2. THE DEVELOPMENT OF MINING AND MINERALS PROCESSING IN SOUTHERN AFRICA

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2.1 Introduction

This section describes the history of the mining and minerals sector and its contribution to the economies of southern Africa. It is based on the six research reports compiled in the southern African regional analysis for the MMSD project.

'Southern Africa' refers to that group of states extending from South Africa north to the DRC. The term encompasses Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia and Zimbabwe. Mauritius and Seychelles were not included because little or no mining takes place in these island states. Collectively these countries constitute the Southern African Development Community (SADC).

Figure 2.1: *The southern African region as defined for the MMSD project*

2.2 A brief history of mining in the SADC region

The exploitation of mineral resources has accelerated during the past century with the discovery of new ore bodies and the development of new mining and metallurgical technologies. These mineral resources hold the promise of exceptional long-term social and economic benefits for the region (Hounsome & Ashton, 2001). Such potential benefits are recognised as a key component of the recently launched and widely supported New Partnership for Africa's Development (NEPAD).

The large-scale exploitation of minerals and the growth of the mining and minerals sector has resulted in the establishment of a manufacturing base, a modern transport and communications infrastructure and the foundation for future growth in the region. However, developments in the mining and minerals sector in the modern era have not benefited all. Historically neither the profits nor the costs of the production of the minerals of the region have been distributed equitably among all the people involved in or affected by their production. The mining and minerals sector is closely linked with the long history of instability and conflict that characterises class and race relations in southern Africa.

2.2.1 Ancient mineral users in southern Africa

The earliest human beings in eastern and southern Africa, the makers of the first weapons and tools, possibly had some knowledge of minerals. In the case of the Bushmen, whose culture was of the Late Stone Age, the indications are stronger: the Bushmen were almost certainly acquainted with iron oxides, manganese dioxide and calcium and magnesium compounds, and used some of these for cosmetics and in pigments for rock art.

Actual mining, involving the extraction of ore from rock and the smelting of metal from the ore, along with the related development of the working of metal in some type of forge, began in southern Africa in the Early Iron Age. The mining of copper is believed to have started in Zimbabwe as early as 200 AD. In Zambia there is evidence of this activity in about 350 AD (Holmes, 2001, in RT6 Granville). Gold was used for ornamentation from a very early period, notably by the Egyptian pharaohs (Kirkemo *et al.*, 1997, in RT6 Granville).

Gold mining by the indigenous people of Africa, as distinct from trading in gold along the east coast, was carried on from as early as 500 A.D in the Early Iron Age until some point in the early 19th century. In the first millennium AD gold was principally obtained from alluvial beds, but also by open-pit mining and from quartz outcrops. The earliest known instance of gold smelting in southern Africa is the Thulamela settlement in the Kruger National Park, extant from the late 14th to the 17th century. Specularite has been mined in Swaziland for 28,000 years (Saunders, 1994, in RT6 Granville).

Most of the pre-colonial mining practised in South Africa dates from the Late Iron Age. The activity was largely confined to the interior plateau, in particular to the mineral-rich area known as the Bushveld Complex, which extends northward from the northern Free State to the Limpopo river and eastward from Zeerust in the North West Province, through the Northern Province, to Lydenburg in Mpumalanga. Extensive archaeological evidence suggests that mining activities in this area were carried out by Sotho speaking people.

Hundreds of ancient mine workings remain in the Northern Province of South Africa. Malachite was the preferred copper ore because it is easy to smelt. Messina and Phalaborwa in the Northern Province were sites for early copper mining. At Rooiberg, to the north of Pretoria, tin was mined and smelted to add to copper for the production of bronze as an alloy. By digging shafts and drives with iron picks and short iron chisels, veins of copper ore were followed for hundreds of metres at depths of around 15 metres (Saunders, 1994 in RT6 Granville). Where the ore occurred in hard rock, heating with fire and quenching with water split this.

Smelting took place close to ore deposits at favourable sites, i.e. those that had clay for constructing furnaces and abundant water and fuel. Pre-colonial iron smelting continued in southern Africa until the 19th century, and the British army in Natal found that the product of this primitive smelting process was superior to the iron imported from Britain.

2.2.2 European interest in the minerals of southern Africa

Large-scale exploitation of minerals began with European exploration in southern Africa. By 1530 the Portuguese had established themselves on the coasts of Angola and Mozambique and moved inland into the Zambezi valley to control trade, including that in precious minerals.

Modern mining in southern Africa is considered to have started after 1852, when systematic attempts were made to recover copper from outcrops around O'Kiep in Namaqualand, South Africa. The first exploitation of coal on a substantial scale was near Molteno in the Eastern Cape in 1870 (de Jager, 1976 in RT6 Granville).

2.2.3 Diamonds, gold and the demand for mine labour

In the last quarter of the nineteenth century southern Africa experienced a mineral revolution. The large-scale mining of high value commodities, first diamonds and then gold, launched the region into industrialisation and paved the way for the emergence of a modern capitalist economy.

The Diamond rush (courtesy of D. Minnitt)

The first alluvial diamonds of the colonial era were discovered near Hopetown in the northern Cape Colony in 1867. The discovery of richer deposits at a deeper level assured the establishment of the diamond-mining industry. The mining operations generated a need for capital and a demand for skilled and unskilled labour. Companies replaced individually worked claims; then followed a phase of company amalgamations. Finally, with the incorporation of the De Beers Company, a virtual monopoly emerged over both the production and marketing of diamonds.

