	23.5
1980	8540	800	1678	1337	144.4	152	19.5
1981	7523	(3405)	1952	1047	151.9	119	22.5
1982	7488	(4573)	100	794	142.3	121	17.8
1983	6149	52	(131)	710	146.5	121	21.8
1984	9290	(860)	195	729	152.3	118	24.5

* Converted from RSA Rand at the following rates (1Z$=): 1970-1.0 1975/6/7-1.34, 1978/9-1.2461, 1980-1.2031, 1981-1.339, 1982-1.499 1983-1.054, 1984-1.2113.
[a] Tons ore per worker. [b] Tons copper per worker.
Sources: Coronation Syndicate Ltd. Annual Reports.
Lonrho Zimbabwe (unpublished data on employment).

The mine has its own small smelter and refinery on site. The whole complex has been operating at a loss since 1980 due to low copper prices on the world market. A working loss is also forecast for 1985. Capital expenditure on the mine, smelter and refinery has fallen off radically since 1981 (Table 9a).

Ore production has fallen significantly since the mid-seventies (Table 9b.), copper output has halved and the total workforce is down to 39% of its 1975 level. Output per worker

(Table 9a.) for mining as well as for smelting/refining seems to be recovering after a low in 1982. The future of the operation is not very secure and it is expected to have to close down in a few years if low copper prices persist. The cut-off ore grade has already been increased from 1 to 2% copper, which decreased the reserve base considerably.

Table 9b.

INYATI COPPER MINE (CORSYN CONSOL.-LONRHO): PRODUCTION PROFILE.

Year 30 Sept.	Reserves [Ktons]a]	Ore [Ktons]	Copper [tons]	Gold [Kg]	Silver [Kg]	Muriel b] [Cu-tons]
1970	19.5	224	3688	98	2189	377
1975	20.8	402	6460	159	4845	432
1976	16.5	316	4696	124	3217	425
1977	14.2	300	4514	134	3137	417
1978	15.9	190	3146	128	2119	407
1979	16.1	194	3237	80	2147	405
1980	19.2	193	2964	70	1760	348
1981	17.5	159	2674	60	1629	345
1982	12.0	113	2152	43	1284	301
1983	13.3	104	2636	50	1404	334
1984	11.8	111	2885	66	1652	320

a] Proven reserves in Ktons contained copper (ore x grade).
b] Muriel gold mine produces copper as a byproduct.
Sources: Coronation Syndicate Ltd. Annual Reports, 1975-1984.

All the exported copper is marketed by the MMCZ through agents to consumers or direct to traders. Of 20,008 tons exported in 1984 90.8% went to Europe (mainly Italy and the FRG) and most of the remainder to Japan (9.2%). The price is LME related, but with the high grade (wire bar) premium. None is sold directly on the LME or any other metal exchange. The copper is railed to South African ports by the NRZ and SATS. The costs to f.o.b. are 77.74 UKP per ton, 7.06% of the f.o.b. value. A small amount of copper (2 to 3 Kton/an) is sold to local companies for further transformation (Cafca: wire and cables).

III.iv) TIN

Tin production of 1209 tons in 1984 was 4% of total mineral

production by value. Exports of 981 tons in the same year were 1.2% of total exports. Employment in tin mining was 4% of total mining in 1984 and the net output in 1982 was 3.2% of total mining.

Kamativi Tin Mining Company [IDC].

Almost all production comes from this mine. It is controlled by the state Industrial Development Corporation (IDC) which holds 91.3% of the equity. Negotiations are underway for its sale to the ZMDC at its book value.

Table 10.
KAMATIVI TIN MINING CO. (91.3% IDC)

Year 31 Dec.	Output Tons.Tin	Profit [Loss]	Capital Expend.	Tax	Labour [a]	Tons per Worker
1975	997	5.21	1.25	0	1548	0.64
1976	915	0.70	na	0	1396	0.66
1977	920	1.34	0.94	0	1388	0.66
1978	945	2.14	0.90	0	1578	0.60
1979	967	3.45	1.38	0.5	1627	0.59
1980	934	2.75	2.46	0.4	1635	0.57
1981	1157	1.39	2.85	0	1692	0.68
1982	1197	(3.00)	na	0	1709	0.70
1983	1235	(0.78)	na	0	1688	0.73

a] Output data is for the calendar year and labour for the year ending 31 March. Hence labour data from the following year has been used, viz: 1975 output over 1976 labour.
Sources: The Industrial Development Corporation, Annual Reports; CSO, 1985a (output data); Chamber of Mines (labour).

Small operations started on the Kamativi pegmatite in 1936. In 1952 Billiton (Shell) started the present mining operation. In 1970 the IDC took a majority share and in 1974 Billiton sold out completely leaving only one private holding, that of the Oakes Trust with about 8%.

The present capitalisation of the company is roughly 3 MZ$ and losses have been incurred since 1981, even with the relatively high price of tin over that period. The recent collapse of the ITC and the world tin price is likely to make the operation a major loss maker as its cut-off price is about 7500

UKP/ton. A MMCZ sale of tin in Dec. 1985 was at 6250 UKP/ton. This means that the government will most probably have to decide whether to subsidise the operation to maintain employment and foreign earnings, or to let it go bankrupt and close.

The ore is processed smelted and refined at the mine in the extreme west of the country. Jupiter brand high grade ingots registered with the LME are produced as well as some solder and white metal for the local market. The smelter also treats concentrates from small workings (about 3tons/month) and tantalum concentrates are produced from the slag. The mine could also potentially produce spodumene (Li) and beryllium.

There were 20 Mtons of reserves grading 0.18% tin at prices prevailing before the market crisis. The life at present prices is not known. Output per employee fell from 0.64 tons in 1975 to 0.59 tons in 1979, then steadily rose to 0.73 tons in 1983.

Tin exports are marketed by the MMCZ at the official LME settlement price for high grade tin. Railage costs are approximately 65 Z$/ton from Dett (the nearest railhead) to the South African port of Durban and ocean freight is about 76 Z$/ton to Europe, 171 Z$/ton to the USA and 100 Z$/ton to Japan. In 1984 981.14 tons were exported earning 16,335 KZ$ to Europe (50%), the USA (25%), Japan (22%), South Africa (2%), Zambia (1%) and Mozambique (4.6 tons, 0.5%).

IV. LABOUR

At the end of March 1985 9160 people were employed on copper, nickel and tin mines in Zimbabwe, down 36% on 1975 (Table 11a.). The average mining labour force between 1975 and 1985 was 11521, while during the same period three mines closed (Empress, Perserverance and Shamrock) and two new ones opened (Epoch and Shangani).

Table 11a.
EMPLOYMENT: NON-FERROUS METALS; MINES (31 March)

Year 31:3	Empr-ess	Pers-erve	Ep-och	Tro-jan	Madz-iwa	Shan-gani	Inya-ti	Sham-rock	LSM	MTD	Kama-tivi*	TOTAL
1975	1421	432		1863	1958		2108	858	2100	2199	1302	14241
1976	1451	267		1869	1007		2135	788	1934	2125	1548	13124
1977	1374		509	1266	1036	429	1671	818	1463	2112	1396	12079
1978	1344		523	1298	1063	452	1380	724	1271	1995	1388	11438
1979	1253		562	1351	1147	713	1043	78	1034	1959	1578	10718
1980	1282	316	568	1347	1081	1157	1292		1179	2077	1627	11926
1981	1195	351	531	1387	946	1174	1386		1296	2364	1635	12265
1982	1133		519	1371	901	1202	1094		1296	2265	1692	11473
1983	885		499	1295	895	1237	785		1296	2101	1709	10703
1984			634	1264	899	1189	705		1260	1970	1688	9609
1985			649	1260	797	1015	679		1219	1954	1587	9160
Av'ge	1260	341	555	1316	1066	952	1298	653	1396	2102	1559	11521

* Kamativi: includes smelter (10 to 20 workers).
Source: Chamber of Mines (safety competition).

Table 11b.
EMPLOYMENT: SMELTERS AND REFINERIES (31 MARCH)

Year 31:03	Empress Smelter	BMR Refinery	BSR S & R	Alaska Smelter	Alaska Refinery	Inyati S & R	TOTAL
1977	349	288	826	481		225	2169
1978	339	300	935	294		173	2041
1979	290	292	801	151		155	1689
1980	269	335	755	159		146	1664
1981	234	351	758	181		136	1660
1982	208	346	789	159	59	130	1691
1983	133	289	813	182	61	103	1581
1984			765	196	61	112	1134
1985			747	201	60	107	1115
Average:	260	314	799	223	60	143	1638

Source: Chamber of Mines, (safety competition)

Employment at the non-ferrous smelters and refineries has fallen 49% to 1115 from 1975 (Table 11b.). The average number employed between 1975 and 1985 was 1638 and in that period one smelter closed (Empress), one refine. opened (Alaska) and one closed then reopened at the end of 1985 (BMR).

Workers committees were instituted shortly after independence in 1980. The system appears to be running relatively smoothly after the initial problems of the first few years. The principal workers union is the Associated Mine Workers of Zimbabwe (. MWZ), which is affiliated to the Zimbabwe Congress of Trade Unions (ZCTU).

A large proportion of mine labour used to be foreign, but since independence most of them have been naturalised (previously Malawians and Mozambicans). The crisis has had a severe effect on the union; membership has fallen from roughly 30,000 to 20,000 representing about 40% of the workforce.

The new labour legislation (The Labour Relations Act) that came out in 1985 got a mixed response from both workers and management. From the workers point of view the positive aspects

of the Act are the right to join a union, protection from discrimination, protection of union officials from victimisation and that the employer will in future send union dues direct to the union and non members may be levied. On the negative side are severe controls on the right to strike and the wide discretionary powers given to the Minister of Mines who can now nullify union congress election results and control the use of union funds. In the opinion of the union the Act attempts to limit union struggle to economic objectives only thereby depoliticizing union activity.

Other legislation affecting mine labour is the Emergency Powers Act, the Pneumoconosis Act, the Workers Compensation Act and the Mines and Minerals Act which has a Health and Sanitation Regulation.

Table 12 gives the evolution of the safety record for mines from 1975 to 1985. The data refers to the whole of the mining industry as disaggregated figures for non-ferrous mining were not available, but these are not thought to deviate much from those for the industry as a whole.

Table 12.

MINING SAFETY: ACCIDENTS AND DEATHS, 1975 TO 1985

Year 31:03	Accidents [a]	Fatal	Workers [b]	Accidents/ K-worker*	Deaths/ K-worker*	Deaths per 100 accidents
1975	2994	31	42409	70.1	0.73	1.03
1976	3057	31	45089	67.8	0.69	1.01
1977 c]	3514	57	55800	63.0	1.02	1.62
1978	3229	39	55237	58.5	0.71	1.21
1979	2609	42	52816	49.4	0.80	1.61
1980	2576	37	54865	47.0	0.67	1.44
1981	2371	46	59675	39.7	0.77	1.94
1982	2074	24	59250	35.0	0.41	1.16
1983	2280	34	56826	40.1	0.59	1.49
1984	1997	26	50711	39.4	0.51	1.30
1985	1967	25	48691	40.4	0.51	1.27

* "K-worker": Kilo-worker = 1000 workers.
a] "accident": minimum of one or more shifts lost.
b] Including smelting and refining.

c] Including iron and steel, and ferrochrome smelting from 1977.
Source: Chamber of Mines.

