

GEOLOGICAL SURVEY AND MINES DEPARTMENT

MINERAL RESOURCES OF SWAZILAND

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MINERAL RESOURCES OF SWAZILAND.

INTRODUCTION.

In order to diversify the sources of economic development in the country Government wishes to foster development of a thriving mining industry that will contribute to sustainable economic development. Government recognises the positive contribution that mining can make as an engine for the economic development of Swaziland by diversifying the export base, widening the tax base, generating skilled employment, creating demand for local goods and services, contributing to infrastructure development, producing raw materials for local usage and acting as a catalyst for wider investment in the economy.

Government wishes to reverse the decline of the mining industry by attracting new investment in the exploration for and exploitation of mineral resources. Government recognises that to do this it must establish an enabling environment for investors that is based upon modern regulatory arrangements and competitive terms. Swaziland has to compete effectively against near-neighbours that are already established among the world's leading mineral producers, such as South Africa, Botswana, Namibia and Zambia.

Whilst Government is seeking to encourage investment by mining companies, there is also a need to ensure that mining operations are conducted responsibly. The neglect of the environment and harm to local communities as a result of mining operations is not acceptable. The intention is to ensure that Swaziland is securing the full economic and social benefits which mining development promises.

Government's policies are directed not only at large-scale mining but also at small-scale mining operations, which offer opportunities to support the rural livelihoods of the Swazi nation. Small scale mines need to be assisted in their efforts to operate in an economically and environmentally sustainable manner. Government recognises its duty to discharge its regulatory responsibilities in an effective, even-handed and co-ordinated way. A process to establish appropriate legal and administrative arrangements and the requisite institutional capacity is in progress. The legal framework being created will ensure that Swaziland's mineral endowment is managed on a sustainable economic, social and environmental basis and that there is an equitable sharing of the financial and developmental benefits of mining between investors and all Swazi stakeholders.

The legal arrangement attempts to encourage local and foreign private sector participation in the exploration for and commercial exploitation of mineral resources, in keeping with Government's commitment to a free-market enterprise economy. Government recognises that private sector investors need to be able to operate profitably, be internationally competitive and satisfy their shareholders' and employees' expectations. To this end, Government through a regulatory framework is establishing a mining bill that will promote and maintain:

- a conducive macro-economic environment for mining investment,
- a stable and predictable regulatory environment in which investors are treated in an even-handed and transparent manner,

- access by investors to and security of tenure over areas of mineral potential, and
- a stable, predictable, competitive and fair fiscal regime.

This report outlines in brief the known mineral resources in the country. Government wishes to encourage investment in beneficiation and value adding activities to the minerals within the Kingdom of Swaziland. Government realises that, if this is achieved where possible shall ensure the industry earns higher export revenues, creates more employment, increases Government revenues, expand the linkages of the mining sector to the rest of the economy. This policy shall ensure sustainable economic development and a weapon to fight poverty in the country. Institutional frameworks is being set-up in the new dispensation to ensure that investors negotiate for the acquisition of mineral rights within a reasonable timeframe and agree to work together for mutual benefit.

The Geological Survey and Mines Department in the Ministry of Natural Resources of Energy has technical reports and bulletins together with geological maps that are available to the public with the relevant information pertaining the minerals in this report.

THE COAL DEPOSITS OF SWAZILAND

EXECUTIVE SUMMARY

This report gives a synoptic inventory of Swaziland well-defined coal deposits. Detail geological exploration work leading to the publication of mining feasibility studies was carried out in Mhlume, Area 1 & Area 2 (including the dormant Mpaka Mine), Area 3, Lubhuku and Maloma (with the only operating anthracite mine) coal deposits. The mineable coal reserves, projected life and employment levels in each potential coal mine are indicated below.

AREA	MINEABLE (Million tonnes)	EST. ANNUAL PRODUCTION	LIFE OF MINE (YRS)	EST. EMPLOYMENT LEVELS
Mhlume	18.4	665000	27	665
Area 1	9.1	-	-	-
Area 2 Mpaka Mine	41.2	500 000	82	600
Area 3	20.6	500 000	41	450
Lubhuku	18.9	510 000	37	500
Maloma	35.3	600 000	58	600
Total	143.5	2 775 000	-	

Coal in Swaziland occurs in two coal zones found respectively in the Upper and Middle Ecca series of the Karoo Supergroup. The coal seams dip 5° to 8° to the east and up to twenty (20) coal seams are found in the coal-field of Swaziland.

The coal deposits of Swaziland are served by a network of tarred and gravel roads; telecommunication systems, electricity grids and most importantly they lie in close proximity with the railway line. As indicated in the report transport of the coal would only require the construction of a railway siding and loading facilities in the relevant railway station. Hence, the development of a coal mine would mean a significant growth to the railway freight and provide additional job opportunities to Swazi citizens.

The establishment of all the potential coal mines would create over two thousand (2 000) direct employment opportunities while other people could be employed in other allied industries such as schools, shops, etc. It would be prudent for the mines to be run by joint venture entities with a strong local representation to ensure operational security, stability and sustainability.