Diamonds formed 20 per cent of the Union of South Africa's total exports in the years 1910 - 14. Immigrants, mainly from Britain, provided the skilled labour. Unskilled labourers were largely migrant workers, many of them, such as the Pedi of Sekhukhuneland, from territory still under independent rule. The distinction between skilled and unskilled workers soon assumed a racial form, giving rise to a de facto industrial colour bar. Partly for security reasons, the practice of housing the workers in closed compounds was adopted. All these features - the colour bar, migratory labour and the compound system - reappeared later, though in somewhat altered form, in the gold mining industry of the Witwatersrand.

The first notable discoveries of gold by Europeans in southern Africa took place within the borders of the old Transvaal (the Zuid-Afrikaansche Republiek) in the early 1880's. The most promising finds were in the eastern Transvaal, particularly at what became the Sheba Mine at Barberton. Gold deposits were also found in Bechuanaland (Botswana), and Swaziland. The major development was the discovery, in 1886, of the gold-bearing reefs of the Witwatersrand. In 1893 the gold-bearing reefs were found to dip towards the south. Mining would now require a preceding development phase, mainly in the form of shaft-sinking. The proving of the deep levels ensured that the gold mining industry of the Witwatersrand would develop on a virtually permanent basis and with far-reaching results. For many years the growth of the industry remained concentrated on the Witwatersrand, until the opening up, in the 1940s, of new goldfields on the Far West Rand and in the Orange Free State.

The concentration of ownership in gold mining was different to that of the diamond industry. Initially the supply of gold was never sufficient to meet the assured demand and the gold price was more or less fixed. In this situation there was no need for a monopoly of production or marketing. Five or so mining groups dominated, notably Hermann Eckstein and Company and Goldfields of South Africa. The groups were owned by mainly London-based holding companies or 'houses', such as Wernher, Beit and Company. In dealings with the Transvaal government[1], the interests of the industry were collectively defended by its local representative body, the Transvaal Chamber of Mines. The combination of a fixed price for the product and the low-grade of the ore made mining more expensive and committed the industry to a constant quest to keep mining costs, particularly wages, low.

The minerals revolution had an immediate impact on the regional economy. Mining towns created an urban market for food and raw materials and became the targets for new railways linking the interior to the British colonial ports and Delagoa Bay (Maputo). The new markets boosted commercial agriculture and, at least initially, black peasant producers. The needs of the diamond and

The Discovery of gold (courtesy of M. Viljoen)

[1] at first the Boer republic, later the British colonial administration under Milner, and ultimately the Union government

gold fields also stimulated coal mining, which subsequently provided the energy for industrial development in South Africa. Mining created a demand for engineers[2], and a broad range of other professional skills. A local commercial community emerged and, to a lesser degree, secondary industry.

By 1914 South Africa produced 38 per cent of the world's gold. South Africa's share of global production peaked in 1970 (almost 70 per cent), and steadily declined thereafter. In terms of Gross Domestic Product (GDP), mining (with gold mining as the most valuable component), remained the sector producing the largest share of the country's wealth until the 1960's, when it was overtaken by manufacturing. Gold is of overriding importance to South Africa's economy: it is the country's major export and the greatest earner of foreign currency. The metal accounts for over 70 per cent of the country's exports for most of the period since the formation of the Union in 1910, and it still totals 59 per cent if the additional value achieved by beneficiation is included (RT6 Granville).

The colonisation of what is now Zimbabwe by Rhodes' Pioneer Column in 1890, under the auspices of the British South Africa Chartered Company, was followed by some mineral discoveries and speculation about a 'second Reef'. These hopes were disappointed, and although mining was of some importance to the local Rhodesian economy, in comparison with the Witwatersrand, its scale was minute.

Gold mining created a demand for skilled workers, which was met by mainly British and colonial immigrants to Kruger's republic. A further change was the steady entry of Afrikaners into mine labour. They were mainly employed, not as skilled artisans, but as supervisors of gangs of black rock drillers. Under the Mines and Works Act of 1911 their jobs were protected by a formal or statutory colour bar. Despite this, fear of displacement by black workers, together with other grievances, led to major strikes and violent protests by white workers in 1907, 1913-14 and 1922. The statutory colour bar was confirmed in the Mines and Works Amendment Act of 1926. No further serious labour disputes involving white workers occurred.

2.2.4 The migratory labour system

The demand for low-paid, unskilled migratory labour was a fundamental feature of the gold mining industry from the start. Without it the profitable deep level mining of low-grade ores would have been impossible. Initially labour was obtained on a voluntary basis, with the support of African chiefs. The main reason for this was the perceived benefit of remittances from workers for the peasant homesteads in the African 'reserves'. At first migrant labour sustained households and preserved peasant agriculture. In the long term, this labour practice, along with economic pressures and legislation[3] that weakened the hold of Africans on the land they cultivated, was destructive. Ultimately migratory labour contributed to the steady impoverishment of rural Africans.

Independent entrepreneurs undertook the necessary recruitment. By the time the South African War began in 1899, there were about 100,000 migratory workers on the gold mines, the largest contingent coming from Mozambique. When the mines re-opened there was a labour shortage as a result of lower wages and alternative employment opportunities that had opened up during the war. The shortage was redressed by the recruitment of Chinese indentured workers. By 1911, the year in which the last indentured workers returned to China, the approximately 54,000 Chinese workers made up about one-third of the migratory work force.

