

THE MINERALS INDUSTRY OF SWAZILAND

BY PAUL JOURDAN

REPORT NO. 104

MARCH 1990

THE MINERALS INDUSTRY OF SWAZILAND

By
Paul Jourdan

INSTITUTE OF MINING RESEARCH
University of Zimbabwe
Harare, March 1990

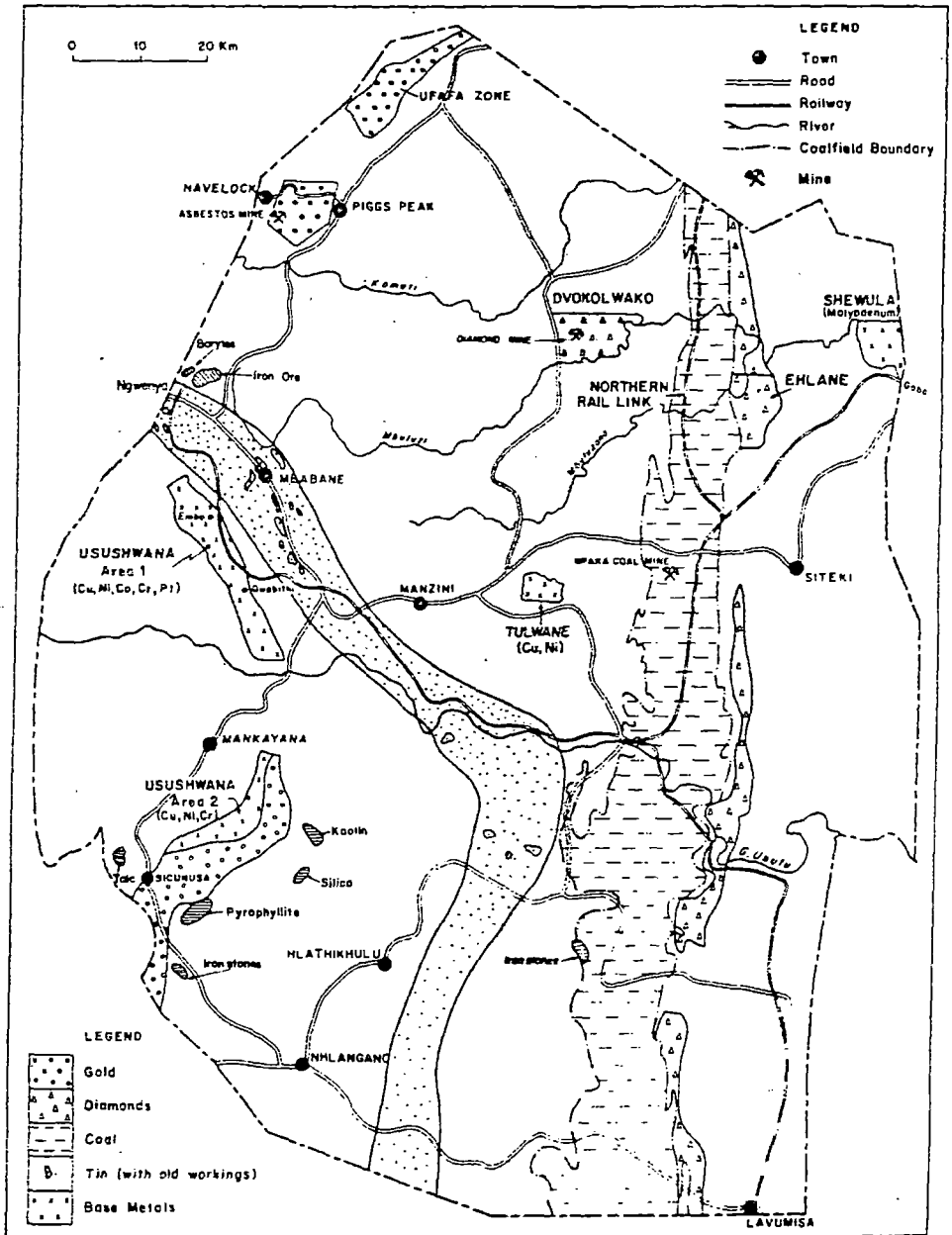
IMR Open Report Number 104

Introduction	1
History	1
The Economy	1
The Mining Sector	3
General	3
Economic Geology	4
Legislation	4
Mineral Production	5
Discussion	7
Footnotes	9