COAL RESOURCES OF SWAZILAND

INTRODUCTION

Coal has been known to exist in Swaziland for a long time. Concession maps drawn in the late nineteenth century accurately show the coal field of Swaziland.

The coal field of Swaziland forms a north - south continuous area with an average width of fifteen (15) kilometres found on the eastern part of the country (Figure 1). The coal field of Swaziland comprises of Karoo sediments and occupies about one sixth of the 17 364 km² area of Swaziland.

The coal field of Swaziland occurs within the Lowveld of Swaziland. It consists of low lying plains ranging between 300 and 400 metres above mean sea level and receives the least amount of rainfall in the country which averages only 700mm per annum.

COAL GEOLOGY

The coal-bearing Karoo sediments lie on the foot of the Lubombo mountain range, which forms its eastern boundary. The Karoo sediments dip to the east at 7°. There are two coal zones each containing numerous coal seams. Up to twenty (20) coal seams of various thicknesses occur in the coal-field. The Upper Coal Zone and Lower Coal Zone are contained respectively, in the Upper Ecca Series and Middle Ecca Series of the Karoo Supergroup.

Coal seams of mineable thickness (at least 1 metre) are found in the Lower Coal Zone. The Main Coal Seam has been found to have a consistent lateral distribution and an average mineable thickness of three (3) metres throughout the coalfield. The mining geology is relatively difficult due to the occurrence of intrusions by dolerite dykes and sills, which are often accompanied by faulting. These igneous intrusions through coal bearing strata resulted in certain areas of the coal to be burnt, devolatilized or even replaced by the dolerite.

KNOWN COAL RESOURCES

Coal Exploration activities conducted to date concentrated, on the shallow western part of the coalfield, and within the Lower Coal Zone. Limited exploration has been conducted on the coals of the Upper Coal Zone because of their inferior quality as compared to the coals of the Lower Coal Zone.

The Lower Coal Zone contains about 485.00 million tonnes of in situ coal resources of which 143 million tonnes are mineable (see table 1).

Table 1 Coal areas and reserves in million tons

AREA	ESTABLISHED (SITU)	MINEABLE
MHLUME	> 34.0	18.4
AREA 1	> 1 15.2	9.1
AREA 2 (MPAKA MINE)	> 55.2	41.2
AREA 3 (SUMCOR)	> 50.0	20.6
MALOMA	> 44.2	35.3
LUBHUKU	<u>186.4</u>	<u>18.9</u>
TOTAL (MILLION TONNES)	<u>485.0</u>	<u>143.5</u>

COAL QUALITY

The coalfield of Swaziland consists of semi-anthracitic or lean coals and anthracite. Coals of the Upper Coal Zone are inferior quality anthracite with a high ash content compared to some of the high quality anthracite of the Lower Coal Zone.

ANALYTICAL SPECIFICATIONS OF LOWER COAL ZONE COALS

Table 2 Analytical Specification of Lower Coal Zone Coals

SPECIFICATION	MALOMA	MHLUME	MPAKA	AREA 1	AREA 2	AREA 3	LUBHUKU
YIELD %	75.00	84.10	75.00	83.20	73.00	90.50	78.00
MOISTURE %	1.60	1.10	1.30	1.00	1.30	1.00	1.40
ASH %	9.25	13.15	14.10	9.80	14.00	10.80	13.20
FIXED CARBON %	84.45	78.50	72.00	98.00	72.60	74.60	76.20
SULPHUR %	0.76	0.27	0.35	0.60	0.40	0.50	0.43
PHOSPHORUS %	0.01	0.01	0.01	0.01	0.01	0.01	-
VOLATILES %	5.40	8.50	12.70	11.00	12.10	13.60	7.70
ASH FUSION TEMP (°C) 1400		-	1250	1300	1250	1265	1320
CALORIFIC VALUE (MJ/Kg)	31.39	30.00	29.00	32.00	29.89	31.53	29.70

The coalfield of Swaziland is served by an adequate system of tarred roads designed to serve both the coal and sugar industries. Swaziland has direct automatic dialling telecommunication with all neighbouring states and the world at large. Adequate electricity distribution networks already exist for any new coal mining development in the coalfield.

It will be necessary to develop adequate water storage facilities, as the coalfield of Swaziland is liable to drought. The coalfield is remote from the present administrative and industrial centres making it necessary for new townships to be constructed for any new coalmines.

Swaziland can provide most of the manpower required in a coalmine with the exception of experienced management personnel. For training of artisans and tradesmen Swaziland has the Swaziland College of Technology (SCOT), Vocational Training Institute, etc, while administrative personnel can be trained at the University Of Swaziland (UNISWA) and in other Institutes.

COAL DEPOSITS

Following are brief descriptions of Mhlume, Area 1 & Area 2 (Mpaka Mine), Area 3 and

Lubhuku coal deposits (Figure 1). Detail coal exploration information and the mining feasibility studies indicate that the coal reserves of each deposit can be increased through execution of further geological exploration in the adjacent areas.