By 1920 the practice of migratory labour had evolved into a system with structural features that remained largely intact for the next fifty years. Wages remained low: economists calculate that between 1897 and 1969 no increase in real wages took place (Wilson, 1972 in Crush *et al.*, 1991). Independent recruitment frequently involved illegalities and coercion, and was expensive and wasteful, therefore recruitment was undertaken by organisations controlled by the mining industry itself: the Witwatersrand Native Labour Association (WNLA) and the Native Recruiting Corporation (NRC). On the mines the compound system ensured the maintenance, by the industry itself, rather than municipalities, of strict discipline over the black workers.

[2] hence the establishment in Kimberley of the South African School of Mines in 1896, followed in 1904 by the Transvaal Technical Institute, the forerunner of the University of the Witwatersrand
[3] such as the Natives Land Act of 1913

Despite these structural features, the system was never entirely stable. In periods of expansion, such as those following the Great Depression and the opening of the Free State gold fields, new sources of supply were needed. By 1961 the migratory system accounted for the employment of 427,000 workers. The sources of supply varied considerably. From 1911 the Chinese were replaced mainly by South African workers recruited from the Eastern Cape. The industry had tried to avoid employing these workers because they preferred shorter contracts and demanded higher wages. After 1911 voluntary workers from within South Africa increased, indicating the greater economic pressures on them to seek work outside the reserves.

In 1913 recruitment from territories north of the latitude 22°S was prohibited, due to the unacceptably high death rate for workers from such territories. This ban remained until 1933. The Portuguese authorities had also set a ceiling on recruitment from Mozambique, and reliance on South African workers increased. In 1936, 58 per cent of black mineworkers originated in South Africa. Thereafter the proportion of foreign workers increased and in 1972 they accounted for 78 per cent of the total. In 1974 all Malawian and most Mozambican labour was withdrawn. Within a few years, 60 per cent of the workers were South African. Significantly, in the years when the proportion of South African workers was high, the mainly negative local impact of the system on the African reserves increased.

On the mines the grievances of black workers were considerable, and desertions, boycotts and compound outbreaks were frequent. In 1920 and 1946 major strikes were forcibly suppressed. Organised resistance was difficult: although black workers could form trade unions they did not have a legal right to strike. The migratory labour system was an integral part of the policy of racial discrimination imposed on the country under both segregation and apartheid. The pass laws and influx control, part of the general policy in South Africa, also sustained the migratory system. Mining was important in the country's economy and to their own revenues, and successive South African governments helped the industry to keep the system in place. Over the years the mining industry itself made no concerted effort to depart from the system, whether through mechanisation, stabilisation of a permanent workforce or abandoning the colour bar.

Since the 1970's the dynamics of change in the migratory labour system have increased dramatically. Wages have risen and black trade unions have gained greater recognition and negotiating power. The political transformation beginning in 1990 has dismantled the apparatus of apartheid.

The cumulative effects of these changes are still in the making. There has been some progress in the advance of black workers into more skilled jobs and some increase in worker productivity. While there has also been stabilisation of a portion of the workforce on a permanently urbanised basis, the essential migratory quality of the mine labour system remains and seems unlikely to disappear soon.

2.2.5 The critical role of coal in the minerals and industrial sectors in southern Africa.

Without the discovery and large-scale exploitation of coal, the rapid industrialisation of South Africa and its emergence as a significant global producer of minerals would not have been possible.

The first commercial exploitation of coal occurred in 1870 at Molteno, and supplied the needs of the Kimberley diamond fields. Shortly after the discovery of gold in 1886, commercial exploitation of coal commenced on the East Rand to supply the needs of the Witwatersrand goldfields. By the end of the 19th century, coal deposits were widely exploited throughout South Africa.

After the Second World War the demand for electricity increased as South Africa underwent rapid and large-scale industrialisation. Numerous coal-fired power stations were erected. The oil crisis of 1973 opened overseas markets to South African coal exports, especially as a result of competitive production costs, a sound infrastructure and the fact that South Africa has more than 70% of the known coal resources of Africa
(Daniel, 1992 in Snyman, 1998).

South Africa ranks 5th in the world in terms of known coal resources and in 1995 it was the 3rd largest coal exporter, earning in that year R8 billion in foreign exchange. In 1996 coal supplied 70 per cent of the country's primary energy needs (Snyman, 1998).

Coal is also present in many southern African countries. It is exploited commercially in Botswana at Morupule, at Wankie in Zimbabwe, Maamba in Zambia and in the Ruhuhu coalfields in Tanzania.

2.2.6 Base metals expansion in Zambia

Mining in Zambia escalated after the South African War. On the Copperbelt, the first claims were pegged at Chambishi, north of Kitwe, in 1903 (Mendelsohn, 1961). The Nkana deposit was discovered in 1910, followed by further discoveries at Mufulira and Kirila Bombwe in 1923 and 1924. At Broken Hill (Kabwe), zinc was produced by 1906 and lead by 1915 (Watts, 1961, in RT6 Granville). Large-scale mining operations and metallurgical plants on the Copperbelt were commissioned between 1929 and 1932 at Nkana and Mufulira, followed closely by Nchanga and later by Konkola (at Kirila Bombwe) in 1957. Kirila Bombwe is now the site of the town of Chililabombwe.

Copperbelt operations were managed privately until after Zambia gained independence in 1964. They were nationalised by the government of Kenneth Kaunda in 1969. In that year, 825,000 t of copper were produced (Coakley, 1995). Declining copper prices in the late 1970's reduced the profitability of the operations and in 1982 the nationalised mines were amalgamated into Zambia Consolidated Copper Mines (ZCCM).