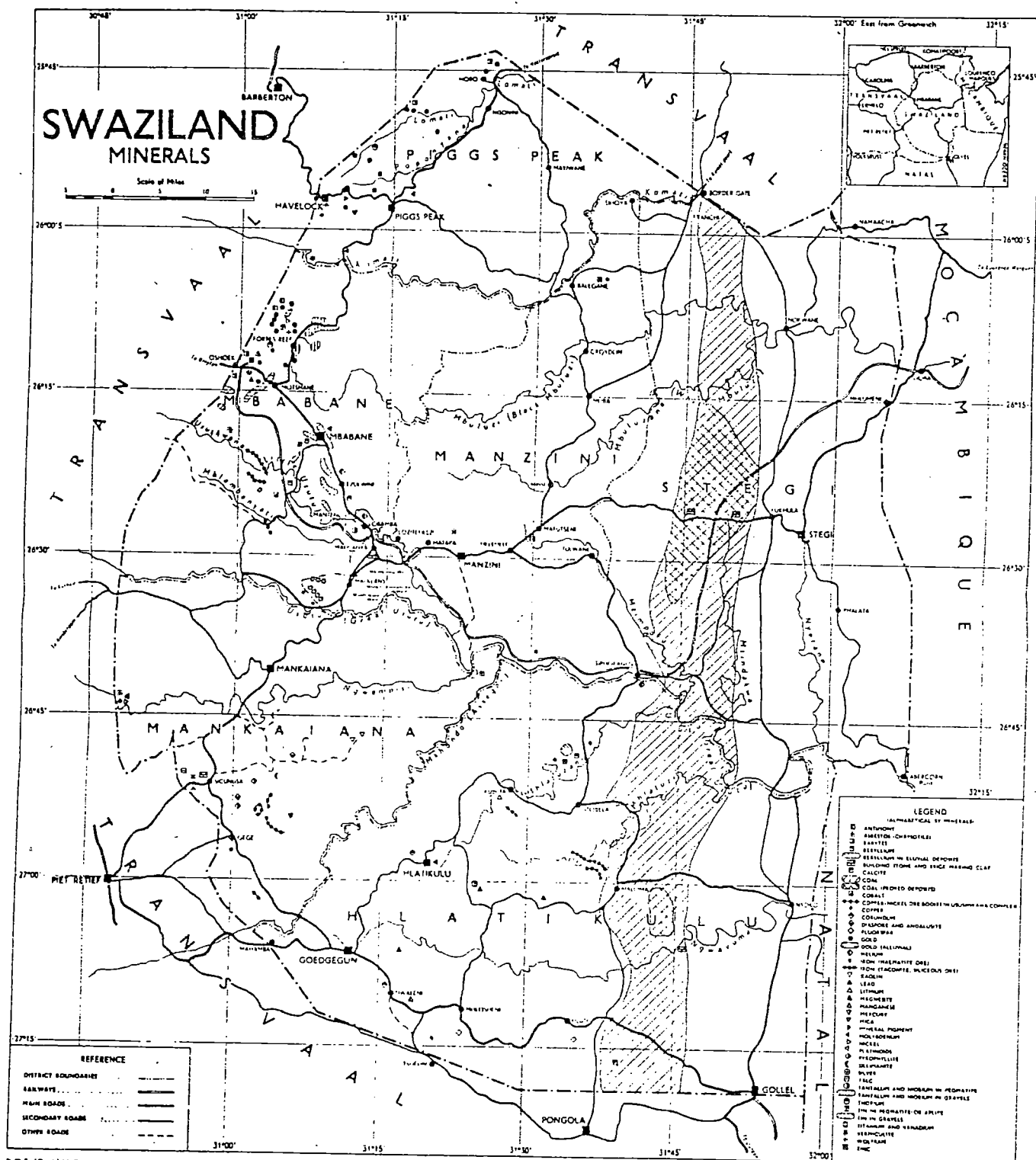
SWAZILAND

Fig.15

MINERAL PROSPECTS IN SWAZILAND



GSMD 1986



The Minerals Industry of Swaziland

Introduction

History

The original Swazi people belonged to the Nguni sub-group of the Bantu and, under Nkosi Dhlamini, broke away from the main Nguni group in the sixteenth century and settled in what is today southern Mozambique. Later, under Chief Ngwane, they moved to southern part of present day Swaziland¹. The Kingdom of Swaziland was created at the same time as the rise of the Zulu state in the 1830's by a chief called Sobuza and was further consolidated by his son, Mswati, from whom the state took its name². The original state was made up not only of Nguni people but also of some Sotho refugees.