MHLUME COAL DEPOSIT

LOCATION

Mhlume Coal Deposit is located north-east of Swaziland in an area of approximately 7km² situated in the south west of Mhlume townships. This area is found along the western edge of the sugar fields (see figure 1).

COAL QUALITY

The Mhlume Coal Deposit has high quality anthracite. The quality of raw and washed coal is shown below:

	Raw coal		Washed Coal	
	Average	Washed	Average	Washed
Ash (%)	22.4	35	17	18
Volatiles (%)	9.2	11	9	11
Sulphur (%)	0.4	0.9	0.4	0.9
Calorific Value (MJ/kg)	25.9	21.0	28.3	27.5

MARKETS

Mhlume Coal Deposit has high quality anthracite. The calorific value of Mhlume anthracite is above that of normal anthracite, its main use would be as a smokeless fuel. South Korea and Japan are the ideal markets for washed coal. It would also be for metallurgical purposes, heating and as a source of fuel in boilers for thermal power stations.

AREA 2 COAL DEPOSIT (MPAKA MINE)

LOCATION:

Area 2 Coal Deposit (Mpaka Mine) is situated in the central part of the Coalfield of Swaziland some 40 km east of Manzini (see figure 1). Coal from Area 2 Coal Deposit was mined from the dormant Mpaka Mine, which is found on the western edge of the coalfield 1 km south of the Manzini - Siteki tarred road.

COAL QUALITY

Area 2 Coal Deposit consists of semi-anthracitic coal generally referred to as lean coal because of the relatively low volatile matter content (12 to 14/o) and high ash content (26% for unwashed coal). However, the coal from Area 2 Coal Deposit has a very high heat value (29MJ/kg) low sulphur and low phosphorus (less than 1 % for each case). Average coal quality data is as follows:

Yield (%)	75.0
Moisture (%)	1.3
Ash Content (%)	14.1
Volatile Matter (%)	12.7
Phosphorus (%)	0.01
Sulphur (%)	0.35
Fixed carbon (%)	72.0
Ash Fusion Temp. (°C)	1250
Calorific Value (MJ/Kg)	29.0

MARKETS

Washed coal from Mpaka Mine, which is found within the Area 2 Coal Deposit has been successfully sold to Kenya where it was used for cement manufacturing. Some coal consignments from Mpaka Mine were sent to the Asian markets (Japan, S. Korea, etc.) where it was used for manufacturing smokeless briquettes for domestic heating and cooking. The bulk of the coal could be used for electricity power generation.

AREA 3 COAL DEPOSIT

LOCATION

Area 3 Coal Deposit is located in Lubombo Region south of the dormant Emaswati Coal Mine (see figure 1). It is in the lowveld region and the topography is relatively flat.

COAL QUALITY

The average coal quality is shown below:

Yield (%)	90.50
Moisture (%)	0.9
Ash (%)	15.1
Volatiles (%)	13.8
Sulphur (%)	0.6
Fixed Carbon (%)	76.6
Ash Fusion (°C)	1265
Calorific Value (MJ/kg)	31.53

MARKETS

Washed coal could find markets in Japan and Asia as a blend for steam coal and for metallurgical purposes. It could also be used as a smokeless fuel for domestic heating. Unwashed coal could be used for stern raising purposes.

LUBHUKU COAL DEPOSIT

LOCATION:

Lubhuku coal deposit is located in the central eastern part of Swaziland - an area known as the

lowveld (see attached figure 1). The western boundary of the deposit is adjacent to the Tshaneni to Lavumisa railway line

COAL QUALITY

The coal is mainly semi-anthracitic to anthracite and compares with Natal anthracite. The average coal analysis of main seam is given below:

Moisture (%)	1.4
Ash (%)	13.9
Fixed carbon (%)	76.9
Volatile matter (%)	7.7
Sulphur (%)	0.43
Calorific Value (MJ/Kg)	29.7

MARKETS

The exploitation of northern portion of the Main Coal Seam would yield 510,000 tons per annum of washed coal for 40 - 50 years. The unclean coal would be used in a thermal power station, which is under consideration.

Washed coal could find markets in Japan, South Korea and others, thus, providing a major freight for Swaziland Railway to transport the export coal through Maputo and/or Richards Bay.