At that time ZCCM was the second largest copper mining operation in the world after Chile's Codelco (Dolley and Coakley, 1996). Continued decline in copper prices and a lack of reinvestment in mining infrastructure resulted in decreasing production by the Copperbelt mines. By 1995 Zambia was ranked 10th in the world in the production of copper, producing 342,000 t compared to Chile's 2,488,000 t (Weaver & Caldwell, 1999). The Copperbelt mines also produce significant quantities of cobalt.

Privatisation of ZCCM began in 1993 under the government of Frederick Chiluba. Negotiations for the sale proved difficult, and agreements for the privatisation of the last major assets were only concluded in 1999. The companies that have invested in the Copperbelt have a real opportunity to help Zambia towards sustainable development, as the minerals sector can generate the wealth needed to stimulate the economy to alleviate unemployment, extreme poverty and the huge backlog of social services. (See Section 3.2.6)

2.2.7 Mining expansion in Tanzania

Tanzania has a variety of mineral resources. These include:

- metallic mineral deposits - iron, nickel, and tin,
- precious metals - gold and silver,
- gemstones - diamonds, ruby, tanzanite,
- industrial minerals - limestone, gypsum, phosphate, and
- fossil fuels - coal and natural gas.

The mining industry developed slowly in Tanzania, largely due to unfavourable mining policies and lack of finance (Mbendi, 2001). In 1985 the government emphasized the mining industry as an important part of reviving the national economy. In 1990 an investment code provided a fiscal regime that attracted considerable foreign and local investment in the mining industry. Between 1995 and 1999, 50 foreign companies acquired 500 prospecting licenses and invested US$297 million in exploration.

In 1999 the sector grew by 27 per cent, and Tanzania is thought to have the largest gold reserves in southern Africa after South Africa. Gold mining has been the driver of major development. By the end of 2002, Tanzania will be producing more than 900,000 ounces of gold a year. That level of production would represent an addition of over US$200 million to Tanzania's exports at today's depressed world gold prices. It is likely that Tanzania will be producing more than 1,500,000 ounces by the middle of this decade (Mbendi, 2001).

The largest mining potential outside gold includes the Kabanga nickel deposit, the large coal reserves in the Ruhuhu area, and the iron reserves in nearby Liganga. These deposits are attracting the interest of some of the largest global mining companies (SADC, 2001a).

Western Deep Levels (courtesy of D. Minnitt)

2.2.8 Factors that stimulated mining

In 1932 South Africa left the gold standard. The gold price doubled within three years, and the gold mining industry experienced major expansion. This expansion stimulated the development of secondary industry in the region.

Sterling was devalued in 1949 and the price of commodities such as copper increased. In 1952 the Northern Rhodesian (now Zambian) colonial government introduced a liberal tax code that allowed new mines to amortize their capital. A surge in copper production resulted, and in 1960 the country was second or third among Western producers (Watts, 1961 in RT6 Granville).

The 1960s were boom years in southern Africa as world demand for metals and minerals grew. The region contributed 3.8 per cent of the value of world mineral production by 1973. South Africa was producing 67 per cent of the region's total, Zambia 12 per cent, Angola 10 per cent, Namibia 6 per cent, Zimbabwe 3 per cent and the other countries the remainder.

Countries of the region were among the top five producers of gold, diamonds, platinum, copper, manganese, vanadium, uranium and asbestos. These mineral resources were regarded as of major strategic and political importance, especially by the USA and USSR.

2.2.9 The minerals industry after the end of the colonial era

The political oppression in Rhodesia and the Portuguese colonies of Mozambique and Angola continued until the collapse of the Portuguese colonial regime in 1975 and the end of the illegal regime in Zimbabwe in 1980. In 1994 the first democratic elections in South Africa signalled the end of formal restrictions on franchise and employment.

Between 1975 and 1990 reform of industrial labour relations in South Africa progressed steadily towards the extension of labour rights to all. Black mineworkers' unions negotiated for better wages and conditions at a time when increasing costs and falling commodity prices were causing mines across the country to cut back on production and employment.

Steep increases in the operating costs of the gold mines were inevitably accompanied by predictions of their imminent demise. Price increases and improved technology deferred the demise, and in 1980 the region was producing over two-thirds of the world's gold. That year was, however, the peak.

Costs increased further with the need to mine at increasing depths, while the gold price dropped steadily as the role of gold in the world monetary system declined. Outdated management structures and old technology, which prevented the mining companies from mining in an efficient and intensive manner, resulted in a decline in production. Eventually large-scale mine closures occurred. SADC countries now produce less than 20 per cent of the world's gold. The closures caused hundreds of thousands of mineworkers to be laid off, with consequent knock-on effects in many other industries.

Production of copper in the region has also declined significantly in the past decade, mainly as a result of lower copper prices and the parlous condition of the state-owned mines of the Zambian Copperbelt (Dolley & Coakley, 1996; Limpitlaw, 1998), which have now been privatised.

Production of some other minerals in SADC countries has increased. For example, chromite increased from 32 per cent to 51 per cent of world production over 1993-1998, while platinum production has held steady at two-thirds of world supply (BGS, 1999 in RT6 Granville). Coal production in South Africa almost doubled between 1980 and 1998 (Segal, 2000 in RT6 Granville). A positive trend is also apparent in the significant exploration (see Figure 2.5) being undertaken in African countries, and mineral production can be expected to grow.

2.3 The current state of the mining and minerals processing sector

2.3.1 Mining remains the economic cornerstone of economies

Today, despite recent adverse economic features and depressed commodity prices for many metals and mineral products, mining and its associated industries continue to form the cornerstone of the economies of most southern African countries (see Table 2.1, Figure 2.2 and Table 3.5).