The number of accidents per thousand workers (K-workers) decreased radically by 50% from 1975 to 1982 (35.0), they then appear to remain static until 1985 (40.4). Fatalities per thousand workers is more variable and shows no improvement from 1975 to 1981, but appears to have settled down at around one death per two thousand workers per year since 1982. The proportion of accidents that are fatal was at a low in 1976, reached a peak in 1981, then decreased to 1.27 deaths per 100 accidents in 1985 (Table 12.).

Table 13.
WAGES: MINIMUMUM MONTHLY WAGE; 1983 & 1985.

Grade a]	Minimum July 83	Minimum July 85	Max. % Inc. b]	% Inc. 83-85	Real % Inc. 1983-85 c]
1	105	143.75	19.97	36.91	+0.11
2	113	147.20	15.00	30.26	-6.54
3	121	156.40	15.00	29.25	-7.54
4	130	166.75	15.00	28.27	-8.53
5	141	179.40	15.00	27.23	-9.57
6	158	198.95	15.00	25.92	-10.88
7	177	220.80	15.00	24.75	-12.05
8	210	258.75	15.00	23.21	-13.59
9	315	359.10	14.00	14.00	-22.80
10	385	438.90	14.00	14.00	-10.60
11	500	570.00	14.00	14.00	-10.60
12	560	638.40	14.00	14.00	-10.60
13	620	697.50	12.50	12.50	-12.10
14	700	787.50	12.50	12.50	-12.10
15	800	900.00	12.50	12.50	-12.10
16	880	990.00	12.50	12.50	-12.10
17	960	1065.60	11.00	11.00	-13.60
18	1040	1154.40	11.00	11.00	-13.60

a] Grades 1-3: unskilled, 4-9: semiskilled, 10-13: skilled, 14-18: professional and managerial.
b] Maximum increase allowed by government.
c] The lower income group deflator has been used for grades 1 to 9 (36.8%) and the higher income one for grades 10 to 18 (24.6%). These deflators are for URBAN families while most mines are rural or semi-rural and have significantly subsidized services (housing, electricity, water, etc.).
Sources: Chamber of Mines (unpublished data).
QESR Vol.6 No.2 1985, Reserve Bank of Zimbabwe.

Since 1980 permission from the Ministry of Mines has been necessary in order to fire or lay-off a worker. The minimum monthly wage increased from 27 Z$ in 1977 to 58 Z$ in 1981 (+115%), to 105 Z$ in 1982 (+81%), then to 143.75 Z$ in 1985 (+37%). In real terms these increases are +66%, +59% and +7% respectively. The deflated increase over the whole period, 1977 to 1985, is 272% (432% in current terms). A comparison of all the minimum wage scales for mining for July 1983 and July 1985 is given in Table 13. It is important to note that all except the lowest grade have decreased in real (deflated) terms.

It should also be noted that allowances for long service, working conditions, etc... are calculated by the industry to add, on average, 40% to the minimum scales. Also, the industry asserts that, again on average, 49.8 Z$ exists as payments in kind in the form of subsidised housing and other services. This would mean that the "average" miner on the minimum scale is receiving 251 Z$/month, but the deflated increases would still hold true as presumably these subsididdies are calculated against the "market" value for these services and would also increase accordingly.

The frequency of expatriates on foreign contracts is extremely low, being zero for most mines. The frequency of professionals holding a foreign passport but working under a local contract is significant, but the number of professional and managerial staff from the "settler" section of the population is extremely high at around 90%. Almost no training of the indigenous population was undertaken during the colonial/settler period. This has improved over the last 10 years, but it will

still be a long time before the mining industry has a majority of indigenous professionals and managers.

V. MARKETING

Before 1983 marketing was done by the companies, usually through agents in the OECD countries. Up until the beginning of 1980 sanctions were applied to the then Rhodesia, so the marketing methods tended to be somewhat devious and clandestine. Since 1983 all mineral exports, except gold, have been controlled by the Minerals Marketing Corporation of Zimbabwe (MMCZ). It was formed in June 1982 and started operating in March 1983. It buys and resells the minerals, authorizes producers to sell or acts as an agent for the producer.

Initially the MMCZ was viewed with a high degree of mistrust by the companies, but after its first three years of operation they appear to have come to terms with it, especially as, in many cases, the old agents and channels are still being used.

In the year ended 30 June 1985 the corporation's sales as an agent totalled 560 MZ$ and sales on its own account 0.72 MZ$. In 1983 it made a small loss (219 KZ$), a profit of 2.1MZ$ in 1984 and a profit of 2.7 MZ$ in 1985. Most of its revenue is derived from commissions on sales as an agent. The MMCZ's structure is determined by the MMCZ Act of 1982. The chairman of the board is the Permanent Secretary for Mines. All staff, except for two recruited and stationed abroad, are locally recruited and are permanent residents of Zimbabwe.

Virtually all non-ferrous metals destined for overseas markets are transported by rail to South African ports for shipment (usually Port Elizabeth or Durban). Before 1976 most

mineral exports were routed via the closer Mozambican ports of Maputo and Beira, but due to direct South African sabotage and South African backed destruction of these routes, they have not regained their previous prominence as export outlets. This has forced Zimbabwe to use the more distant South African ports, clearly at that country's discretion.

The instability of the southern routes has motivated Zimbabwe to attempt to make the Mozambican routes functional. The first step in this regard was the sending of troops to help guard the Mutare-Beira corridor and the second, the reconstruction of the railway line jointly with the Mozambican Railways, due for completion in June 1986. Unfortunately the port of Beira's ability to handle bulk mineral cargo is limited, both in terms of the port's handling facilities and the limited tonnage of ships that can enter the port (25 Ktons). Maputo is more suited for mineral exports but the security of the line is more difficult to maintain as for 500 Km it runs between 50 and 100 Km from the South African border. Recently some minerals have been exported from Maputo, but routed via South Africa.

VI. LEGISLATION

Mineral Rights: The right of searching for and mining of all minerals is vested in the President, in terms of the Mines and Minerals Act. To prospect a prospecting licence or an Exclusive Prospecting Order (EPO) must be obtained. It is valid over a defined area, for a limited time period and for the defined mineral/s only and from this right stems the right to peg a claim and dispose of the minerals won. The landowners fees for the area of ground covered by the claims are paid by the government, but are nominal at 4 to 9 cents per hectare.

Taxation: In terms of tax, repatriation of profits and other fiscal matters the mining companies fall under the general laws governing these aspects for the whole of the economy. Income tax is 45% of the taxable income of the company. In terms of mining companies the following allowances apply: They can deduct the initial capital expenditure in one year or over a number of years over the life of the mine; expenditure incurred in exploration can be deducted immediately or carried forward and allowed against subsequent mining income; a depletion allowance of 5% of the value of mineral production is also deductable. Other general, not mining specific, allowances also apply. Companies incorporated outside Zimbabwe are subject to a branch profits tax of 8.4% but a locally incorporated subsidiary of a foreign company is not liable. Legislation exists for the payment of royalties by mining companies at the rate of 4% of output value but has apparently not been applied for about 10 years.

Repatriation: New foreign venture capital may be fully repatriated after two years after deducting amounts already remitted. The balance can then be remitted over six years in equal amounts. Existing foreign companies can repatriate 50% of after tax profits as dividends which are then subjected to a non-residents shareholders tax of 20%. An exemption exists in the case of mining companies which may apply for a larger portion to be remitted in view of the wasting asset nature of the investment.

Borrowing: Companies with more than 15% foreign ownership may not borrow locally more than 15% of the shareholders funds or they lose the right to repatriate profits. This is to encourage foreign concerns to bring new, foreign, capital into the country for new capital investment. It also encourages locally incorporated foreign companies to raise capital for local expansion by increasing the equity base locally, thereby diluting the foreign holding.

VII. ENERGY

The principal forms of energy consumed by mining, smelting and refining are electricity, coal, petrol and diesel. Of these the most important is electricity supplied by the Electricity Supply Commission (ESC).

In 1983 45% of the total ESC supply went to mining if the ferrochrome smelters are included (about 2000m kWh) and in 1983/4 non-ferrous metal mining and processing consumed 519m kWh, 43% of the total for mining (excluding ferrochrome).

Table 14a.
NON-FERROUS MINING, ESC SALES (m.kWh)

Consumer	1982/3	1983/4	% Change
Nickel	378.59	318.52	-15.87
Copper	156.28	155.48	- 0.51
Tin	44.78	45.30	+ 1.16
Total Non-ferrous	579.65	519.30	-10.41
Total Mining*	1255.45	1199.98	- 4.42
% Non-ferrous	46.17%	43.28%	- 2.89

* Excluding ferrochrome smelting.
Source: ESC, Annual Report 1984.

Electricity charges have increased almost five-fold in current terms since 1979. This has mainly been due to the 1 MZ$ Hwange Power Station (HPS) project. The total outstanding loans of the ESC stood at 567 MZ$ in mid-1984 of which 63% were foreign denominated. This large foreign component means that in Z$ terms the loans have increased appreciably due to the devaluation of the local currency in the last few years (63% against the US$ since 1980).

Table 14b.

NON-FERROUS MINES, ESC SALES (KZ$)

Mine	1974/5	1976/7	1978/9	1980/1	1982/3	%Change*
Trojan	774.5	2140.9	2158.6	2800.6	4231.4	96.0
Madziwa	245.5	300.8	364.6	490.5	696.9	91.1
Shangani	75.0	348.2	451.3	697.5	1073.8	137.9
Epoch	16.0	173.0	227.1	301.0	468.5	106.3
Mhangura	610.1	770.4	972.0	1219.0	1921.2	97.7
Lomagundi	523.4	602.3	550.5	711.3	1265.7	129.9
Kamativi	221.0	312.2	440.0	588.1	1087.4	147.1

* % Change from 1978/9 to 1982/3
Source: ESC.

From the above table it is clear the electricity costs for the mines have increased considerably up to 1982/3. Since then there have been further major increases. The next table gives the increases for Tariff 6 (300 to 10000 kVa) and Tariff 7 (>10000 kVa) which includes the mining industry.

Table 14c.

ESC CHARGES (01:1979=100)

Tariff	07:79	07:80	01:81	08:82	10:82	01:83	07:83	09:85
6	126.2	138.0	154.0	163.0	218.0	266.5	388.4	484.3
7	127.4	139.3	155.5	164.5	220.0	390.8	393.3	490.8

Source: ESC.

From this table it is clear that electricity charges have increased significantly faster than general inflation (110% over the same period). In real (deflated) terms electricity charges have more than doubled from 1979.

These increases have put severe pressure on non-ferrous mining, especially as they came as the world recession set in. In the past the mining industry has been based on relatively cheap electricity and labour. Since 1979 the minimum wage has only increased 137% compared to a staggering 390% for electricity. While wage increases of this order in the post settler period are justifiable, the logic behind the erection of the HPS and the concommitant massive increases in electricity charges, has been

questioned in several quarters.

It appears that the HPS was thought to be necessary on the basis of totally unrealistic consumption projections for both Zimbabwe and Zambia (formerly a major source of Zimbabwean power from its share of Kariba). Also, the Mozambican potential at Cahora Bassa was not considered. The north bank of this dam, 325 Km from Harare, could generate 1600 mW once the turbines are installed, at a fraction of the capital and recurrent costs of the HPS. But, at the end of the day, it seems that the logic of self-sufficiency finally won out, with some help from The World Bank who did the original study.