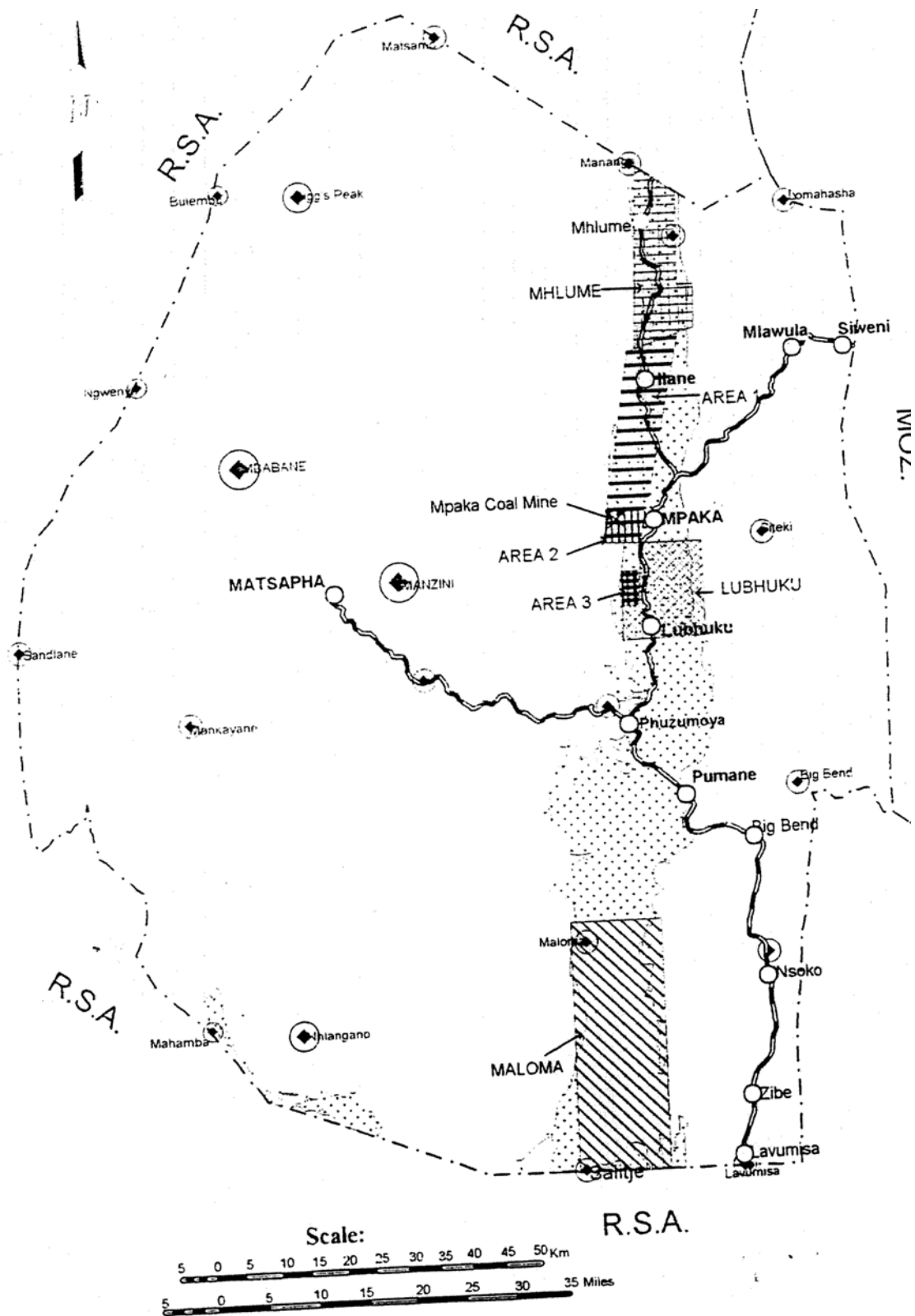


Figure 1 Locality map of the Coal Field of Swaziland.

SWAZILAND IRON ORE DEPOSITS

Swaziland has numerous occurrences of low grade iron ore deposits, the deposits vary in grade from 30% Fe-50%Fe with pockets of 60% Fe in some locations. These occurrences are restricted to narrow belt stretching from north western Swaziland, 10-15 km. North of the old –defunct Ngwenya iron ore mine to south eastern Swaziland (Figure 2).

The banded iron ore deposits in north western Swaziland are largely made up haematite and magnetite inter layered with quartzite and jaspilite. In the northern part, west of the Piggs Peak village the iron ore formations are of magnetiferous amphibolites (taconite)

The grades and estimated tonnages are shown in Table 2 A-C. It is clear from these Tables that the grade of the banded iron formations is much higher in the vicinity of the old Ngwenya Mine averaging around 45% with small pockets of 50%-60% iron. Further north the iron ore deposits are of slightly lower grade averaging around 35% iron.

Banded iron ore deposits in south central Swaziland are of a much lower grade than those occurring north western Swaziland and average about 30% Fe- 35% Fe. Generally these iron stones are made up of ferruginous lenses occurring within the sediments of the Mozaan Group. Some of the iron stones occur as enclaves within the granitoids. Table C shows the grades and tonnages of these iron stones.