The climate in terms of government policy, laws and regulations also affects the level of private sector mining investment. In recent years this has, in some instances, resulted in slow progress in the development of the mining industry in certain SADC countries.

In Zambia the minerals industry accounts for about 10 per cent of employment, and copper and cobalt account for 77 per cent of total exports (Coakley, 1998). When processed minerals and metals are included, the contribution of the minerals sector of SADC rises from 8 per cent of the region's GDP to some 10 per cent, and its contribution to foreign exchange earnings from 43 per cent to 60 per cent (Granville *et al*., 2000, in RT6 Granville).

These figures show that mining plays a critical role in the economies of southern Africa but do not show the sector's significant contribution to the informal economy. Small scale mining is an important source of income for many people in the region and is likely to grow in importance. It is estimated that, in a number of southern African countries, small scale mining contributes up to 5 per cent of GDP, and in Zimbabwe and Tanzania, for example, small scale miners contribute up to 25 per cent of the total gold production (RT1 ITDG). Small scale mining is estimated to have accounted for between 15 - 20 per cent of the world's non-fuel mineral production (Hentschel *et al*. 2001).

Table 2.1: *Contribution of southern Africa to world mineral production Sources: (BGS, 2000; USGS, 2000; Minerals Bureau, 2000; Granville et al., 2000; SADC, 2001; all in RT6 Granville); (Schneider pers. comm., 2001).*

Mineral	per cent, 1998	Countries with contribution greater than 5 per cent	Other regional producers
Alumino-silicates[#]	59	RSA	
Asbestos*	n/a	Zimbabwe, RSA, Swaziland	
Chromite	51	RSA	Zimbabwe
Coal	7	RSA	Zimbabwe, Botswana, Swaziland, Zambia, Tanzania, Malawi
Cobalt	42	Zambia, DRC	Botswana, RSA, Zimbabwe
Copper	4		Zambia, RSA, Botswana, Namibia, Zimbabwe, DRC
Diamonds**	46	DRC, Botswana, RSA	Angola**, Namibia, Tanzania, Swaziland, Zimbabwe, Lesotho[##]
Ferrochrome	49	RSA, Zimbabwe	
Gold	19	RSA	Zimbabwe, Namibia, Tanzania, Botswana
Iron ore	3		RSA, Zimbabwe
Manganese	18	RSA	Namibia, Botswana, Zambia
Nickel	7		RSA, Botswana, Zimbabwe
Phosphate rock	2	RSA	
Platinum-group Metals	49	RSA	Zimbabwe
Semi-precious stones[##]	n/a	Tanzania, Zambia	RSA, Malawi, Botswana, Namibia
Steel	1		RSA, Zimbabwe, DRC
Titanium	20	RSA	
Vanadium	61	RSA	
Vermiculite	45	RSA	
Zinc	2		Namibia, RSA

[#] andalusite, kyanite, sillimanite; * not available; ** not including smuggled diamonds;
[##] small scale mining.

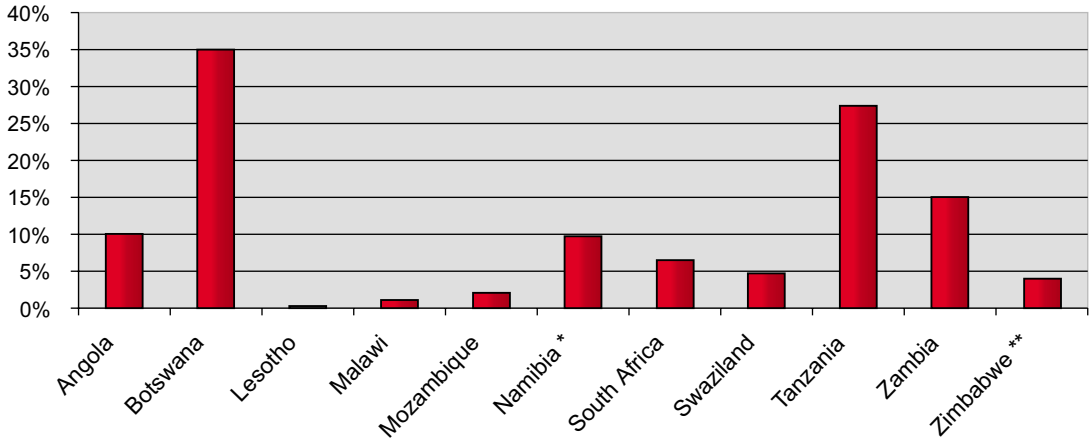

Figure 2.2: *Contribution of mining to GDP, selected countries (source: SADC 2001 in RT5 MacFarlane).*
** Some authorities consider mining's direct contribution to Namibia's GDP to be 15% (Schneider, pers. comm.,2001).*
*** Figures for Zimbabwe from Murangari (pers. comm., 2001). The contributions to GDP listed above exclude the significant indirect contribution arising from the activities of the sector. No data was available for the Democratic Republic of Congo.*

To form a complete picture of the way in which mineral wealth contributes to, or detracts from, sustainable development, cognisance should be taken of the extent to which minerals fuel civil wars and undermine governments and economies. Between 1992 and 1997 UNITA, the Angolan rebel movement, is estimated to have earned US$ 3.7 billion from the sale of conflict diamonds. In 1999 alone, the movement is estimated to have earned US$ 150-200 million (MMSD 2001c).