In the 1840's the first Europeans started entering the country and secured mineral concessions from the Swazi kings and in 1881 at the Convention of Pretoria, the British and Transvaal Republic governments ratified the present day frontiers of Swaziland which deprived the nation of much of their best farmland, which was incorporated into the Transvaal Republic. Since then the land issue has remained central to Swazi relations with South Africa.

In 1902 British administration of the country commenced, which continued until independence in 1968. In 1973 the Westminster type constitution was suspended and since then Swaziland has been essentially an absolute monarchy which was ruled by King Sobuza II until his death in 1982. After four years of disputed ascendancy Crown Prince Makhosetive was installed as Ingwenyama (king) in 1986.

In the late 1970's and early 1980's, with the rapidly changing regional geopolitical configuration, caused by the independence of the ex-Portuguese colonies (Mozambique and Angola) and the capitulation of the settler regime in Rhodesia (Zimbabwe), Swaziland made a tentative attempt to reduce its dependency on the Republic of South Africa. The most important acts in this regard were that Swaziland rejected the South African sponsored regional grouping, CONSAS, and instead joined the SADCC³, expanded its electricity generating capacity (to reduce South African imports) and installed its own telecommunications link with the outside world (that did not go via South Africa).

But these moves came to an end in 1982 when Swaziland signed a secret security agreement with South Africa undertaking not to allow the ANC to operate from its territory. The reasons for "relinking" were complex including both internal Swazi politics and incentives/disincentives offered by the RSA, the most important being the offer of a transfer of land from South Africa to Swaziland, between southern Swaziland and the Indian Ocean, thereby giving them access to the sea. This transfer never finally materialised.

Since the signing of the security agreement with South Africa it appears that their security apparatus has had fairly free access to Swaziland and throughout the decade there were numerous kidnappings and assassinations of South African exiles and ANC cadres in Swaziland. In addition there have been persistent reports of the South African sponsored MNR bandits using Swaziland for recruiting, for transit to Mozambique, as a refuge and even as a rear base. Paradoxically, the Swazi railway to Maputo via Goba has regularly been out of action due to MNR attacks and sabotage by MNR operating from Swaziland.

The Economy

The Swazi economy is heavily dependent on the RSA for both imports (around 90%) and exports (around 30%) and in terms of control by South African business interests. In addition Swaziland is a

member of SACU whose revenues consistently generate the bulk of government receipts (40% to 65%) and South African firms own most of the economy, except for the sugar and forestry industries. Invisibles from South African tourism and remittances from Swazi workers in South Africa complete the picture of a country that is a virtual satellite of its huge neighbour. Even the Swazi currency (emalangeni) is pegged to the South African Rand at 1:1, meaning that South African companies treat Swaziland as a small extension of their domestic market.

Table 1. SWAZILAND: DEPENDENCE ON SOUTH AFRICA

(ME)	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988
Exports fob	M	287	340	332	324	332	373	610	709	844
RSA	M	83	108	123	105	111	125	204	342	
% RSA	%	29%	32%	37%	32%	33%	33%	33%	41%	
Imports cif	M	406	443	469	516	548	617	689	743	995
RSA'	M	361	433	467	512	492	575	621	692	
% RSA	%	89%	98%	99%	99%	90%	93%	90%	92%	
Trade Balance	M	(119)	(102)	(137)	(193)	(216)	(243)	(79)	(34)	(151)
Govt Revenue+	M	126	150	182	185	213	245	255	337	428
SACU Receipts	M				118	121	130	137	120	135
% SACU Receipts					65%	65%	61%	56%	47%	40%
Migrants RSA	k	11	11	11	14	14	14	15	17	18

Sources: CSO 1985/6/7, CBS 1987/8/9, EIU 1988/9, DEPS 1989.