VIII. NON-FERROUS METAL TRADE

As mentioned, the non-ferrous metals of Zimbabwe are all processed into their pure form before export onto the world markets. Virtually no concentrate, matte, leach alloy or blister is exported. Hence the linkages between mining, processing, smelting and refining are very high, but the downstream linkages to the local metal transformation industry are very low and a variety of non-ferrous semi- and finished products are imported. Also, several non-ferrous metals are not produced (lead, zinc and aluminium) and hence all requirements are imported.

Copper: In 1984 22.6 Ktons of high grade copper were produced. Of this about 10% went into local industry and the rest was exported. In 1983 about 1500 tons of copper and copper alloy products were imported, excluding 944 tons of copper matte and 785 tons of copper slag imported for the local refining industry (Table 15a.). The import of several products has shown a marked decline since 1975, such as Cu alloy bar and rod, while others have increased, such as Cu alloy sheet.

With an imported consumption of 1.5 Ktons, the scope for further import substitution is somewhat limited, however there clearly exists greater scope for further transformation for export. It should also be borne in mind that Table 15a. only represents those imports classified as copper/brass/bronze based. There is clearly a large amount of copper imported in goods not classified as metal based, such as electrical equipment and machinery.

Table 15a.

TRADE IN COPPER & COPPER BASED COMMODITIES (KZ$)

	1980		1983	
Commodity	Tons	Value	Tons	Value
Cu matte			944	567
Cu slag	200	20	785	278
Cu oxide			54	85
Cu, unrefined			97	107
Cu/alloys*, unwrought			6	188
Cu bar/rod	80	306	60	160
Cu alloy bar/rod	50	103	2	3
Cu alloy pipes/tubes	8	36	1	4
Cu sheet	191	491	180	394
Cu alloy sheet	100	246	385	135
Cu tubes	140	468	84	243
Cu pipe (fittings)			22	124
Cu alloy pipe fittings	22	106	6	27
Cu/Cu alloys	43	116	74	209
Cu manufactures	--	418	--	312
Insulated Cu cable/wire	44	129	93	418
Cu wire/cable	697	1598	1087	2350
Brass wire			5	16
Exports:				
Cu slimes/ore/concentrates			3125	13947
Cu waste/scrap			124	119
Cu anodes	2313	2208	601	1105
Cu cathodes/bar/ingot	592	652	229579	31010
Cu refined	4140	4034	1316	1542
Cu/Cu alloys	91	108	110	86
Cu alloys bar/rod	133	194	18	7
Cu alloys sheet			17	9
Cu blister	15960	17674		

* Alloy: brass and bronze.

Source: CSO, Statement of External Trade.

Table 15b.

TRADE IN NICKEL & NICKEL ALLOY COMMODITIES (KZ$)

Commodity	1975 a]	1980		1983	
Imports:		Tons	Value	Tons	Value
Ni mattes/sinters				7904	11446
Ni sulphates		15	25	103	86
Ni bar/rod/angles/etc.				19	92
Ni plate/sheet/strip/foil				12	107
Ni tubes/pipes/blanks					14
Ni electroplating anodes					32
Ni not specified				3	18
Ni/Ni alloys		120	156		b]
Exports:					
Ni/Ni alloys		14449	52754	16237	67771

a] Import figures for 1975 are under "miscellaneous non-ferrous

base metals" and not further described.
b] Imports for 1980 are grouped under "Ni & Ni alloys".
Source: CSO, Statements of External Trade.

Nickel: Most nickel imports are in the form of Cu-Ni matte for refining in Zimbabwe. The matte was imported from Botswana (BCL) in 1982/3 to be refined at BSR (RTZim.) at Eiffel Flats. Deliveries recommenced late 1985. Other than matte very little nickel is imported (about 150 tons/an), offering very limited scope for local transformation for the national market. A small amount of locally produced nickel is used by local foundries for ferrous alloys. A project for the production of nickel wire for export is under consideration by BNC and, in the longer term, the possibility of manufacturing stainless steel for the local, regional and world market is being investigated as Zimbabwe produces steel, ferro-chrome, nickel and coke.

Table 15c.
TRADE - TIN AND TIN BASED COMMODITIES (KZ$).

Commodity	1980		1983	
Imports:	Tons	Value	Tons	Value
Sn foil/sheets/strip			72	42
Sn bar/block/ingot	76	32		1
Sn solder	5	56		
Exports:				
Sn bars/rods/sections/etc.	890	8610	845	6467
Sn solder	9	20		1
Sn not specified			73	129

Source: CSO, Statement of External Trade.

Tin: From Table 15c it is apparent that as there is no rolling mill in the country most tin imports are in the form of sheet, foil and strips, but it should also be borne in mind that a large amount of tin comes in in the form of tin plate. Most of the country's solder and white metal requirements are produced from local tin. The advent of a steel rolling mill, at present under consideration, would put the manufacture of tin plate on the agenda. In 1980 roughly 8 Ktons of tinplate were imported and in 1983 about 10 Ktons.

Lead, zinc and aluminium are not produced in Zimbabwe but are used in significant quantities by the local metal industries. Bauxite is mined on the eastern border of the country at Penhalonga, but is used for the manufacture of aluminium sulphate for water treatment.

Zinc: In 1983 about 3 Ktons of zinc, zinc alloys and oxide were imported (Table 15d.). Zinc dust/shavings is manufactured locally from imported zinc. It is mainly used in gold processing, but over the last six years demand has been falling as mines have gone over to the carbon-in-pulp and carbon-in-solution processes. Zinc is also used by the metal industries for galvanizing, in alloys and by the paint manufacturers.

Table 15d.

TRADE IN ZINC AND ZINC BASED COMMODITIES (KZ$)

Commodity	1980		1983	
Imports:	Tons	Value	Tons	Value
Zn fume/dust/shavings	51	45	7	10
Zn waste/scrap			22	22
Zn oxide	413	277	533	470
Zn pipes/bars/tubes/etc.			19	44
Zn ingots/bar/spelter	2425	1395	1399	1117
Zn sheet	226	300	395	612
Zn/Zn alloys	106	94	351	252
Exports:				
Zn fume/dust/shavings	289	40	240	59
Zn waste/scrap			22	7
Zn unwrought	155	49	5	18
Zn plates, sheets/foil/strip			16	20
Zn bars/rods/angles/wire			2	3

Source: CSO, Statement of External Trade.

The ZMDC is in the process of considering a new mine, Copper Queen, 60 Km west of Alaska. The ore grades at 1.3% Cu, 1% Pb, and 3.4% Zn, with significant amounts of silver. Reserves stand at 8 Mtons of sulphide ore and the cost of bringing the mine into production is estimated at 32 MZ$ with a three year lead time. This would make the country self-sufficient in lead and zinc

which are presently imported from Kabwe in Zambia. As yet no final decision has been taken on whether to go ahead with the project. The main problems appears to be the complex mineralogy of the ore and in raising the capital.

Lead: The principal importers of lead are the battery manufactures, the main one being Chloride Zimbabwe (Pvt) Ltd. Lead salts are consumed by the paint industry. In 1983 518 tons of lead bar and ingots were imported (Table 15e), mainly from Zambia. Lonrho Zimbawe is at present investigating the possibility of producing lead at their gold mine, Redwing, on the eastern border of the country. The lead is mined at present for the gold and flotation tests are being carried out to produce a suitable lead concentrate.

Table 15e.

TRADE IN LEAD AND LEAD BASED COMMODITIES (KZ$).

Commodity	1980		1983	
Imports:	Tons	Value	Tons	Value
White lead	19	21	164	27
Pb dioxide	90	71	13	16
Pb oxide	38	42	65	72
Pb unrefined			52	92
Pb bar and ingot	702	565	518	224
Pb tubes/pipes/fittings			4	13
Pb sheet/foil	60	80	30	49
Pb foil/powders/flakes			6	23
Pb/Pb alloys				296
Pb waste/scrap			155	56
Exports:				
Pb bar/ingot				2
Pb tubes/pipes				3
Pb alloys			56	42
Pb other			5	11

Source: CSO, Statement of External Trade.

Alumunium: Roughly 4 Ktons of aluminium are imported per year in various forms, but mainly as raw metal as there is a fairly diverse transformation industry in the country. The main importer is Aluminium Industries (Pvt) Ltd. who manufacture

extruded sections, pipes, rod, etc. and roll foil. They also supply Cafca with between 1 and 2 Ktons of Al rod/an. At present no plans exist for the local production of alumina or aluminium as the country has no significant bauxite deposits.

Table 15f.

TRADE IN ALUMINIUM AND AL BASED COMMODITIES (KZ$)

Commodity	1980		1983	
Imports:	Tons	Value	Tons	Value
Al oxide			8	22
Al/Al alloy pipes/tubing			2	9
Al bar/rod/ingot	2327	2909	39	114
Al circles	12	40	4	32
Al foil/leaf	22	30	36	151
Al tubes/pipes			107	113
Al powder/flake/paste	103	235	215	708
Al sheet	1120	1941	908	1735
Al extruded sections	19	47	3	12
Al/Al alloys	55	46	2264	3447
Al other			249	670
Exports:				
Al/Al alloys	27	94	286	196
Al bar/rod/ingot			67	67
Al foil/leaf			27	85
Al tubes/pipes			18	17
Al extruded sections			31	42
Al door/window frames			8	41
Al other structures			6	36
Al wire/cable			1	3
Al other				35

Source: CSO, Statement of External Trade.

IX. NON-FERROUS METAL TRANSFORMATION

As there are a myriad of companies that consume non-ferrous metals, only the principal ones which consume significant amounts will be treated here.

Central African Cables (Cafcal:

This company, based in Harare, is by far the largest consumer of copper in the country. In 1985 roughly 2.2 Ktons of copper were purchased from MCM and Inyati. The company is 75% owned by BICC of the UK with 18% local equity and 5% South African. The main products are copper and aluminium cable and wire, insulated and bare. The technology employed is medium to high and the company receives some technical assistance from the mother company. The main processes are wiredrawing, extrusion and stranding. Investment of 5 MZ$ for an Outokumpu up-casting process is planned for 1986. The financial profile of the company for 1975 to 1985 is presented in Table 16a.

Table 16a.
CENTRAL AFRICAN CABLES LTD.

	Financial Profile (MZ$)					Inputs (Tons)	
Year	Turnover	Capital Employed	Profit	Tax	Fixed Assets	Labour	Metal Consumed Cu	Al
30:06								
1975		3.43	1.88	0.87	0.94		3202	2087
1976		3.82	1.77	0.73	1.00		4098	496
1977	7.60	3.94	1.46	0.63	0.97		3211	669
1978	7.25	5.09	1.52	0.58	1.94		2024	549
1979	8.10	5.43	2.17	0.97	1.93		2436	329
1980	12.26	5.91	3.32	1.58	2.06	371	2299	1085
1981 a]	14.58	6.37	4.01	2.02	2.05	361	2774	1264
1982	20.21	8.31	5.08	2.45	na	397	3175	2175
1983	18.81	9.19	3.89	1.50	6.20	453	2288	1731
1984	20.62	10.43	3.45	1.03	8.35	420	1771	1804
1985	23.67	12.12	4.08	2.31	8.92	360	2195	1249

a] Name changed from Rhodesian Cables Ltd. to Cafca.
Source: Cafca Ltd., Annual Reports.