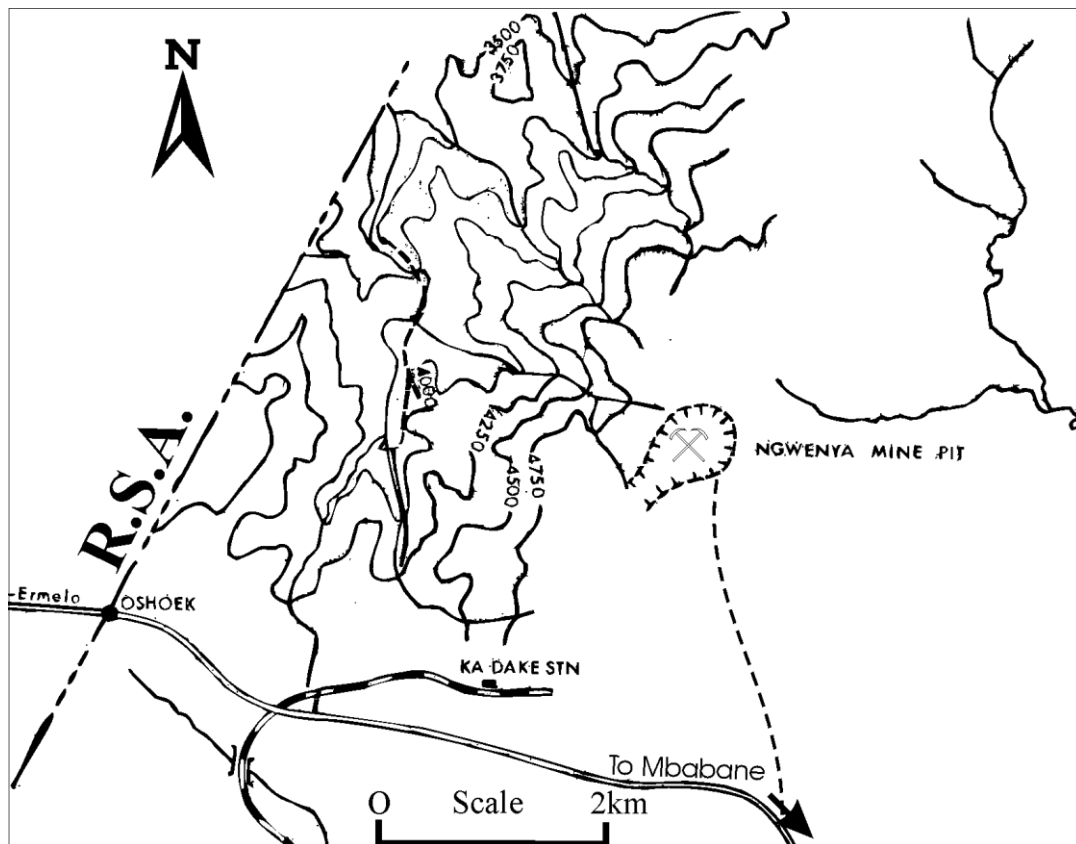


Figure 2 Locality map of the dormant Ngwenya Iron Ore mine in the north-western part of Swaziland.

Table 3 A to C Showing grades and tonnage of iron stones in Swaziland

IRON FORMATION RESERVES

(A). WITHIN NGWENYA MINE LEASE AREA (ONE MULTIPLE HORIZON)

ORE TYPE	GRADE (%)	TONNAGE
BANDED HAEMATITE QUARTZITE - STOCKPILED	43.70	28,019,839
SLIMES	50.30	4,023,839
BANDED HAEMATITE QUARTZITE - IN SITU IN HANGING WALL OF PITS	43.70	26,551,623
SUB TOTAL	43.70	58,595,301
ORE IN SITU BELOW ECONOMIC PIT LEVELS	60.00	17,900,000
BANDED HAEMATITE QUARTZITE - IN SITU BELOW ECONOMIC PIT LEVELS		16,750,000
SUB TOTAL	52.20	34,650,000
BANDED MAGNETITE CARBONATE FORMATION IN PITS	45.10	339,498
BANDED MAGNETITE CARBONATE FORMATION OUTSIDE OF PITS	45.10	2,712,251
SUB TOTAL	45.10	3,051,749
TOTAL MINE LEASE AREA	46.50	96,297,050

NOTE: These were expected tonnages at the finalization of the medium grade contract.
The contract was fulfilled in the second part of 1978.

(B). NORTH OF MINE LEASE (2 HORIZONS)

ORE TYPE	GRADE (%)	TONNAGE
BANDED MAGNETITE QUARTZITE, NORTH EXTENSION	32.60	16,556,852
BANDED MAGNETITE QUARTZITE, JASPILITE (NORTHERN)	32.00	11,651,495
BANDED MAGNETITE QUARTZITE, JASPILITE (SOUTHERN)	28.50	4,426,497
BANDED MAGNETITE QUARTZITE, JASPILITE (NORTHERN)	32.00	33,140,768
BANDED MAGNETITE QUARTZITE, JASPILITE (SOUTHERN)	28.50	2,124,895
SUB TOTAL	31.70	67,900,507

(C). PIGG'S PEAK AND HAVELOCK AREA (4 DISTINCT BODIES)