Swaziland's population is the lowest in the SADCC, but its population density is one of the highest at 34 persons/km² in 1988. The main economic activity is agriculture which typically accounts for about one quarter of GDP. Its GDP per capita is third in the SADCC region (after Namibia and Botswana), mainly due to its relatively large manufacturing sector (about one-fifth of GDP) and in real terms GDP growth has managed to keep ahead of population growth throughout the 1980's, unlike most other SADCC states⁴. There clearly are certain advantages in collaboration with the apartheid regime.

Table 2. SWAZILAND: BASIC ECONOMIC INDICATORS

(ME)	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988
Population	M	.56	.58	.60	.62	.64	.66	.68	.71	.74
Pop. density	/km ²	32	33	35	36	37	38	39	41	43
Forex Rate	/USD	.77	.89	1.10	1.12	1.47	2.24	2.27	2.07	2.26
CPI		100	114	129	148	164	199	230	252	289
GDP mp	G	.42	.50	.55	.58	.66	.74	.96	1.10	1.35
GDP/cap	USD	975	974	831	831	696	502	623	753	807
GFCF	M	148	140	153	170	209	225	229		
GFCF/GDP	%	35%	28%	28%	29%	32%	30%	24%		
Debt	GUSD	.17	.16	.17	.18	.17	.18	.22	.27	
Debt/GDP	%	30%	29%	34%	34%	38%	55%	53%	51%	
Labour Force	k	85.3	90.2	88.2	90.1	89.2	85.2	91.6	94.7	
Area: 17,364 km ² , Currency: Emalangeni										

Sources: CSO 1986/7/8, EIU, 1988/9, DEPS 1989.

The main forex earners are sugar (35% of exports in 1987) which is controlled by British transnationals, woodpulp (18%), fruit (fresh and canned) and vegetables (11%) and minerals (5%). In addition significant forex is earned through SACU receipts, tourism (mainly South African controlled) and migrant workers' remittances. National debt is about half GDP and around 75% of the total value of exports. The country has experienced high inflation in the 1980's, almost 200%, mainly due to the fact

that the Emalangeneni is pegged to the Rand and therefore devalued at the same rate as the Rand causing "imported" inflation from South Africa.

With the increasing isolation of the South African regime, in the form of economic sanctions, due to its racist policy of "apartheid", there has been a temptation for Swaziland to obtain quick profits by becoming a centre for sanctions busting for South African goods. There have been several well documented instances where South African goods are labelled "made in Swaziland" for export onto the world market⁵. There also appears to be evidence to suggest that certain South African products are exported to the EEC under Swaziland's Lome quotas⁶.

With regard to the minerals sector there are suspicions that not all Swazi coal exports come from Swazi mines⁷ and in 1988 it was announced that two Australian companies (WMC and Boulder), jointly with Swazi (Tibiyo) and European interests, planned to open a ferrochrome smelter in Swaziland that would produce 120 kt/an of ferrochrome⁸, but as Swaziland has no chromite deposits, the ore would have had to be imported, and the only economic source would have been South Africa. The project was however later abandoned.

The Mining Sector

General

Ancient exploitation of iron ores for red (haematite) and black (specularite) ochres by hunter gatherers occurred as far back as 43,000 years ago about 20 km north-west of the present day capital of Mbabane⁹. This deposit was later mined out by a consortium led by Anglo American Corporation in the 1960's and 70's. Iron mining and smelting people came to Swaziland in the 4th and 5th centuries and ancient mining sites are found in several locations across the country.

The discovery of gold in the late 1870's in the Forbes Reef area heralded the beginning of the modern era of mineral exploitation, that of incorporation into the world capitalist economy. Gold was the principal mineral produced until the First World War when it was replaced by tin until production of asbestos started at the Havelock Mine in 1939. From 1964 to 1979 iron ore was exported to Japan at the rate of about 2 million tonnes per year, "leaving Swaziland with nothing but a hole and a railway to Maputo"¹⁰