Table 16b. also gives the evolution of their raw material consumption from 1975 to 1985. Copper consumption peaked in 1976 at 4.10 Ktons and fell to a low of 1.77 Ktons in 1984. Aluminium consumption is as erratic due to increases when large power line projects are being built and drops in years without major cable consuming projects. The aluminium is supplied by Aluminium Industries (Pvt) Ltd. The evolution of the prices of the principal inputs is given in Table 16b. It should be noted that the rapid price increases since 1981 are due to the devaluation of the Z$, 58% against the US$ from 1981 to 1985, as the prices paid are LME based.

Table 16b.
CAFCA: EVOLUTION OF INPUT PRICES, 1975-1985 (Z$).

Material	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Copper	671	778	763	739	964	1200	1300	1300	1500	1750	2200
Aluminium	678	829	1004	1132	1357	1550	2080	2080	2300	2392	3300
Armour Wire a)		---na---				945	930	940	1180	1300	1794
PVC b)		---na---				850	800	835	1015	1300	1300

a) 0.9mm armour wire from Haggie Wire and Rope Ltd.
b) PVC from Treger Products (Pvt) Ltd.
Source: Cafca Ltd.

Most of Cafca's production is for the local market (90%) mainly to the Electricity Supply Commission (ESC) and to the National Railways of Zimbabwe (NRZ), for the rail electrification scheme. Exports are usually about 10% of production but fluctuate significantly, going up to a maximum of 45% of production, depending on orders which are usually "one-off" rather than regular. Most export is to the regional market where most of the countries suffer from acute foreign exchange shortages, hence the variability in orders from year to year. As Cafca is more than 50% foreign owned it does not benefit from the PTA tariffs agreement. Cafca is also in direct competition with Zamefa of Zambia on the regional market, for many of its copper cable and wire ranges.

At present Cafca is considering expanding their range to include telephone cables for the regional market (Zamefa is already producing telephone cables) and within the next 10 years they hope to be able to produce high voltage insulated cables (11 KV). The company would like to export to Europe but cannot, as the parent company (BICC) will not permit it to, as this would bring them into direct competition.

There are numerous small companies producing copperwares for the ornamental and tourist market. These companies work copper sheeting which is imported as there is no local rolling mill. There are also several foundries producing non-ferrous alloys (brass, bronze, white metal, gun metal, etc.), but these generally use copper scrap rather than high grade cathodes from the mining industry.

Non-ferrous Metal Works (Zimbabwe) (Pvt) Ltd.: The company is based in Herare and is 100% owned by Metramet of the UK. It began operations in 1957 and by 1983 its turnover was 3.3 MZ$ with a total capital employment of 1 MZ$. In the same year profits stood at 0.7 MZ$ and the company employed 110 people. The principal mineral inputs are silicon (RSA), antimony (RSA), lead, zinc (Zambia), copper scrap (Zimbabwe) and aluminium billets (Aluminium Industries, Zimbabwe). In 1982 consumption of inputs was: roughly 2.5 Ktons of non-ferrous scrap, 75 tons of lead 50 tons of zinc, 10 tons of silicon and 3 tons of antimony.

The principal products are non-ferrous alloys and cast copper and aluminium alloys. Present production is at 80% of capacity, of which 60% is for the home market and the rest is exported. The main customers are Zisco, the mining houses (lead anodes, bronze empellors), battery companies and local foundries. The company holds 30 to 40% of the local market, the main competitors being Metal Sales Co. (Pvt) Ltd. and various small foundries. The total staff of 110 is local and the skilled to unskilled ratio is 1:6.

All Metal Founders (Pvt) Ltd.: This is a private (family) company based in Bulawayo with a turnover in 1983 of 900 KZ$.

fixed assets of 180 KZ$ and profits of 150 KZ$. Production in terms of turnover is: ferrous castings 25%, non-ferrous castings 5%, sanitary ware 15%, agricultural implement components 10%, brake drums 10%, phosphor bronze 10%, and solid fuel stoves 10%. The principal raw materials are pig iron (Zisco), coke (Wankie), limestone, ferrous scrap, non-ferrous scrap and tin (Kamativi). The company holds 20% of the local market for sanitary ware and nearly 100% for presses. The total labour force of 130 is local of which 70% is unskilled. About 3% of production is exported.

Menashe and Son (Pvt) Ltd. is a small private company in Bulawayo. The products are; general engineering, 75% of turnover, resincord solder 20% and casting moulds 5%. The annual turnover is roughly 200 KZ$. The main inputs are lead (Zambia), tin (Kamativi), pig iron (Zisco), aluminium (Al Industries) and brass (Radiator and Tinning). All production is for the home market except for solder, 25% of which is exported to the RSA. All of the staff of 50 is local.

Non-ferrous Die Casting (Pvt) Ltd is a private company which started up in Norton (near Harare) in 1971 and had a turnover of roughly 1.0 MZ$ in 1982. Production in terms of turnover is: plumbing fittings 50%, electrical fittings 20%, marine fittings 10%, irrigation fittings 20%. The main inputs are non-ferrous scrap, copper and copper alloys, zinc, coal and coke. The principal customers are the building industry 50%, ESC and Capco 20%, irrigation equipment manufacturers 20% and boat builders 10%. All production is for the local market except for marine fittings which are exported to the RSA. All of the staff of 100 are local.

Flowerday Industries (Pvt) Ltd of Bulawayo, commenced operations in 1966 and had a turnover of roughly 1,5 MZ$ in 1982. The products are destined largely for the building and furniture trade; brass stampings 50%, pressure die castings 5%, domestic fittings 22% and fancy goods 23%. The main raw materials are brass sections (local), zinc ingots (Zaire), copper sheet (Europe), brass ingots (local), steel strip (imported) and coke (1.3 Ktons/an, Wankie). All production is for the local market except for window fittings, where about 40% goes to the RSA and 2% to Malawi. The work force of roughly 130 is all local.

Cecon Enterprises (Pvt Ltd., a Bulawayo company, is 30% owned by the IDC and is a major producer of non-ferrous metal based products. In 1983 sales were 1.4 MZ$ and profits were 128 KZ$. The principal products are copperoxychloride 660 tons/an (fungicide for coffee plants), copper sulphate 500 tons/an (activator for flotation and for animal feeds), zinc sulphate 250 tons/an (trace element for fertilizers), zinc chloride 130 tons/an, zinc ammonium chloride 70/an tons (both for galvanizing and soldering) and zinc dust and shavings 160/an (for processing gold ore and for paints). A major investment of 5 MZ$ is underway which will increase capacity for the regional market (at present 5.4% of output). Once completed copperoxychloride production will increase to 1320 tons/an, zinc sulphate to 500 tons/an, zinc chloride to 260 tons/an, zinc ammonium chloride 140 tons/an, zinc dust and shavings 200 tons/an.

The main annual inputs are copper scrap 350 tons (local), copper cathodes 150 tons (Inyati), zinc spelter 200 tons and zinc galvanizing ash 160 (both are a byproduct of galvanizing). After

the expansion, consumption of these inputs will increase to 610 tons of copper scrap, 300 tons of cathode copper, 250 tons of zinc spelter and 300 tons of zinc ash. The principal obstacle facing the company at present is the acute shortage of suitable local scrap on the market.

Radiator and Tinning (Pvt) Ltd. is based in Bulawayo and is 100% owned by the Hodgskin family. The company started out in 1956 and has a present annual turnover of roughly 5 MZ$ and fixed assets of about 1.6 MZ$. The principal production lines are radiators (70% of turnover), metal fabrication (20%) and non-ferrous metal and alloy products (10%), mainly extruded brass tubes, bar, sheets and rods. The inputs consumed are non-ferrous scrap (local), tool steel (imported), copper billets (local), zinc (imported), lead (imported), tin (Kamativi), brass and copper radiator strip (imported), steel sheet and strip (imported) and steel shapes (Zisco). The main customers are vehicle assembly plants, engineering shops, brass processors and hardware wholesalers. Transport takes roughly 20% of production, industry 75% and agriculture 5%. The company has 100% of the local radiator market and about 75% for their non-ferrous products. Out of a total local labour force of 450, 30 are skilled, 340 semiskilled and 80 unskilled. About 25% of the radiator production and 10% of non-ferrous metal production is exported to South Africa, and 15% of non-ferrous output is exported abroad.

Tinto Industries Ltd. is a wholly-owned subsidiary of Rio Tinto Zimbabwe Ltd. and produces a wide range of products, principally ferrous, but has a small non-ferrous section. The

main divisions of the company are: agricultural implements, trailer, chemicals (including mining chemicals), irrigation and, works and engineering. In 1984 the company had a turnover of 15.24 MZ$ and made a loss of 107 KZ$, principally due to the drought which caused a fall in demand for products to agriculture. The main non-ferrous products are aluminium irrigation equipment, brass castings and domestic copper fittings. The principal non-ferrous inputs are aluminium ingots, brass and copper, together about 50 tons/an, with a value of roughly 750 KZ$.

Chloride Zimbabwe (Pvt) Ltd. is a major consumer of lead for the production of wet cell batteries. The company is based in Harare and is owned by the mother company in the UK. Roughly 750 tons/an of lead is imported from Zambia and Zaire and significant amounts are reclaimed as scrap from old batteries and smelted at the factory. Local stibnite is used for antimony and the company has plans to become vertically integrated to produce all the battery components in future. The company has a turnover of about 3 MZ$ in 1984, almost all as batteries. At present the company is liaising with Lonrho regarding the possible production of lead concentrate from the Redwing gold ores.

Aluminium Industries Ltd. is the country's principal aluminium consumer and is 38% owned by the IDC, 49% by Huletts Aluminium of South Africa and 15% by Zimbank. The company is based in the outskirts of Harare in Southerton. In 1983 it had sales to the value of 9.8 MZ$ and profits of 944 KZ$ which was down on 1982 (11.7 and 1.81 MZ$) due the low demand for irrigation equipment caused by the drought. The company started

out in 1968 virtually as the local agent for Alcan products then progressively started to manufacture various Al semis and finished goods from imported billets and sheet. In 1982 it acquired Toolmaking and Diecasting (Pvt) Ltd. for 400 KZ$, increasing its range of products.

Output in terms of turnover is: foil 12%, extruded Al products 39%, extruded 13 mm rod for Cafca 32%, sheet for resale 6% and seam-weld tube for irrigation 11%. The diecasting division produces roughly 100 tons/an of Al casts, mainly irrigation fittings. The level of technology is medium to high and the principal processes used are: the extrusion press (FRG), the foil mill (second-hand from RSA), the remelting furnace (UK) and the anodizing tanks (local). Facilities for copper and copper alloy extrusion, cold drawing and milling are planned and will have a capacity of 3.6 Ktons/an. The new facility will cater for most of the, presently imported, copper tubing demand. The company has a technical and consultancy agreement with Huletts (RSA) and with Vereinigte Metallwerke (Austria Metall AG) for the planned copper processing.