In 1999 a South African was accused by the South African government of bankrolling the Kabila government in the war in the DRC. He allegedly used profits from cobalt and copper exploitation in the DRC to reimburse the Zimbabwean government for its involvement in the Congo war (Powell, 1999).

Hundreds of thousands of civilians or military personnel have been mutilated and injured, or have died, in the wars funded partly by conflict diamonds (MMSD 2001c).

United Nations sanctions against the trade in Angolan conflict diamonds, introduced in 1998, had very limited impact. De Beers voluntarily stopped purchasing any diamonds whose origins were not certifiable (pers. comm., Tweedy, 2002). The South African government, with other major producer and consumer governments, initiated the Kimberley Process, which involves industry, governments and NGOs. The Kimberley Process recognises "…that the possibilities for conflict diamonds to play a role in fuelling armed conflict can be seriously reduced by submitting the international trade in rough diamonds to a certification scheme that would guarantee, to the maximum extent practicable, the absence of conflict diamonds in that segment of internationally traded rough diamonds" (Government Communications, 2001a).

The Kimberley Process could, if successful, be used as a precedent for regulating the use of other minerals to eliminate their role in funding civil unrest and armed conflict.

2.3.2 Major minerals and metals

The following minerals and metals have been of major importance in the history of mining development in southern Africa: chromium, coal, cobalt, copper, diamonds, gold, iron, manganese, nickel, phosphates, platinum-group metals (PGMs), semi-precious stones, lead, zinc and titanium. Over 60 minerals are mined in the SADC region and exported to over 100 countries worldwide.

Southern Africa is one of the world's most mineral-rich regions, and the economies of most of the states in the region have grown as a direct result of the development of mining operations. Table 2.2 shows the southern African share of world mineral reserves.

2.3.3 Minerals processing

Development of the mineral processing industry in the region has progressed from primitive fire-smelting of single metals to the stage where mineral products are used in manufacturing. In the South African Government white paper, "A Minerals and Mining Policy for South Africa", beneficiation is described as successive processes of adding value to raw materials. These processes of value addition, reflected in Table 2.3, include mining a mineral from underground, concentrating it and converting it into an intermediate product, refining it for use in primary manufacturing and final conversion into a manufactured product (Baxter, pers. comm., 2001).

Table 2.2: *Southern African proportion of world mineral reserves (Baxter, pers. comm.., 2001).*

Commodity	SADC Country	Percentage of Global Reserves	Total percentage in SADC
Gold**	South Africa	35.0	
PGMs	South Africa	55.7	
	Zimbabwe	8.9	64.6
Silver	South Africa	2.4	2.4
Coal	South Africa	10.9	10.9
Hydrocarbon fuels	-		
Uranium	South Africa	9.4	
	Namibia	6.7	16.1
Cobalt	DRC	26.0	
	Zambia	5.6	
	South Africa	0.2	31.8
Copper	Zambia	5.2	
	DRC	4.6	
	South Africa	2.0	11.8
Lead	South Africa	2.1	2.1
Nickel	South Africa	8.4	
	Botswana	0.6	
	Zimbabwe	0.2	9.2
Titanium	South Africa	20.4	20.4
Zinc	South Africa	3.5	3.5
Chromium	South Africa	68.3	
	Zimbabwe	20.5	88.8
Iron Ore	South Africa	0.9	0.9
Manganese	South Africa	80.0	80.0
Vanadium	South Africa	44.5	44.5

* reserves data unavailable,
** only South African gold reserves data available

Possible stages of transformation are shown in Figure 2.3. The furthest stage of transformation achieved in each southern African country for selected major minerals is listed in Table 2.3.

Stage	Mineral beneficiation process catergory	Process flow-chart	Labour	Capital
1	The action of mining and producing an ore or concentrate (primary product)	Run-of-mine ores → Washed & sized concentrate	High	High
2	The action of converting concentrate into a tonnage product (such as a metal or alloy)	Mattes/slags/ bulk chemicals → Ferro pure	Low	High
3	The action of converting the intermediate goods into refined product suitable for purchase by both small and sophisticated industries (semis)	Steel/alloys → Worked shapes & forms	Low	High
4	The action of manufacturing a final product for sale	Worked shapes & forms → Worked shapes & forms	Medium to High	Medium to High

Figure 2.3: *The four stages of the minerals beneficiation process (Baxter, pers. comm., 2001).*

Table 2.3: *Stages of processing achieved in southern Africa for selected commodities (RT6 Granville, Ireton, pers. comm., 2001, King, pers. comm., 2001).*

Commodity	Product	Beneficiation Stage	Country
Aluminium	Aluminium	Stage 3	South Africa, Mozambique
Chromium	Stainless steel	Stage 3	South Africa
Chromium	Ferroalloy	Stage 2	Zimbabwe
Cobalt	Manufactured product	Stage 4	South Africa
Cobalt	Metal	Stage 2	DRC, Zambia
Cobalt	Salt	Stage 2	Zimbabwe
Cobalt	Matte	Stage 2	Botswana
Copper	Manufactured product	Stage 4	South Africa, Zambia, Zimbabwe
Copper	Metal	Stage 2	DRC
Copper	Matte	Stage 2	Botswana, Namibia
Copper	Copper concentrate	Stage 1	Mozambique
Diamonds	Rough	Stage 1	Angola, DRC, Lesotho, Swaziland, Zimbabwe
Diamonds	Cut	Stage 4	Botswana, Mauritius, Namibia, South Africa, Tanzania
Gold	Bullion	Stage 2	Botswana, DRC, Mozambique, Namibia, Tanzania, Zambia, South Africa, Zimbabwe
Gold	Fabricated product	Stage 4	South Africa, Zimbabwe
Iron	Manufactured products	Stage 3 and 4	Angola, Botswana, DRC, Lesotho, Malawi, Mozambique, South Africa, Zambia, Zimbabwe
Manganese	Ferro-alloys, manganese steel products	Stage 2	South Africa
Nickel	Matte	Stage 2	Botswana
Nickel	Metal	Stage 2	Zimbabwe, South Africa
Nickel	Stainless steel	Stage 3	South Africa
Platinum group metals	Concentrate	Stage 1	Zimbabwe
Platinum group metals	Manufactured product	Stage 4	South Africa
Ilmenite	Titania slag	Stage 2	South Africa