Table 3. SWAZILAND: BASIC MINERAL DATA

(ME)		1980	1981	1982	1983	1984	1985	1986	1987	1988
GDP Mining	G	14.1	16.4	14.4	15.7	12.4	18.0	21.5		
% GDP Mining	%	3.3%	3.3%	2.6%	2.7%	1.9%	2.4%	2.2%		
Mineral Prod.	M	19.2	21.3	18.4	24.4	21.8	29.6	35.4	38.9	43.6
Min.Prod/cap	USD	44.3	41.4	28.0	35.0	23.2	20.0	23.1	26.5	26.0
Min.Exports	M	20.2	20.9	17.4	21.7	22.2	28.8	32.4	35.9	39.7
% Min. Export	%	6.5%	6.2%	5.2%	6.3%	6.9%	8.8%	6.0%	5.1%	4.0%
Mining labour	k	2.6	2.6	2.5	2.2	2.4	2.4	2.4	2.4	2.1
% mng lab	%	3.0%	2.9%	2.8%	2.5%	2.7%	2.9%	2.7%	2.5%	
Min.Prod/lab	kUSD	9.8	10.8	6.8	9.8	6.3	5.5	7.1	8.1	9.3
average wage	k/an					3.81	4.11	4.69	5.20	6.08
average REAL wage/an						3.81	3.39	3.35	3.39	3.46

Sources: CSO 1985/6/7, DEPS 1989, GSMD 1987/8/9.

The contribution of the minerals sector to GDP has fallen steadily from 3.3% in 1980 to around 2% today due to both a drop in volume and real value. Mineral production per miner has also fallen in USD terms, from 9.8 kUSD in 1980 to 9.3 kUSD in 1988. Minerals as a percentage of total exports has decreased from 6.5% in 1980 to about 5% in 1989, due to a fall in mineral exports rather than an increase

in other exports.

From 1980 to 1988 the number of official migrants in South Africa, mainly on the mines, increased by three-quarters to 17,600. Hence there are more Swazis on the mines of South Africa than on their own mines. Mining sector employment as a proportion of total wage labour has always been low, at around 3% and is expected to fall further in the 1990's as the asbestos mines wind down. Average monthly wages were about 500 E (220 USD/m), well below equivalent wages in South Africa and fell in real terms by 10% from 1984 to 1988.

For many years all mining royalties went into the Tibiyo TakaNgwane Fund, directly under the control of the King, and the fund has provided the main vehicle for Swazi capital accumulation by buying back foreign owned land and by taking a minority share in most major foreign investments¹¹.

Economic Geology

The economic geology of Swaziland is dominated by the ancient granite-gneiss basement in the centre, the Archaean schist belts in the west and south-west and the sediments and volcanics of the Karoo System in the east¹².

The granite-gneiss basement hosts very few minerals but the younger, post Swaziland, granites are thought to be the source of, and contain, numerous cassiterite-bearing pegmatites which, upon erosion, give rise to Swaziland's scattered elluvial and alluvial tin deposits.

By far the most economically important rocks are those of the Archaean schist belts or gold belts. These metasediments and volcanics belong to the Swaziland System which is made up of the Onverwacht Series (volcanics), the Figtree Series (metasediments) and the Moodies Series (sediments), though the last is also thought to constitute a System of its own. This system contains the gold deposits (Forbes Reef Area and Pigg's Peak District), the iron ore (enriched banded ironstones) deposits, the barytes deposits (Fig Tree Series), talc and antimony deposits¹³.

The Jamestown Igneous Complex is thought to intrude the Swaziland System and contains the Havelock asbestos deposits in a sill-like body of serpentinite roughly conformably intruded into the sediments of the Fig Tree Series¹⁴. The post Swaziland sediments of the Mozaan Series contain several occurrences of kaolin clay but the later intrusive basic Ushushwana complex contains no mineral deposits of economic importance.

The eastern part of the country contains a monocline of Karoo sediments and volcanics striking north-south dipping east towards Mozambique. The Eccas Series of the Karoo System contains extensive coal seams and the weathering of Eccas shales has resulted in brick clay deposits.

Finally, the kimberlite pipe at Dokolwayo, in the centre-north of the country, is the source of the country's diamonds.

Legislation

All minerals are vested in the King (Ngwenyama), in trust for the Swazi nation, who is advised by his Minerals Committee which appraises all applications for prospecting licences and mining rights for approval by the King¹⁵. Individually tailored exclusive prospecting licences are granted by the King and the activities of the prospecting company are monitored by the Geological Survey and Mines Department to whom quarterly reports must be submitted.