The company holds virtually 100% of the market for its main products. Its principal customers are agriculture (irrigation), the building industry (frames and fittings), energy (Cafca, Al rod) and transport (Zambezi Coachworks- Lonrho). The only non-ferrous metal input is aluminium (in future cathode copper) consumption of which has steadily increased from 900 tons in 1975 to 3900 tons in 1985 and is all imported in the form of sheet and billets, from a wide variety of sources including the RSA (Alusaf), Bahrain, Norway, USSR, France and Spain for billets,

while the sheet comes from Hullets. In house waste is also recycled to the furnace. Of the total labour force of 174, 55 are white collar/skilled and 119 semi and unskilled (ratio 1:5).

The new expansion will cost roughly 5 MZ$ most of which will come from the company's capital reserves. It will roughly double the local consumption of copper cathodes bringing it up to 30% of total refinery production. The expansion has been initiated with the regional (SADCC/PTA) market in mind. Other future plans are to increase the diecasting facilities (from gravity to presses), acquisition of a milling machine for the diecasting (due in 1986), and, in the long term, the acquisition of an Al sheet mill, but the price of roughly 25 MZ$ is beyond the company's present capability.

There are many more smaller enterprises transforming non-ferrous metals not described here, especially in the field of wares for domestic use and tourism which generally use imported high quality sheet. Most of the non-ferrous foundries use local scrap rather than the more expensive cathodes, but the recent shortage of scrap has started to push the price to levels where cathodes may become more attractive. Also not described are the several large ferrous foundries which have a minor non-ferrous consumption but which have considerable backward linkages with non-ferrous mining, smelting and refining in terms of equipment inputs.

X. DISCUSSION

From the description of the transformation plants in section VIII, it is apparent that Zimbabwe has a considerable capability for producing non-ferrous semi and finished goods, but generally on a small scale for the local market within an overal strategy of import substitution. The forward linkages to the other sectors of the economy, such as agriculture, transport, energy and construction are high, while the backward linkages to local metal suppliers are low. More than half the non-ferrous metal inputs to the transformation industries are imported even though three are mined in the country. Although about 15% of copper and 10% of tin production is consumed locally, significant amounts of these metals are still imported as for example copper sheeting and tin plate (Tables 15a to 15e). Almost no nickel is consumed locally as the local steel industry does not as yet produce steel alloys.

The technological dependence on the developed world is relatively low for an economy of this size. Many of the processes were locally developed or adapted for the local market. During the UDI period foreign patents and processes were copied with impunity. It was only after independence that these had to be paid for, but by then the in house grasp of the technology had often developed to a level where the specific patented technology was not necessary. Some companies only discovered recently that they were using a patented process. As it was difficult to import technology from the source during UDI, local and sometimes initially uneconomic, technology was developed, resulting in a

situation today of a low degree of technological control by the developed countries. Much of the basic equipment, such as furnaces, is manufactured locally, but equipment like machine tools has always been imported.

Non-ferrous mining and mineral processing are generally assumed to have two principal roles in the industrialization of a developing country. By far the most important is usually to export minerals to the developed economies and thereby generate capital in the form of foreign currency for the development of the rest of the economy. In some cases mines are opened by companies from the industrialized nations specifically to supply raw inputs to their industrial plants in their country of origin. The second, and usually minor role, is to supply the necessary mineral raw materials for local resource-based industrialization.

Zimbabwe exports over 90% of the total value of its non-ferrous minerals. In 1983 mineral and crude metal products constituted 44% of total exports of raw iron and steel, ferro-chrome and other alloys, coke and cement are included, of which non-ferrous mining contributed 23%. Crude minerals constituted 8.0% of total exports, refined metals, alloys, cement and coke 26.8% and gold 9.1% (Table 2), thereby making the mining sector the largest generator of foreign exchange (504 MZ$ in 1983), followed by agricultur

A small fraction of the non-ferrous metals are consumed by local industries. The situation is somewhat better for for iron and steel (20%), coal (90%) and a high proportion of some of the minor minerals are used locally (eg. phosphates, baukite, limestone and other industrial mineral).

It can therefore be stated that the bulk of the non-ferrous mining industry is vertically integrated into the economies of the developed western countries rather than into the local economy and that where there is some local transformation of minerals into finished products, these are for the limited local market.

This situation whereby the mining industry generates the (foreign) capital for the development of the rest of the economy would be feasible except for two drawbacks: The first is that unlike agriculture, mining is consuming non-renewable resources so that the lifespan of the exploitation of any one mineral is limited and mineral resources exhausted for export today could well have to be imported in the future when the economy has developed to a point where these minerals are necessary (eg: nickel). The second and major drawback is that for developing countries the terms of trade value of most minerals is constantly falling, meaning that progressively greater volumes have to be exported to maintain the same level of imports.

Between 1979 and 1984 the average value per ton of non-ferrous metals produced in Zimbabwe increased by 43% in Z$ terms but decreased by 36% in US$ terms and it should be noted that the real (deflated) value of the US$ also decreased substantially over this period meaning that the real loss in value was well above this.

According to Shearson Lehman Brothers, between 1970 and 1983, the real (indexed) price of copper fell by 54% and nickel 64%. Further losses in the real price of these metals have been recorded since then. The only non-ferrous metal to rise in real

price between 1970 and 1983 was tin (37%), as it was the only metal with an effective producer organisation, the ITC, but recently the tin price has collapsed due to over-supply from renegade producers, and smuggling, causing the ITC buffer stock to become unfinanceable.

The decline in the profitability of mining concerns caused by the falling real value of minerals on the world market can temporarily be ameliorated by devaluing the local currency, as has been done over the last few years in Zimbabwe, but over the medium to long term this gain will be diluted by the increased cost of imports to the economy as a whole. There is no way of getting around the fact that an imported machine that cost 1 unit of copper 15 years ago, will now costs 3 units!

The primary commodity sectors of the economy (mining and agriculture) generate over 80% of the foreign exchange of the country and are in effect financing the necessary imports to keep the rest of the economy operating, especially the manufacturing sector. The declining real value of primary commodities on the world markets provokes a downward pressure on wages and salaries in these sectors which in turn limits the growth of the manufacturing sector due to the low purchasing power of workers in the primary commodity sectors.

From the above it is apparent that a non-ferrous mining sector that is vertically integrated into the industrialized market economies (by supplying raw materials to them and purchasing finished capital goods from them) is, in the long run, caught in a cycle of deteriorating terms of trade. The alternative role of non-ferrous mining, that of generating the

raw materials for local industrialization, avoids the problems of declining terms of trade but comes up against the obstacle of economies of scale. For Zimbabwe to develop a capital goods industry, thereby integrating a larger proportion of its mining industry, would be extremely costly given the limited demand for these goods on the local market, but in some instances the cost may be justified.

Possibilities of exporting finished capital goods onto the world market are pretty limited, given Zimbabwe's land-locked situation and the present recession in world trade, but the region (SADCC, PTA) offers not only a greater market but also a larger resource base. In the opinion of the author, the most feasible method of breaking out of the stagnating and crisis ridden one-sided integration into the develeloped market economies, is by collective self-reliance in a regional resource-based industrialization strategy. This would entail overcomming a great deal of petty nationalism prevelent in the SADCC region and would necessitate the giving up of a certain degree of national sovereignty for the benefit of the region and its peoples, but surely this would be preferable to the present loss of sovereignty to the vagaries of a world economy dominated by the developed world?

The establishment of the regional Preferential Trade Area (PTA) has gone some way in reducing tariff barriers and encouraging intraregional trade, but at the end of the day most of the countries in the region do not have the foreign currency to pay for much needed imports from their neighbours who in turn are not in a position to provide soft export credits, so must

turn to the developed world to import their goods on easier terms. A regional resource-based industrialization strategy would go beyond trade by establishing regionally integrated industries in which case trade balances would be more equitable.

Limited regional cooperation in non-ferrous metal refining has already taken place in the case of copper-nickel matte from Botswana being refined in Zimbabwe and copper concentrates from Mozambique will soon be smelted and refined in Zimbabwe. But in both these cases Zimbabwe is adding value to a raw material from a neighbour. For regional integration to be successful the benefits clearly need to balance for the countries participating. Because of Zimbabwe's more developed economy it could easily become the dominant partner in the region, importing raw materials from and exporting finished goods to its neighbours, a situation that its regional trading partners would not tolerate for long and would revert to importing often cheaper, finished goods from the developed and newly industrialised countries with their easier credit terms.

At present both Zambia and Zimbabwe are attempting to penetrate the same, fairly limited, regional market for copper and copper alloy semis and finished goods. Regional integration of the transformation of non-ferrous metals would necessitate the planning of the location of manufacturing plants to achieve an equitable distribution of the benefits and to avoid costly duplication. In the case of Zimbabwe this could well entail the transfer of skills and capital to its neighbours.

The SADCC Mining Unit based in Lusaka has commissioned regional studies on the mining sector, several of which are

pertinent to the regional integration of the non-ferrous metals industries, namely: A skilled manpower survey.

The development of small scale mining.

Foundry and fabrication facilities.

Mining machinery manufacture.

Production of mining chemicals and explosives.

Sharing of mineral processing facilities.

Manufacture of copper semis and finished goods.

Establishment of an aluminium industry.

Athough these studies are likely to come up with proposals that would promote the integration of the non-ferrous metals industries of the region, the present scope of the SADCC as a regional body does not appear to include the establishment of regionally integrated industries.

XI. CONCLUSION

Most of the conclusions and recommendations on the various aspects of this study are contained in the body of the report and in the discussion section. The following is therefore a brief summary of the most pertinent:

1). The forward linkages between non-ferrous mining, smelting and refining are very high, with all metals being processed to their pure form.

2). The forward linkages between refining and the metal transformation industries are low. Over 90% of non-ferrous metal production is vertically integrated into the economies of the industrialised nations.

3). The linkages between industry and mining are low in terms of the non-ferrous metals consumed as over half are imported either because they are not mined, or are not produced in a suitable form, but the linkages are fairly good in terms of the local manufacture of the imputs to mining.

4). There is still considerable scope for the continuation of an import substitution strategy in terms of producing the forms of non-ferrous metals and inputs to mining presently imported.

5). The growth of industry as a whole in the context of deteriorating terms of trade of foreign exchange-generating export metals, is severely limited.

6). Regionally integrated resource-based industrialization offers the best possiblity for the integration of the non-ferrous

metals industry into the rest of the economy. In this context the development of the SADCC into a body for the coordination of regional industrial integration needs to be considered.