In southern Africa the mining industry has been pivotal in the development of infrastructure and the establishment of manufacturing industries. Manufactured products have been produced in nine SADC countries, mainly in the iron and steel and copper industries. Governments are now encouraging downstream development of, for example, the jewellery industry.

Although the direct contribution of mining to the economies of SADC countries has varied during the past 30 years, the importance of manufacturing industries based on a wide variety of minerals has grown substantially.

The economic contribution currently made by mining to the economies of mainland SADC countries are highlighted in Table 2.4. This excludes associated industries and beneficiation programmes.

The economic benefits attributable to the mining sector are reflected in the contribution to direct foreign exchange earnings in each country. The economies of Angola, Botswana, DRC, Namibia, South Africa, Tanzania, Zambia and Zimbabwe obtain between 22 per cent (Tanzania) and 90 per cent (Angola) of their foreign exchange directly from mining and mineral exploitation activities. The high percentage contribution to Angola's direct foreign exchange earnings is as a result of oil production, as well as the mining and minerals sector.

Table 2.4: *SADC countries: Mining outputs and GDPs (Granville et. al., 2000 (for 1997); Van Rensburg, 1977 (for 1973) both in RT6 Granville)*

Country	GDP (US$m) 1997	Mining output 1997 (US$m)	Mining as per cent of total GDP*	
			1997	1973
Angola	7,830	705	9	15
Botswana	5,713	1,942	34	10
DRC	11,730	469	4	29
Lesotho	1,054		<1	0.3
Malawi	1,721	52	3	0.1
Mautitius	4,596			
Mozambique	1,801		<1	0.2
Namibia	3,150	473	15	69
Seychelles	530			
South Africa	140,020	11,202	8	16
Swaziland	1,101	52	5	17
Tanzania	4,542	45	1	1
Zambia	3,913	419	11	41
Zimbabwe	7,848	314	4	9
SADC	**195,549**	**15,673**	**8**	**16**

* at current prices

Overall, it is conservatively estimated that mining contributed an average of 40 per cent to the direct foreign exchange earnings of SADC countries in 2000 (Mbendi, 2000; CIA, 2001 in Hounsome & Ashton, 2001). The estimates of foreign exchange earnings are likely to be on the conservative side as they exclude the economic contribution made by informal miners to the economies of several countries.

Despite the prevailing economic pressures on the mining industry, the mining sector in the twelve mainland SADC countries directly employed 1,5 million people in 1999 (SADC, 2001b). This represented 2.3 per cent of the region's total available workforce, which was estimated at 68 million in 1999 (CIA, 2000). Employment in the sector increased to two million in 2000, not including informal miners, except in Tanzania. (SADC, 2001b). While these figures do not account for the millions of people dependent on miners' incomes for their livelihoods, they do emphasize the importance of the mining sector as a source of employment.

2.4 Trends in mining's contribution to the economy

(Where SADC figures are not available, South African figures are quoted.)

2.4.1 Gold and the South African economy

The contribution of all mining, as a proportion of GDP for the region, was lower in 1997 than in 1973. A chart for South Africa (Figure 2.4) shows that the proportion was approximately constant at around 12 per cent until the early 1970s and peaked in 1980. This increase resulted mainly from high commodity prices, especially for gold. The price of gold increased at an average annual rate of 37 per cent in both US dollars and South African Rand over the decade 1970 to 1980 (Segal, 2000, in RT6 Granville). Since then the proportional contribution of all mining in South Africa has been in continuous decline.

Between 1992 and 1999 the nominal value of mining output in South Africa increased from R26.6 billion to R44.2 billion at current prices (Loxton, 2001 in RT6 Granville). Inflation was a major contributor to this increase. The slowdown in mining has continued, and growth in this sector in South Africa was only 0.1 per cent in the first quarter of 2001 (Ebersohn, 2001 in RT6 Granville).

Mining contributed 43 per cent to the SADC region's exports in 1997. In South Africa there has been a persistent decrease in the mining contribution - from 62 per cent in 1980 to 35 per cent in 2000 (Jourdan, 1993, COM, 2001 both in RT6 Granville). When beneficiated minerals are included with primary minerals in South Africa's exports for 2000, the total contribution to exports increases to 59 per cent (Segal, 2000 in RT6 Granville).