DEPOSIT	GRADE %	TONNAGE (TO 100 m DOWNDIP)
<u>NOTTIGNHAM PEAK</u>		
GENERALLY BANDED MAGNETITE QUARTZITE WITH SURFACE OXIDATION	35.00	170,000,000
MIDWAY BANDED HAEMATITE QUARTZITE	35.00	30,000,000
<u>MHLATANE</u>		
TACONITE	35.00	46,000,000
<u>IRON HILL</u>		
MASSIVE HAEMATITE	62.00	50,000
ENRICHED BANDED HAEMATITE QUARTZITE	45.00	2,500,000
BANDED HAEMATITE QUARTZITE	35.00	45,000,000
IRON HILL SUB-TOTAL	35.40	47,550,000
PIGG'S PEAK SUB-TOTAL	35.00	293,550,000

(D). SOUTHERN SWAZILAND (3 SEPARATE DEPOSITS).

ORE TYPE	GRADE (%)	TONNAGE
<u>MALOMA TACONITE</u>		
(METAMORPHOSED FERRUGINOUS SHALE OF PONGOLA SYSTEM)	30.00	100,000,000
<u>GEGE TACONITE</u>		
(METAMORPHOSED FERRUGINOUS SHALE OF PONGOLA SYSTEM)	30.00	50,000,000
<u>MKHONDO VALLEY</u>		
IRON FORMATIONS (HIGHLY METAMORPHOSED)	30.00	10,000,000
SUB-TOTAL	30.00	160,000,000

<u>GRAND TOTAL</u>	<u>36.00</u>	<u>617,747,557</u>
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GOLD OCCURRENCES IN NORTH WESTERN SWAZILAND

Gold occurrences were discovered over a hundred (100) years ago in north western Swaziland between Motshane and Horo (Fig 3). The gold occurrences in Swaziland are all found on the western side of the iron ore formations.

Gold mining activity was only recorded after 1910 at that time only 130,000 ounces had been produced and prior to this date it can only be assumed that a similar amount was produced.

The most productive areas in north western Swaziland at the time were: Pigg's Peak, Forbes Main Reef, Wyldsdale, Daisey and Gobolondo and most of the gold mining activity in these locations (Table3) occurred between 1882 and 1914 and between 1920 and 1967 irregular small mining activity was recorded.

Table3 shows estimated reserves and grades and from these figures it is fairly obvious that there is still enough gold in the ground for future mining and the grade is very encouraging.

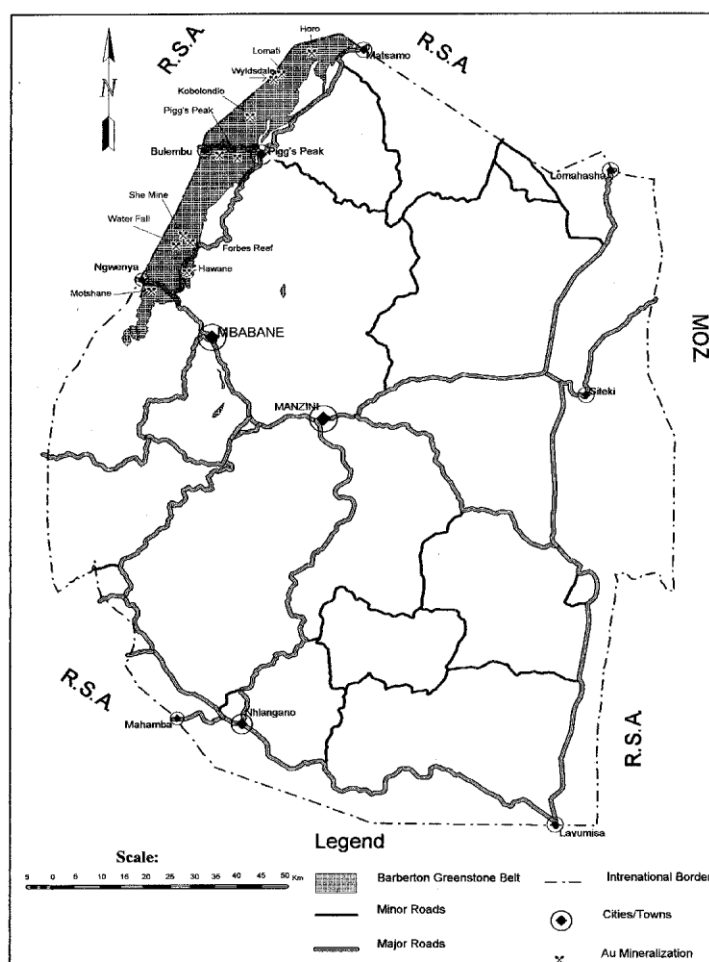


Fig.3. Map of Swaziland showing the Barberton Greenstone belt and the location of gold deposits and occurrences (modified after Wilson 1982) and the road network.