APPENDIX I

III Terms of Reference for the Study

In the context of the objectives and methodological elements pointed out, the main aspects to be developed in the study of the mines and each of the different processing operations (smelting, refining, producing semi-finished and finished products) are the following:

A. Analysis of the technical and socio-economic characteristics of the nonferrous metals sector:

a) Exploited mines

Please indicate for each exploited mine;

1. location;
2. reserves: initially and in 1985
3. type of ownership; nature of the concessional contract between the firm and the state;
4. eventually the mode of calculus of the royalties and duties; the mode of profit sharing;
5. available infrastructure (build by whom?): road, railways, ports;
6. labour force now: skilled, unskilled;
7. intermediary consumption in 1985 (as detailed as possible along the different types of equipment and intermediary commodities) and its evolution during recent years;
8. evolution during the last ten years of:
   - a - production (quality, specification, quantity)
   - b - investment
   - c - cost of production
   - d - productivity
   - e - wages and salaries
   - f - price of production (export, national market)
   - g - profits
   - h - use of the crude product in the national economy
   - i - exports
   - j - price on the national market and export

b) Existing processing operations (smelting, refining, producing semi-finished and finished products)

1. Locations (for each transformation unit)
2. Infrastructure: roads, ports, etc;
3. Technology: level, type of machinery, technological change;
4. Products and subproducts produced;
5. Raw materials used: main characteristics;
6. Labour force: skilled and unskilled;
7. Production capacity: installed capacity and level of utilization;
8. Technical materials coefficients between the different operations of production, (smelting, refinery, semi-finished, finished), and their evolution in the last years;
9. Concentration of production by type of ownership and size of the units of production;
10. Evolution of production in the last 10 years;
11. Investment (national, foreign) in the last 10 years;
12. Evolution of consumption of the main inputs (energy etc) in the last 10 years;
13. Transportation; type, origin (national, foreign) and evolution of the transport costs to the port and from the port;
14. Payments for technology (royalties etc);
15. Evolution of prices of production (internal, exports) in the last 10 years;
16. Evolution of prices of the main inputs (raw materials, energy etc) in the last 10 tears;
17. Evolution of the real wages and salaries of workers and management staff in the last 10 years. Difference between the wage and salary levels;
18. Evolution of productivity in the last 10 years;
19. Evolution of profits and its use in the last 10 years;
20. Analysis of the changes in the structure of balance sheets, profit and loss statements and sources and users of funds in the last 5 years;
21. Marketing: (internal, external); organization, destination of production and infrastructure.

c) Nature and organization of the links between the non-ferrous metals sector and the other sectors of the economy

1. Analysis of the main flows between the non-ferrous metals sector and the other sectors of the economy;
2. Identification of the main users and suppliers of inputs of the different production operations at the national and subregional levels;
3. Identification of the main technical and socio-economic characteristics of the relations between the non-ferrous metals industries and the main consumers of their production and suppliers of inputs;
4. Establishing the main technical coefficients between the non-ferrous industries and the main users and suppliers of inputs and their evolution over the last years;
5. Effects of the mines or processing units on the national economy:
   - development of a more integrated and self-reliant development
   - development of related industries
   - mastering of technology
   - employment
   - improvement in qualifications of manpower and technical staff
   - effects on the balance of payments

d) Analysis of the main actors

1. Government strategy, policies and incentives to develop the non-ferrous metals industries;
2. If mine and transformation plants are national enterprises:
   - organizations of exports (direct, through trade merchants, through the London market).
   - countries to which the production is exported
   - final users of the production (internally, externally)
   - if the mineral is not processed domestically, reasons for not having further processing within the country

3. If mine and transformation plants are operated by TNCs:
   - type of contract (joint venture, other)
   - share of equity
   - technical assistance programmes
   - principal products of the TNC
   - secondary products of the TNC
   - final users of the production (internally, externally)
   - policy of diversification
   - relations with the state

e) Legal and institutional aspects

1. Legislation related to:
   - treatment of foreign capital
   - protection of the environment
   - working conditions
   - health and safety
   - wage levels
2. Institutional organization: main characteristics and mechanisms for co-ordination with other sectors of the economy

B. Strategies of development and cooperation

The participants are recommended to pay a special attention to this part of terms of reference because it is essential from the point of view of a new mode of development.

a) Non exploited deposits

Please indicate for each non exploited but known deposit

1. location
2. known reserves
3. quality
4. required infrastructure for exploitation
5. reasons for explaining the non exploitation
6. conditions for an eventual exploitation (precise as it is possible the volume of required investment)

b) Envisaged or feasible projects for transformation

if such projects are existing please indicate and give for ach of them useful information and essentially if they are internal or external market orientated.

c) The economics of non-ferrous metals

1. national use of non-ferrous metals at their different stages of production
2. imports of those different products, for investment and equipment for intermediary consumption, for final consumption.

d) Alternative strategies of development and co-operation

1. Identify and develop alternative strategies for development that will:
   - reinforce national sovereignty over mineral resources;
   - create a coherent national productive system;
   - create a more autonomous process of accumulation
   - develop technologies that are better suited to the resources and size of the country.
2. Identify the main obstacles to the implementation of the proposed development alternatives
3. Identify main areas for co-operation at the subregional and regional levels and with other selcted countries outside the region
4. Propose programmes of co-operation oriented towards implementing the development strategy selected.

APPENDIX II

I. MINERAL PRODUCTION

TABLE 1: VALUE AND QUANTITY OF MINERAL PRODUCTION

Mineral	Rank Value 1983	Value (KZ$*) 1975	Value (KZ$*) 1980	Value (KZ$*) 1983	Tonnage 1975	Tonnage 1980	Tonnage 1983
Antimony	25	197	128	124	400	150	143
Arsenic	-	-	19	-	-	79	-
Asbestos	2	41701	70201	69335	261542	250949	153221
Barytes	32	12	4	22	272	195	950
Bauxite	26	2	51	108	156	4281	23145
Beryl	36	16	2	12	291	9	48
Calcite	-	15			1155		
Chromite	6	22056	18449	25629	575058	552475	420347
Clay	24	115	136	126	109302	69153	63097
Coal (a)	4	18677	28031	42174	3303365	3134000	3126000
Cobalt	20	24	2724	231	18	115	74
Copper (metal)	5	24555	35359	32953	47579	26901	21500
Corundum	19	109	770	305	5429	18601	5157
Diaspore	-	3			325		
Feldspar	22	40	56	144	1499	1253	1045
Fireclay	30	24	32	41	17557	17005	9255
Fluorspar	-	9	-	-	585	-	-
Gemstones (b)	23			1006	-	-	-
Gold (Kg)	1	31955	144875	193914	11325	11444	14101
Graphite	12	355	739	2364	6415	7365	19862
Iron ore	8	3033	14815	14028	1246035	1621651	926472
Kaolin	35	23	18	15	2628	4452	4470
Kyanite	-	161	15	-	8245	716	-
Limestone	11	2394	3043	4305	1368369	1217278	1305130
Lithium Mins.	13		1921	1877		21032	19193
Magnesite	15	1840	1452	577	99368	76217	24872
Mica-Cut	29	7	14	65	8	5	3
-Scrap	33	53	64	21	5936	1017	54
Nickel (metal)	3	19616	55572	43130	9121	15075	10146
Ornament Stone	31	1	8	31	6	48	1637
Palladium (Kg)	18		645	327		211	74
Phosphates	10	2960	4030	6719	150772	130337	132911
Platinum (Kg)	14		1102	327		94	53
Pyrites	17	303	622	396	57232	58896	23345
Quartz-Rough	28	246	459	34	131051	102868	14610
-Sand	17	255	399	572	62163	63259	32512
Silver (Kg)	9	607	13035	10553	7737	29661	29166
Talc	34	21	23	20	1499	456	552
Tantalum conc.	14	48	2538	1061	23	41	35
Tin (metal)	7	3971	9171	16213	997	934	1234
Tungsten conc.	27	695	1221	100	229	194	23
Other Minerals			1362	6554	-	-	-
TOTAL:		177838	414758	469121	-	-	-

"-" no production or not applicable. A blank space = no data available.

* Exchange Rates (1Z$=US$): 1975-1.60, 1976-1.62, 1977-1.54, 1978-1.48, 1979-1.48, 1980-1.59, 1981-1.39, 1982-1.09, 1983-0.94, 1984-0.67.

(a) The value is for coal sold and quantity is for coal raised.

(b) Includes emeralds, ornamental stone, garnets (gem), beryl (gem), citrine, tourmaline, chrystoberyl, amazonite, chalcedony, rose quartz, amethyst, iolite and agate.

Source: Ministry of Mines (MMZ), Report of the Secretary for Mines (RSM), for 1981 and 1983, Harare, 1982 & 1985.

MMZ, Unpublished data for 1975, Harare, 1985.

Central Statistical Office (CSO), Quarterly Digest of Statistics (QDS), March 1985, Harare, 1985.