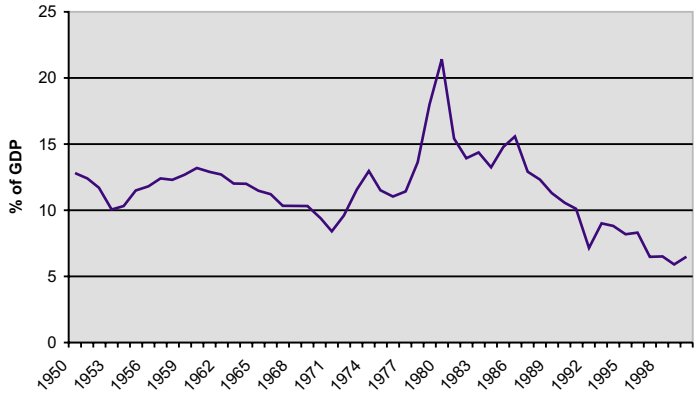

Figure 2.4: *Contribution of mining to South African economy, (1950-1999: RT6 Granville; 2000: Baxter, pers. comm., 2001).*

An aspect of the relative decline of mining's contribution to the South African economy is decreased government revenue. Mining companies contributed only 1 per cent to South African government revenue during the 1990's, compared to 12 per cent in the 1970s and 1980s (Segal, 2000 in RT6 Granville). This is because revenue is dependent on taxation of profits, and not on royalties. Revenues from diamond mining also decreased, principally as a result of declining prices.

2.4.2 Future prospects

The image of the mining industry as an industry in decline is changing. For example, gold, which accounted for over 60 per cent of South Africa's mineral sales in 1983, now accounts for ess than one third (Minerals Bureau, 2000 in RT6 Granville), but other minerals have collectively replaced it in significance. With the exception of gold and manganese, all of South Africa's major minerals have experienced long-term growth (Segal, 2000 in RT6 Granville). The output of three sectors - coal, platinum group metals and chrome - has doubled since 1980, and the non-gold component of mining grew faster than the overall economy from 1980 to 1998. Prospects are good for the further growth of these minerals and their eventual compensation for the decline of gold in mining's share of GDP.

There are also good prospects for the revival of mining in other SADC countries such as Tanzania. It is likely that the common misconception that mining is declining in importance in the economies of nations is not correct for the SADC countries, in spite of the fact that the prices of most minerals have been declining on a long-term basis and that most mineral economists believe that they will continue to decline (RT6 Granville).

The above discussion refers to the direct contribution of mining to the regional economies. Indirect contributions include:

- capital formation: gross domestic fixed investment, attraction of foreign and domestic capital (COM, 1999 in RT6 Granville),
- forward linkages: material inputs into other industries (e.g. energy generation),
- backward linkages: purchase of goods and services from domestic industry,
- income terms of trade multiplier: the impact on foreign exchange earnings and the balance of payments,
- consumption expenditure by mine employees, and
- social multipliers: employment, health care, education and physical infrastructure.

The increase in exploration activity is evidence of a potential improvement in mining's contribution to the economy. In 1997, US $ 86 million were spent in eight countries in the region (See Figure 2.5). The continent's share of world exploration spending was estimated at 17.5 per cent in 1998, up from 7 per cent in 1993 (Segal, 2000, in RT6 Granville).

The mining and minerals industry has been the economic cornerstone of southern Africa. The wealth generated by this industry has not always been used to rehabilitate environmental degradation caused by mining, nor to benefit the communities affected by the industry. In spite of this history, current trends in the mining and minerals industry indicate that it can contribute to the region's move towards sustainable development. The industry remains a most significant factor in the region's future development.

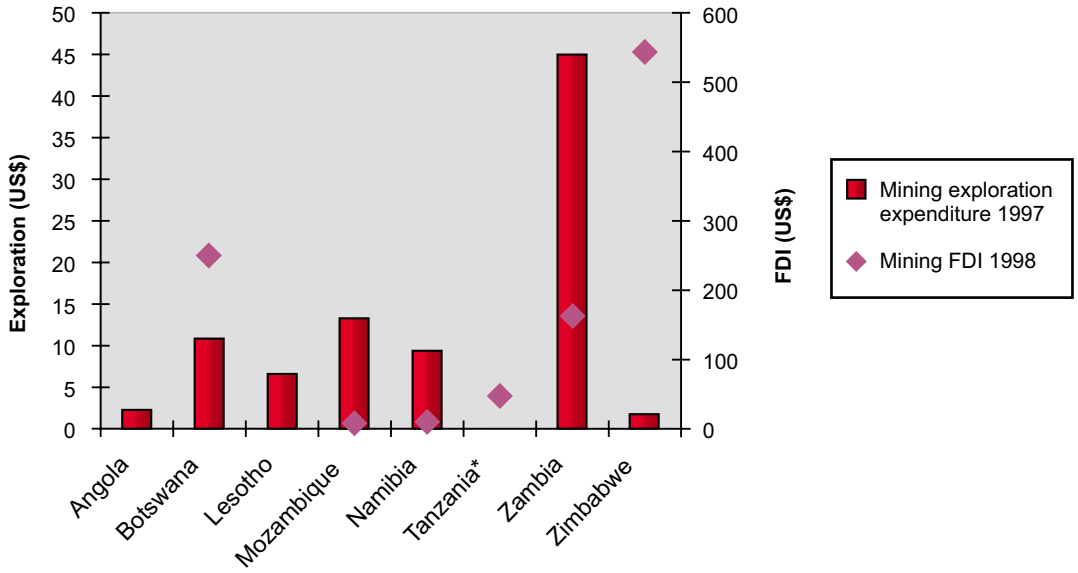

Figure 2.5: *Mining exploration expenditure 1997 and Mining FDI 1998 (Source: Segal, 2000, in RT6 Granville). Data in US$ millions.*
** Exploration expenditure for Tanzania not available. This is the latest data available, and no data was available for the Democratic Republic of Congo, which is an important part of the mining and minerals sector in southern Africa.*

Indirect contributions by mining to the economy include health care - AngloGold's Lusikisiki Medical Centre (courtesy of AngloGold)