Table 4. Summary of gold deposits in Swaziland

Locality	Deposit Name	Brief Deposit /Reef description	Estimated <i>in situ</i> reserves (t)	Average grade (g/t)	Recommended Mining method
Northern Hhohho	Daisy (Horo) deposit	Reef varied between 6.1-18.3m wide Auriferous quartz veins occur in quartz-sericite-fuchsite schists, biotite schists, amphibolites and foliated granite	46 300 tailings and dumps not included	5.4	Open cast / stoping and selective mining
Hhelehhele	Wyldsdales	Pervasive 10mm smoky quartz veins in deeply weathered granodiorite and mafic schists	331900	5.4	Open cast may be up to 60m
Hhelehhele	Lufafa	Disseminated sulphides in ferruginous shale of the Moodies Group	1 652 700	1.3	Open cast up to 60m / adits
Hhelehhele	Lomati	Brecciated carbonate and mafic schists	9 331 possible reserve 12 444kg Au	11.9	Stoping without pillars
Hhelehhele	Kobolondo	Almost vertical quartz veins dipping at about 78° towards the south along a shear parallel to a granodiorite plug	Not encouraging	1.2-2.62	Open cast up to 60m / Stoping without pillars
Pigg's Peak towards Bulembu	Pigg's Peak	Single sub-vertical horizon of massive chert with a strike length of 6km	75 000 plus small amounts of Au in mine dumps and tailings	5.0	Underground method / Stoping with backfill
North east of Bulembu	Devils Reef	Gold lode within a ferruginous and manganese was exceptionally rich but not extensive	Information not available	1.27kg/t	Stoping without pillars
Malolotja Nature Reserve	Forbes Main Reef	Reef being an auriferous quartz vein steeply dipping at 65° towards the south	Detailed mapping required	47.5	Stoping with cement and backfill
Same as above	Waterfall	High grade obtained within a vein with a strike length of 0.91m	Detailed study recommended	11.9	Stoping with cement and backfill
Same as above	Avalanche	Acid reef ranging from 1.5-2.75m wide		4.3	Stoping without pillars
Same as above	Ivanhoe	Auriferous quartz vein in talcose and siliceous carbonate schists	6 000	8.5	Open pit
Same as above	She	Ore body was 1.5-3.4m wide striking east-west with a strike length of 457.2m dipping at 45°-70° towards the south	25 000	6.6	Open cast

DIAMOND OCCURRENCES IN SWAZILAND

Diamond is hosted in a kimberlite and in Swaziland this rock type is found at Dvokolwayo. Other diamond deposits occur as fluvial deposit at Hlane and Mlawula Game Reserves. The quantity of ore in these deposits is not known.

DVOKOLWAYO KIMBERLITE

LOCALITY

The diamond bearing kimberlite pipe is located in the Dvokolwayo area some 65km from Manzini some 2km north of the Mbuluzi River (Fig. 4). It is accessed from Manzini through the northbound MR6. This dormant a 66kv power line from Swaziland Electricity Board and automatic exchange telephone line with international dialling service mine, which is under watchful eye of the army for security.

GEOLOGY

The Dvokolwayo kimberlite pipe is intruded into the Mliba granodiorite and forms a vertical pipe-like structure. Initially, at surface the pipe occupied some 2.8Ha whereas at 50m depths it occupied 3.4ha signalling size increase at depth. However at 120m depths it decreases. Presently the kimberlite has been mined up to depths of 72m.

GRADE

During previous mining operations by Trans Hex the Dvokolwayo Kimberlite produced diamonds, which were 80% industrial grade and 20% gem quality.

RESERVES

The present pit geometry is 600m in length, 160-180m in width; the kimberlite is some 60m wide. The pipe may still be mined and could still be paying to depths of 450m. This converts to 5million tons of *insitu* ore.

HLANE ALLUVIAL DEPOSIT

LOCALITY

The richest and most extensive alluvial diamond deposit in Swaziland is confined to the Hlane Game Reserve. This is some 30km to the east of the Dvokolwayo kimberlite pipe (Fig. 4). Geological reserves may be found beyond the Hlane game reserve to the south and north.

GEOLOGY

The Hlane alluvial deposit occurs within the red beds near the top of the Karoo sediments. The most occurrences are found in conglomerate/gravel horizons. The sediments dip 10-12° to the east. The main diamond bearing sediments crop out in a 5km north-south trend along the Mbuluzane River (Howthorne et al.). Diamond bearing Red Beds were established at 170m depths some 1.2km to the east of the banks of the Mbuluzane River.

QUALITY

Diamonds in the conglomerate are moderately sorted, of small size (average 0.008 carats) and include a high percentage of well-formed crystals.

RESERVES

Diamonds are present in sufficient quantities to warrant detailed investigation of the deposit (Howthorne, et al.). The deposit has not been quantified.