APPENDIX III

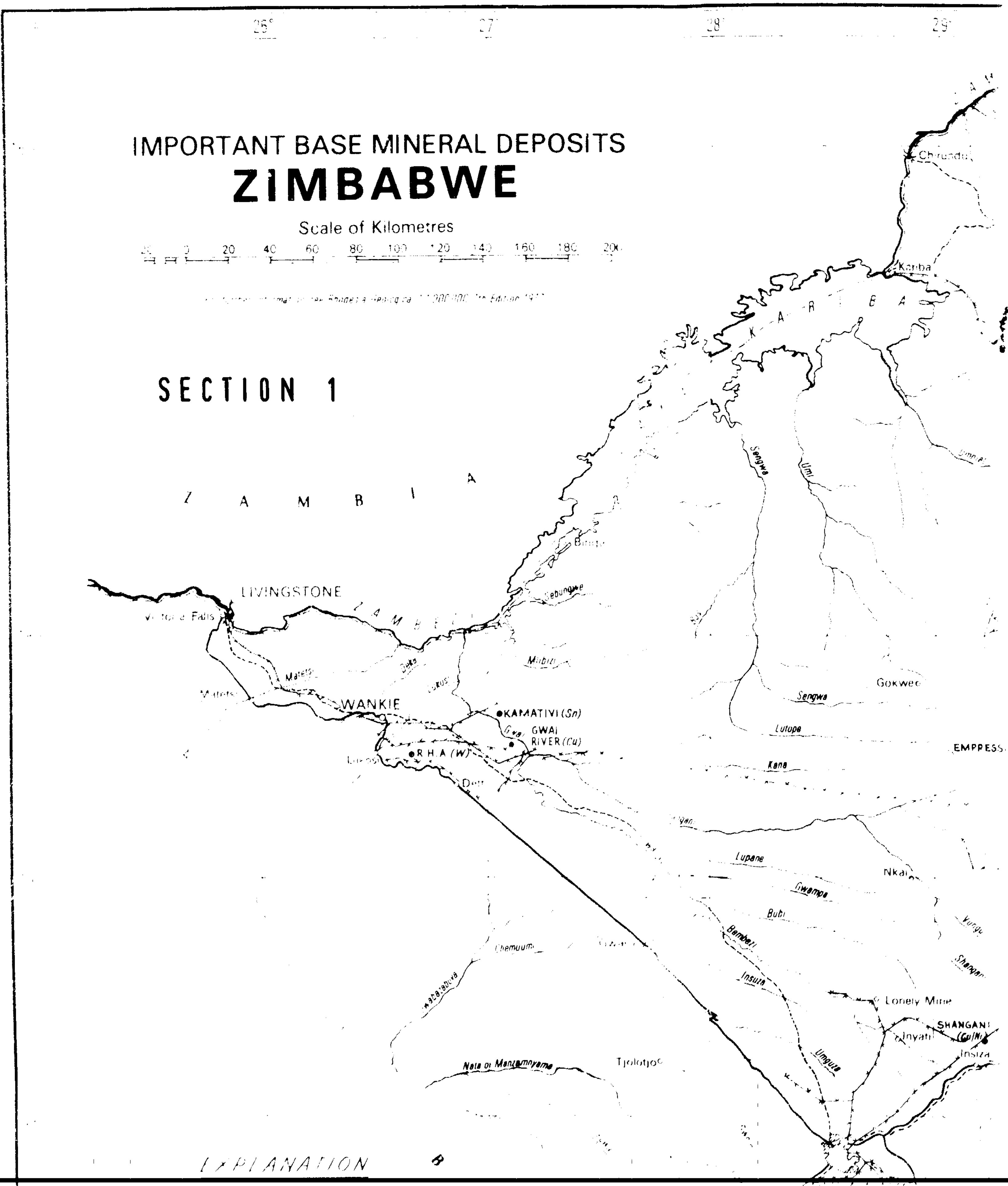
FOREIGN EXCHANGE RATES

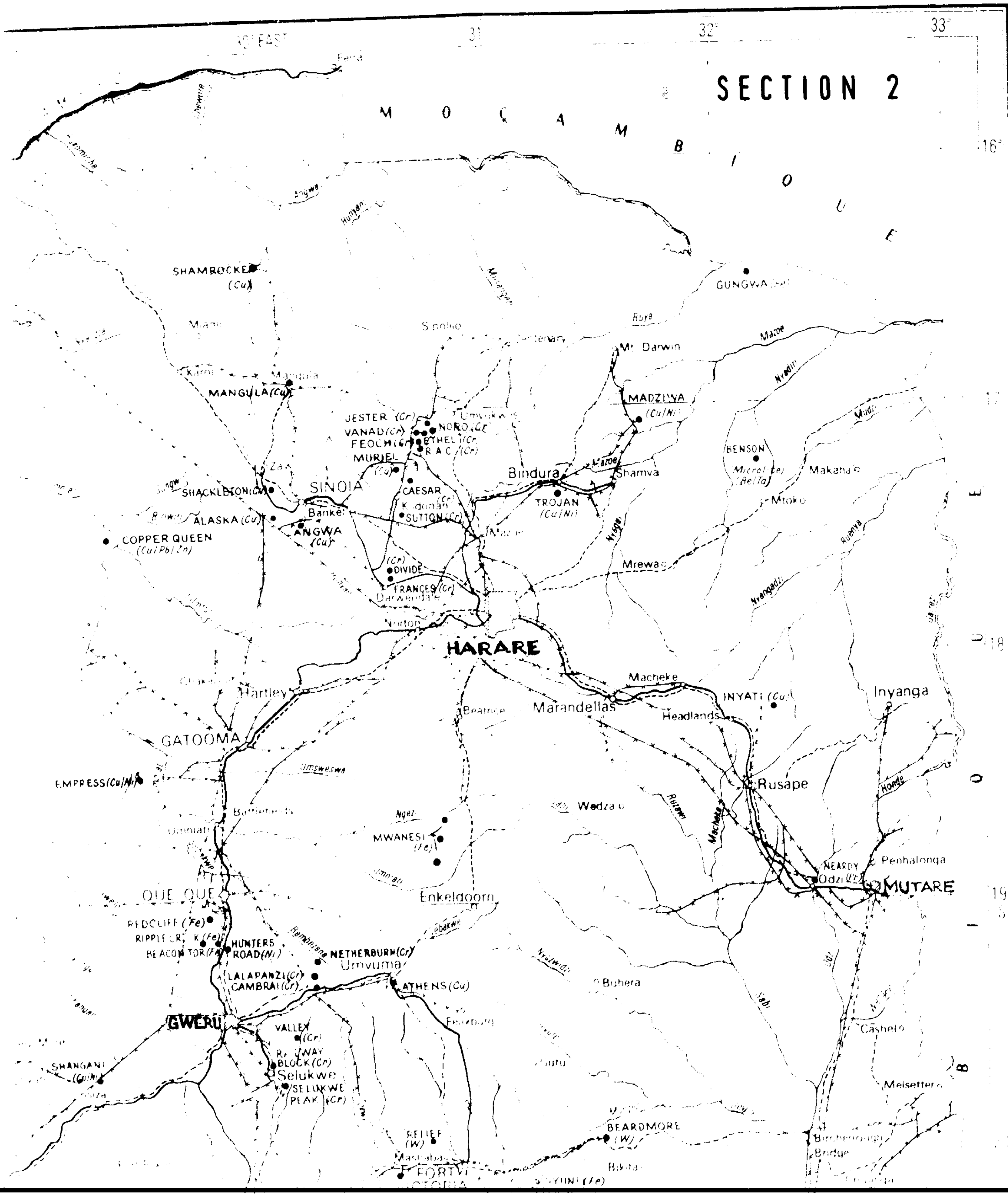
Middle rates — foreign currency units per Zimbabwe dollar for spot transactions

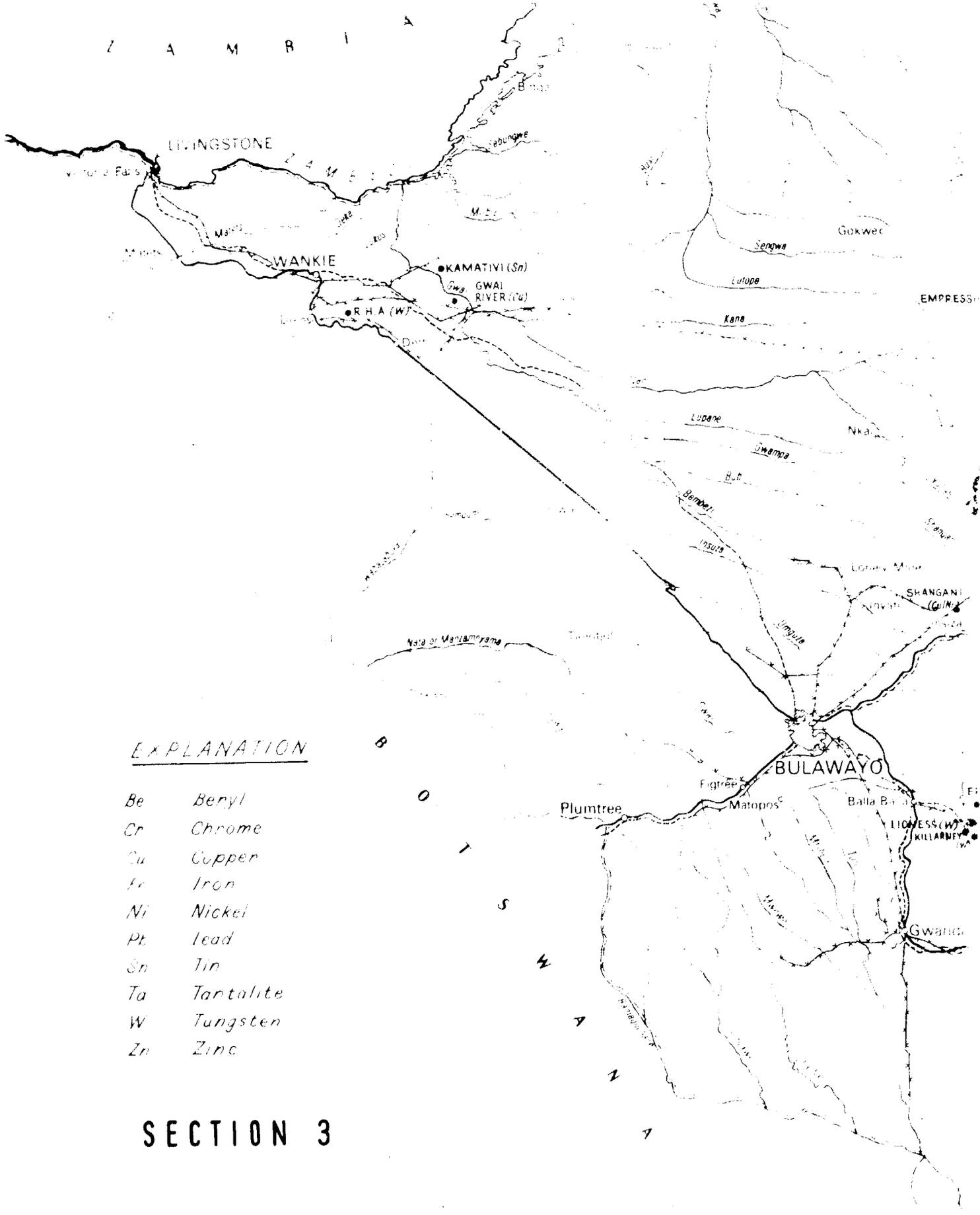
End of[1]	U.S. dollar	Sterling	Rand	Deutsche mark	Swiss franc	French franc	Italian lire	Mozambique metical	Botswana pula	Zambia kwacha	Tanzania shilling
1975	1.6013	0.791313	1.3400	4.1920	4.1955	7149.3	1092.0	—	—	—	—
1976	1.6158	0.949413	1.3400	3.8035	3.9505	8.0113	1412.5	—	—	—	—
1977	1.5440	0.808008	1.3000	3.2443	3.0985	7.2433	1347.0	—	—	—	—
1978	1.4818	0.728088	1.2400	2.7020	2.4015	6.1910	1232.5	—	—	—	—
1979	1.4833	0.665120	1.2400	2.5640	2.3713	5.9738	1196.0	—	—	—	—
1980	1.5859	0.664081	1.1835	3.1138	2.8173	7.1759	1472.0	52.4560	—	—	—
1981	1.3944	0.730052	1.3386	3.1388	2.5085	7.9829	1673.3	50.3588	1.2288	1.2334	11.6148
1982[2]	1.0876	0.671047	1.1670	2.5896	2.1790	7.3195	1488.92	41.9340	1.1520	1.0082	10.3910
1983	0.9046	0.622574	1.1017	2.4564	1.9693	7.5082	1492.59	37.7001	1.0476	1.3576	11.3137
1984	0.6656	0.571085	1.3163	2.0872	1.7211	6.3848	1277.29	29.2604	1.0366	1.4721	12.0157
1983 Jan	1.0402	0.676223	1.1095	2.5287	2.0664	7.1618	1455.24	40.7374	1.1071	1.2306	10.1085
Feb	1.0374	0.679260	1.1191	2.5032	2.1064	7.1010	1448.21	40.5333	1.1095	1.2228	10.0835
Mar	1.0186	0.692572	1.1165	2.4719	2.1238	7.4103	1472.30	40.3793	1.1042	1.2184	10.0222
Apr	1.0251	0.656274	1.1190	2.5207	2.1158	7.5550	1498.70	40.4515	1.1068	1.2175	9.9292
May	1.0262	0.638948	1.1034	2.5816	2.1445	7.7377	1531.79	40.6170	1.1055	1.2282	9.9553
Jun	1.0057	0.658935	1.1011	2.56[illegible]	2.1200	7.6010	1519.11	40.5408	1.0929	1.2139	12.3115
Jul	0.9844	0.645508	1.0801	2.6008	2.0958	7.3014	1538.62	40.0483	1.0766	1.2228	12.0937
Aug	0.9527	0.636[illegible]9	1.0697	2.5680	2.0847	7.7264	1531.94	39.9021	1.0597	1.2948	11.8025
Sept	0.9529	0.637818	1.0493	2.5138	2.0287	7.6200	1522.26	39.0394	1.0477	1.2897	11.7581
Oct	0.9386	0.628246	1.0848	2.4657	2.0056	7.5191	1499.88	38.4352	1.0465	1.2697	11.5593
Nov	0.9111	0.621593	1.0990	2.4566	1.9703	7.4744	1488.74	37.6708	1.0474	1.3054	11.3488
Dec	0.9046	0.622574	1.1017	2.4564	1.9693	7.5082	1492.59	37.7001	1.0476	1.3576	11.3137
1984 Jan	0.8740	0.621843	1.1046	2.4616	1.9632	7.5265	1498.47	36.6276	1.0335	1.4346	11.0255
Feb	0.9112	0.612263	1.0932	2.3765	1.9773	7.3147	1476.14	37.5929	1.0379	1.4491	11.2460
Mar	0.9000	0.621762	1.1146	2.3319	1.9314	7.1843	1456.20	37.1124	1.0356	1.4537	11.1164
Apr	0.8689	0.619979	1.0852	2.3534	1.9446	7.2206	1457.15	36.1606	1.0157	1.4414	10.8629
May	0.8559	0.617978	1.0989	2.3394	1.9320	7.1874	1446.47	35.8798	1.0175	1.4683	10.7711
June	0.8325	0.614845	1.1337	2.3125	1.9339	7.0950	1423.58	35.1361	1.0161	1.4735	14.2677
Jul	0.7598	0.580887	1.2446	2.1958	1.8651	6.7413	1351.30	32.3663	1.0588	1.4291	13.2434
Aug	0.7691	0.587323	1.2027	2.2192	1.8470	6.8123	1377.07	32.8267	1.0430	1.4490	13.3675
Sept	0.7235	0.580541	1.2089	2.1915	1.8098	6.7286	1364.50	31.5113	1.0255	1.4359	12.8520
Oct	0.6869	0.564652	1.3084	2.0822	1.7131	6.3899	1291.37	29.9573	1.0514	1.4276	12.2987
Nov	0.6841	0.569608	1.2633	2.1075	1.7328	6.4562	1303.89	29.9411	1.0256	1.4665	12.2598
Dec	0.6656	0.571085	1.3163	2.0872	1.7211	6.3848	1277.29	29.2604	1.0366	1.4721	12.0157
1985 Jan	0.6466	0.571201	1.2842	2.0488	1.7292	6.2581	1262.81	28.6133	1.1559	1.5215	11.6502
Feb	0.6141	0.563911	1.2251	2.0434	1.7379	6.2303	1271.19	27.6830	1.1483	1.5217	11.4697
Mar	0.6505	0.529723	1.2414	2.0305	1.7189	6.1976	1268.40	28.8061	1.1274	1.4947	11.6346
Apr	0.6447	0.517208	1.2597	1.9873	1.6669	6.0618	1272.32	28.3826	1.1358	1.5238	11.5215
May	0.6321	0.495570	1.2604	1.9475	1.6419	5.9370	1244.60	27.6446	1.1269	1.5375	11.1904
Jun	0.6290	0.493436	1.2587	1.9502	1.6317	5.9411	1243.49	27.8160	1.1254	1.5309	11.2449
Jul	0.6459	0.453422	1.3276	1.8130	1.4820	5.5224	1215.26	27.4438	1.1661	1.4408	10.9797
Aug	0.5808	0.415450	1.6201	1.6161	1.3242	4.9397	1084.93	24.6468	1.1909	1.3077	9.8745