Mining rights are issued in the form of notarial mining agreements and are for a limited time period

after which they can be renewed. Company tax is relatively low at 37.5% and there is a non-resident's shareholders tax on dividends of 15% while the balance may be repatriated¹⁶.

Mineral Production

General

By value the principal minerals produced in 1988 in Swaziland were asbestos, diamonds, coal and stone in that order. No iron ore has been produced since the last ore was moved from the Ngwenya Mine in 1979 and no gold has been produced since 1966. Except for stone (aggregate) all minerals are exported.

Table 4. SWAZILAND: MINERAL PRODUCTION

Mineral		1970	1975	1980	1985	1986	1987	1988	1989	Avg ¹
Asbestos	kt	33.1	37.6	32.8	25.1	23.1	25.9	22.8	27.3	31.7
Barium	kt	.34	.22	.00	.00	.00	.00	.00	.00	.09
Coal	kt	123	127	184	166	172	165	165	165	146
Diamond	Mcts.	.000	.000	.000	.021	.039	.100	.120	.055	.018
Iron ore	kt	2552	2240	0	0	0	0	0	0	---
Kaolin	kt	1.6	2.7	.0	.0	.0	.0	.0	0	.7
Talc	kt	.25	.00	.00	.00	.00	.00	.00	.00	.04
Tin	kt	.000	.000	.000	.000	.000	.000	.000	.000	.001

¹Average for 1970-88. Source: GSMD 1989, BGS 1980

Asbestos

Chrysotile asbestos mining first started at Havelock Mine in 1939 in the north-east of the country close to the South African border. The mine is in fact so close to the frontier that the asbestos is transported by aerial cableway from the mine to the railhead at Barberton in South Africa.

The mine was originally owned by Turner Newall of Manchester. The Swazi Nation (Tibiyi) took a 40% share of the equity and in 1985 Gencor (Sanlam group) of South Africa, owners of the Mswali Asbestos Mine across the border, bought out Turner Newall and are now the mine operators. The reasons behind Gencor's purchase are thought to be more strategic than economic as the mine has limited reserves and the world asbestos market has been depressed since the seventies due to its perception as a health hazard in the West. If sanctions were imposed against South African asbestos, it has been suggested that it would be difficult to differentiate between Mswali (RSA) and Havelock (Swazi) fibre on the world market.

Production peaked in 1969 at 38.5 tons and averaged 32 tons for the period 1970 to 1988 from an average of roughly 860 kt/an of ore milled. The yield varies between 3.5% and 4% of ore milled. Reserves are limited and the mine is slowly being scaled down and closure is expected in the 1990's if no further reserves are located. In 1988 the company was granted an exclusive prospecting licence to explore in the surrounding area and a mining lease was obtained for the exploitation of the adjacent far west area.

In 1988 the mine employed 1,484 workers and sales of fibre amounted to 19.3 ME. Exports were 99.3% of sales (28.15 t) and mainly to South Africa (44%), the EEC (18%), Japan (13%) and south-east Asia (8%). All exports are via South Africa.

Coal

Coal seams belonging to the Ecca Series of the Karoo System occur in a band about 20 km wide running north-south in the eastern part of the country. Although the deposits were drilled in the early twenties, mining did not start until the railway line from the Nwenya iron ore mine to Maputo (then Lourenco

Marques), which runs through the coal fields, was built in 1964 making exports feasible. In 1965 29 kt of anthracite were produced increasing to over 123 kt by the end of the decade. From 1970 to 1988 production averaged 145 kt/an.

All production is from the Mpaka Colliery in the centre of the coal band, near both road and rail links, which employs about 350 people. It used to be owned by Swaziland Collieries Limited (Anglo American Corporation of SA) but was bought by Gencor in 1985 and is now called Emaswati Coal (Pty) Limited in which the Swazi nation (Tibiyo) also has a share. As with Gencor's take over of Havelock, it has been suggested that the purchase of Emaswati could also be to cover for at least part of Gencor's South African production in the event of sanctions.

Of total sales in 1988 of 191.6 kt, 160.2 kt (84%) were exported and 31.3 kt were consumed locally, mainly by ranches for power generation. Exports were to Bamburi Cement Works in Kenya (82%) and to South Korea (18%). Exports are both via the Goba line to Maputo and the Golela southern link to Richards Bay in South Africa.