Table 5. Summary of diamond and other mineral resources in Swaziland

Diamond	Dvokolwayo	5 million tons	20% gem, 80% industrial quality	Dormant mine
	Hlane	Feasibility study recommended		
DIMENSION STONES	Mololotja Greenchert	Feasibility study recommended		
	Granites and rhyolites	Feasibility study recommended		
Barite	Londosi	286 000 tons	Industrial grade	Dormant mine
Talc	Forbes Reef/ Sicunusa	Feasibility study recommended		
Kaolin	Mahlangatsha	700 000 tons	Cream white to pinkish in colour	Dormant Mine
Silica	Madinda Hills	230 000 tons	76% SiO ₂	Never been exploited
Ball Clays	Lubhuku	Feasibility study recommended		
	Langa			In production

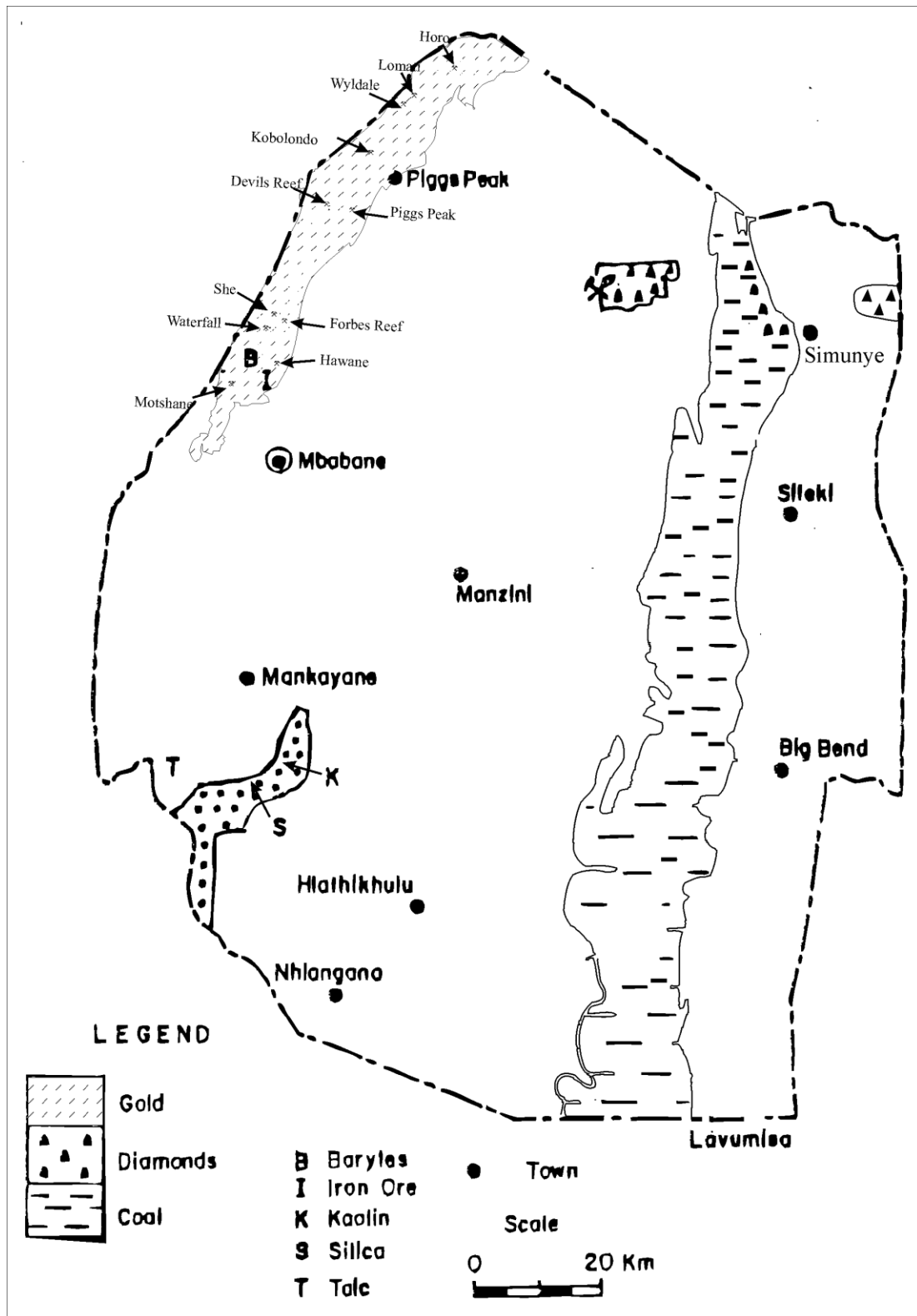


Figure 4. General locality map for the major minerals in Swaziland

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MAPS

SWAZILAND GEOLOGICAL MAP (Covers whole Country)

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Sheet 2 Pigg's peak
Sheet 3 Forbes Reef
Sheet 4 Motjane

GROUNDWATER RESOURCES OF SWAZILAND MAP

(Covers whole Country)

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GROUNDWATER RESOURCES OF SWAZILAND MAP

SCALE 1: 50 000

Sheet 19