1. Last trading day of the relevant period.
2. Zimbabwe dollar devalued by 20% on the 9th December 1982.

SOURCE: RESERVE BANK, QESR, VOL 6, N23, 1985.


IMPORTANT BASE MINERAL DEPOSITS
ZIMBABWE
Scale of Kilometres
20 0 20 40 60 80 100 120 140 160 180 200
SECTION 1
ZAMBIA
LIVINGSTONE
ZAMBEZI
KARIBA
Chirundu
Kariba
Victoria Falls
Matetsi
Deka
Lukosi
Mlibizi
Sebungwe
Binga
Sengwa
Umi
Gokwe
Lutope
Kana
Lupane
Gwampa
Bubi
Bembesi
Insuza
Umguza
Nkai
Shangani
Lonely Mine
SHANGANI (Cu/Ni)
Inyati
Insiza
EMPRESS
WANKIE
KAMATIVI (Sn)
GWAI RIVER (Cu)
R.H.A. (W)
Dett
Chemuum
Nata or Manzamnyama
Tjolotjo
EXPLANATION


SECTION 2
30° EAST
31°
32°
33°
16°
MOÇAMBIQUE
SHAMROCKE
(Cu)
GUNGWA
Mt Darwin
MADZIWA
(Cu/Ni)
MANGULA (Cu)
JESTER (Cr)
VANAD (Cr)
FEOCH (Cr)
MURIEL
(Cu)
NORO (Cr)
ETHEL (Cr)
R A C (Cr)
BENSON
Micro! Be)
(Be/Ta)
Makaha
Bindura
Shamva
SINOIA
SHACKLETON (Cu)
CAESAR
SUTTON (Cr)
TROJAN
(Cu/Ni)
Mtoko
ALASKA (Cu)
ANGWA
(Cu)
Banket
COPPER QUEEN
(Cu/Pb/Zn)
DIVIDE
FRANCES (Cr)
Darwendale
Mrewa
Norton
HARARE
Macheke
Hartley
Marandellas
INYATI (Cu)
Headlands
Inyanga
GATOOMA
Umsweswe
EMPRESS (Cu/Ni)
Rusape
Wedza
Honde
Ngezi
MWANESI
(Fe)
Penhalonga
Enkeldoorn
Odzi
MUTARE
QUE QUE
REDCLIFF (Fe)
HUNTERS
ROAD (Ni)
NETHERBURN (Cr)
Umvuma
LALAPANZI (Cr)
CAMBRAI (Cr)
ATHENS (Cu)
Buhera
Sabi
GWERU
VALLEY
(Cr)
BLOCK (Cr)
Selukwe
SELUKWE
PEAK (Cr)
SHANGANI
(Cu/Ni)
Cashel
Melsetter
RELIEF
(W)
BEARDMORE
(W)
Birchenough
Bridge
FORT
19
18
17



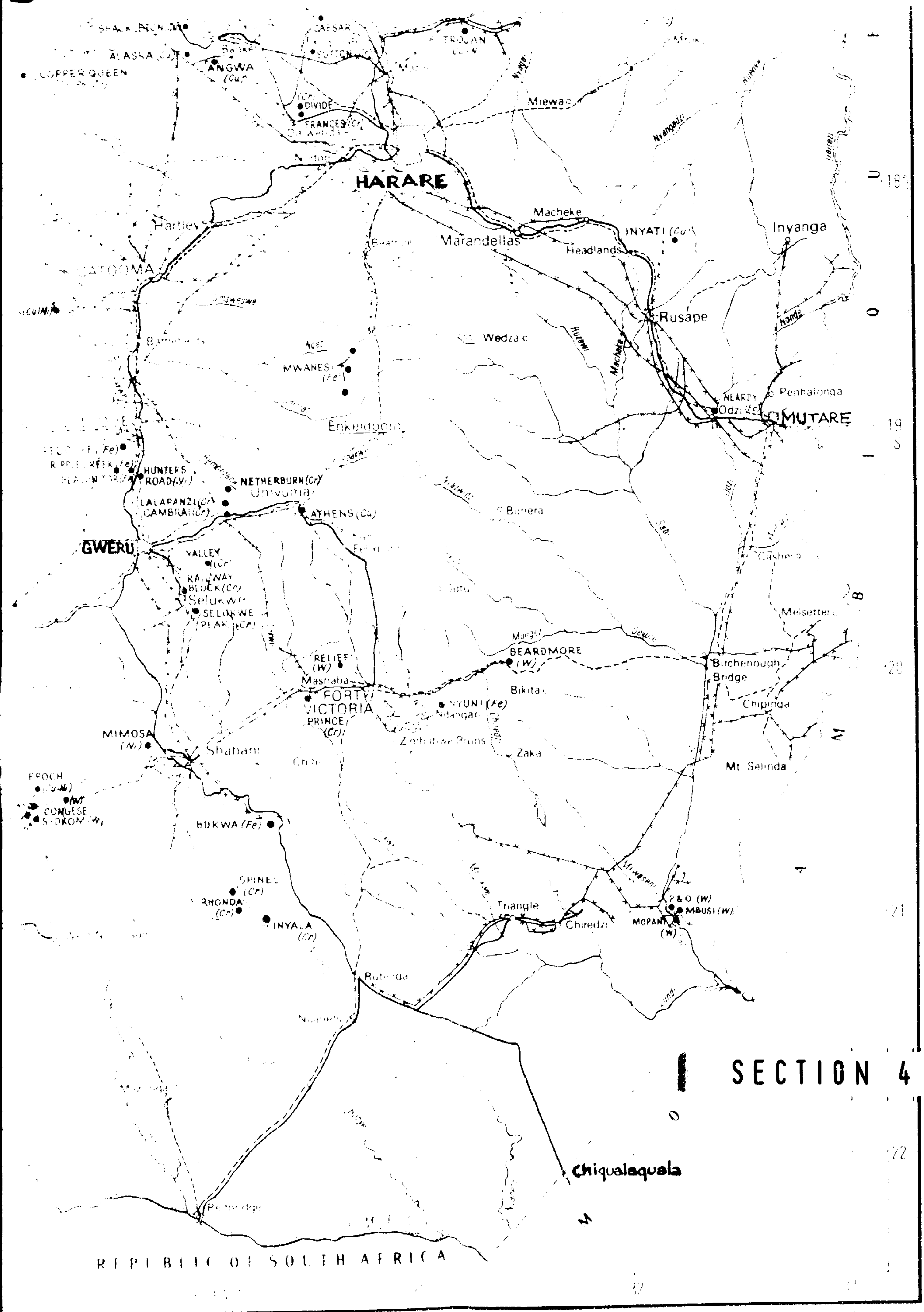
EXPLANATION

Be	Beryl
Cr	Chrome
Cu	Copper
Fe	Iron
Ni	Nickel
Pb	lead
Sn	Tin
Ta	Tantalite
W	Tungsten
Zn	Zinc

SECTION 3

Main Electricity transmission line

Main road


CAESAR
TROJAN
ALASKA
ANGWA
COPPER QUEEN
SUTTON
DIVIDE
FRANCES
Mrewa
Nyangadzi
HARARE
Macheke
Marandellas
INYATI
Headlands
Inyanga
KADOMA
Hartley
Rusape
Wedza
MWANES (Fe)
Rusawi
Macheke
Penhalonga
Odzi
MUTARE
Enkeldoorn
HUNTERS ROAD
NETHERBURN (Cr)
Umvuma
LALAPANZI (Cr)
CAMBRIA (Cr)
ATHENS (Cu)
Buhera
GWERU
VALLEY (Cr)
RAILWAY BLOCK (Cr)
Selukwe
SELUKWE PEAK (Cr)
Cashel
Melsetter
BEARDMORE (W)
Birchenough Bridge
RELIEF (W)
Mashaba
FORT VICTORIA
Bikita
NYUNI (Fe)
Ndanga
PRINCE (Cr)
Zimbabwe Ruins
Zaka
Chipinga
Mt Selinda
MIMOSA (Ni)
Shabani
EPOCH
CONGESE
BUKWA (Fe)
SPINEL (Cr)
RHONDA (Cr)
INYALA (Cr)
Triangle
Chiredzi
P&O (W)
MBUSI (W)
MOPANI (W)
Rutenga
Chiqualaquala
REPUBLIC OF SOUTH AFRICA
SECTION 4