Paradoxically, Swaziland imports as much coal as it exports. In 1985 a total of 173 kt was imported from the RSA for the pulp manufacturer (38%), the asbestos mine (27%), the railways (17%) and industry (11%). These imports are of bituminous grade for burning installations (boilers) that originated from South Africa and require South African, lower, grade coal with a high volatiles content. A SADCC mining sector project funded by France will study the possibility of adapting the facilities to burn Mpaka coal, which has a higher calorific value¹⁷

Swaziland's coal reserves are estimated at one billion tonnes of which about 250 Mt have been proved to be mineable. The low volatile, low sulphur anthracitic coals are the only resources of this grade in the region outside South Africa.

Diamonds

Diamonds are a recently discovered mineral resource. Opencast production from the Dokolwayo kimberlite pipe started as late as 1984 when 16,837 carats were produced. An alluvial deposit has also been located at Ehlane in a band running parallel to the coal in the north.

The Dokolwayo operation will continue as an open pit mine until 1994 when it is planned to start mining underground. The Swazi nation and a South African company, Trans-Hex (Rembrandt Group), have equal shares in Dokolwayo Diamond Mines Limited. Trans-Hex is a holding and investment company, and the diamond marketing arm of the Rembrandt (tobacco) group¹⁸. Production is about 40,000 carats/an mainly of industrial grade stones which are sold independently of the CSO, who most probably are not concerned given the small amount involved.

In 1988 there was some concern that gem grade stones were reaching the London market by routes other than Trans-Hex. Dokolwayo employs about 150 people and has become the second largest mineral producer and exporter after asbestos, with exports of about 7.8 MUSD in 1989.

Other Minerals

The Ngwenya iron ore mine was opened in 1963 and the first ore was shipped to Japan the next year. The mine was owned by the Swaziland Iron Ore Development Company in which Anglo American had a majority holding in partnership with Guest, Keen & Nettlefolds and the CDC¹⁹. From 1964 to 1979 over 28 million tonnes of high grade (62.5% Fe) iron ore was shipped to Japan. Further resources at Ngwenya and elsewhere (Gege, Maloma, Mahlamati) have been assessed but found not to be feasible for exploitation.

There has been renewed interest in the gold deposits of the goldbelts of the Swaziland System, but no

new operations have materialised. Historically the main production areas were the Forbes Reef Area, the Pigg's Peak District and various alluvial deposits. From 1880 to 1966 126,868 thousand troy ounces were produced²⁰. There has also been some interest in the schist belts in the south-east of the country, but no firm commitments.

Kaolin was produced at the Mahlangatsha deposit until 1976 at the rate of about 2 kt/an. The development of these deposits as the raw material for a ceramics industry for the production of whiteware (porcelain) forms part of a regional (SADCC) study in this regard.

A clay exploration programme was carried out at Lubhuku in 1983/4 which delineated substantial reserves of good quality brick clay, but there are currently no firm plans for the exploitation of the deposit. Talc deposits associated with a chlorite-carbonate-schist of the Jamestown Complex were mined near Sicunusa until 1974 at the rate of 200 to 300 t/an.

Swaziland Barytes Limited used to operate a small mine in the extreme west of the country near the border post of Oshoek in the meta-sediments of the Fig Tree series. Opencast (quarry) production took place from 1945 to 1976 at the rate of 200 to 300 t/year.

Tin mining has been carried out intermittently since 1892 (Mbabane district) from alluvial and eluvial cassiterite-bearing gravels, from pegmatites in the younger granites, in a belt running south-east from the west (Ngwenya) to the centre, then turning south to southern border. There has been no production since the late seventies and there are no immediate plans for new operations.

Other minerals that have in the past been exploited are diasporite (Sicunusa), pyrophyllite (Sicunsa), yttrioantalite (in tin-bearing gravels), corundum (Hlatikulu), beryl (pegmatites) and fluorite. In addition there are minor occurrences of a wide variety of other minerals that have never been exploited such as manganese, nickel, lead, calcite and quartz.

Discussion

Any discussion on the minerals industry of Swaziland must inevitably use as its starting point Swaziland's domination, in all fields, by its neighbour, the Republic of South Africa, with which it shares a common currency and customs union.

After becoming a British colony in 1902, initial penetration and development of the economy was more by British capital (eg Turner Newall) than South African. The biggest exports, sugar and woodpulp, are still controlled by British interests (Tate & Lyle, Lonrho, CDC and Courtaulds), but most other sectors of the economy have been taken over by South African capital, particularly the mining sector which is now completely controlled by South African firms (Gencor and Trans-Hex). What is also noteworthy is that both the South African companies come from the smaller Afrikaner section of South African capital and both investments were made relatively recently, in the eighties.

The possibility that these, relatively small, investments were as a contingency in the event of sanctions being imposed against South Africa has been raised and, if true, would embroil Swaziland even further in support of the South African regime than is already the case under their joint security agreement. The ferrochrome project, now shelved, was a fairly clear example of attempt to "relabel" chromite ore from a South African bantustan (Lebowa) as Swazi ferrochrome for export.

The development of Swazi mineral resources for the SADCC market is unlikely given the logistic

problems of moving goods to other SADCC states, except for southern Mozambique, particularly coal for the Maputo area. Although the possibility of establishing a SADCC whiteware industry, based on Swazi kaolin resources, is being investigated, in the final analysis the feasibility of the project will most probably depend on the South African market.

The future development of Swaziland's minerals is likely to be determined by the world market for high unit value precious and base minerals and the local and South African market for lower unit value industrial minerals, except for the substantial coal resources which are only 100 km from the port of Maputo. A high international gold price is all that is needed to provoke the development of the country's numerous gold occurrences. In addition, these have not been reassessed in terms of low grade high tonnage opencast heap leach operations. This type of operation accounts for almost all of the spectacular increase in gold output in western Australia, on Archaean schistbelts very similar to those of the Swazi System. Both an improvement in the security of the Goba line to Maputo (Matola) and an increase in price would be necessary for the establishment of a large scale coal exporting industry.

South African gold mining technology is centred on large scale underground reef operations on the Witwatersrand System, which is not particularly applicable to the small scattered occurrences of the Swazi schistbelts. The small scale gold mining technology of Zimbabwe could be more appropriate for the development of an indigenous mining sector. Zimbabwe has over 600 small gold mines with less than ten workers.

The rapidly changing situation within South Africa is also certain to have an impact on Swaziland. In this regard it is likely that the Swazi leadership will also start to hedge its bets by cooling its collaboration with the present white regime in anticipation of a post-apartheid government.

The first signs of this happening were recently reported when Turner Newall offered to set up its purchasing office, for all their South African companies, in Swaziland. All the group's purchases would have been invoiced to the Swazi company, but even before arrival at the South African port the products would have been resold to the South African companies, to whom they would be directly despatched, on arrival. In this way bans on exports to South Africa would have been circumvented, but it is reported that the Swazi government turned down the plan as it would have drawn them further into the maintenance of the apartheid government and would have been difficult to conceal.

Finally, the Swazi minerals industry is structurally typical of a third world country in that almost all production is exported with minimal beneficiation. The linkages to the rest of the economy are low except in that the mining sector generates foreign currency for the import of goods by other sectors. In 40 years the asbestos mines have initiated almost no downstream processing, even though the previous owner, Turner Newall, is a worldwide producer of asbestos-based products such as brake pads (Ferodo) and asbestos-cement products. There are attempts to integrate coal mining and a ceramics industry based on the Lubhuku clay (for bricks) and the Mahlagatsha kaolin (for porcelain) which would go some way in transforming the minerals sector into a vehicle for national development.

Footnotes t

- 1 Barclays Bank, 1986
 - 2 Fage 1978
 - 3 Hanlon, 1986
 - 4 DEPS, 1989
 - 5 Hanlon 1986 and Askin 1988
 - 6 Hanlon 1986
 - 7 Times of Swaziland 31/12/86
 - 8 Mining Journal, 24/02/89
 - 9 Lanning, 1979
 - 10 Hanlon, 1986, p98
 - 11 Hanlon, 1986
 - 12 Haughton, 1963 and 1969
 - 13 Hunter, 1962
 - 14 Haughton, 1969.
 - 15 GSMD, 1986
 - 16 Barclays, 1986
 - 17 SADCC 1988
 - 18 Mining Annual Review 1989
 - 19 Metal Bulletin 1969
 - 20 Hunter 1962
-