MINERAL AND MINING DEVELOPMENT STUDY OF THE MOLEMOLE LOCAL MUNICIPALITY, LIMPOPO PROVINCE

Completed

by

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EXECUTIVE SUMMARY

This report provides an overview of the mineral occurrences and deposits in the Molemole Local Municipality (MLM) in the Capricon District Municipality, Limpopo Province. The objective of this report is to stimulate interest in and development of the mineral deposits in the municipality, thereby creating employment and improving the standard of living in the affected areas. A large variety of minerals occur in the municipality area, although most of them are small in size, uneconomic or suitable for exploitation by small-scale miners. These include iron, gold, copper, graphite, nickel, lithium, chromite, corundum and resources of dimension stones. Currently there are several dimension stone quarries operating in MLM. These quarries have a potential to grow into larger projects if proper planning and marketing of the products is put in-place. These quarries only produce rough blocks. If these blocks are processed into finished products the revenue and jobs created will possibly increase. The municipality with the help of the Provincial Government can establish a centralized processing plant for dimension stone in the province. The waste produced from these operations can be crushed and used as aggregates. Sand is also mined in a number of localities in the MLM; however, most of these operations are illegal.

Other minerals that can be mined in the MLM include the iron ore, gold, lithium and manganese. Currently companies such as Sishen Iron Ore Company (Pty) Ltd and Sekoko Resources are investigating the economic viability of exploiting some of these minerals.

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1. INTRODUCTION

1.1 LOCATION

The Molemole Local Municipality (MLM) former Dendron/Dikgale is one of the five local municipalities falling under Capricon District Municipality (CDM) in the Limpopo Province of South Africa. It covers an area of 3 347.25 km^2, which represents 19.7 % of the total surface area of the CDM (CDMEP, October 2008). The location of the MLM in the Limpopo Province is shown in Fig. 1.

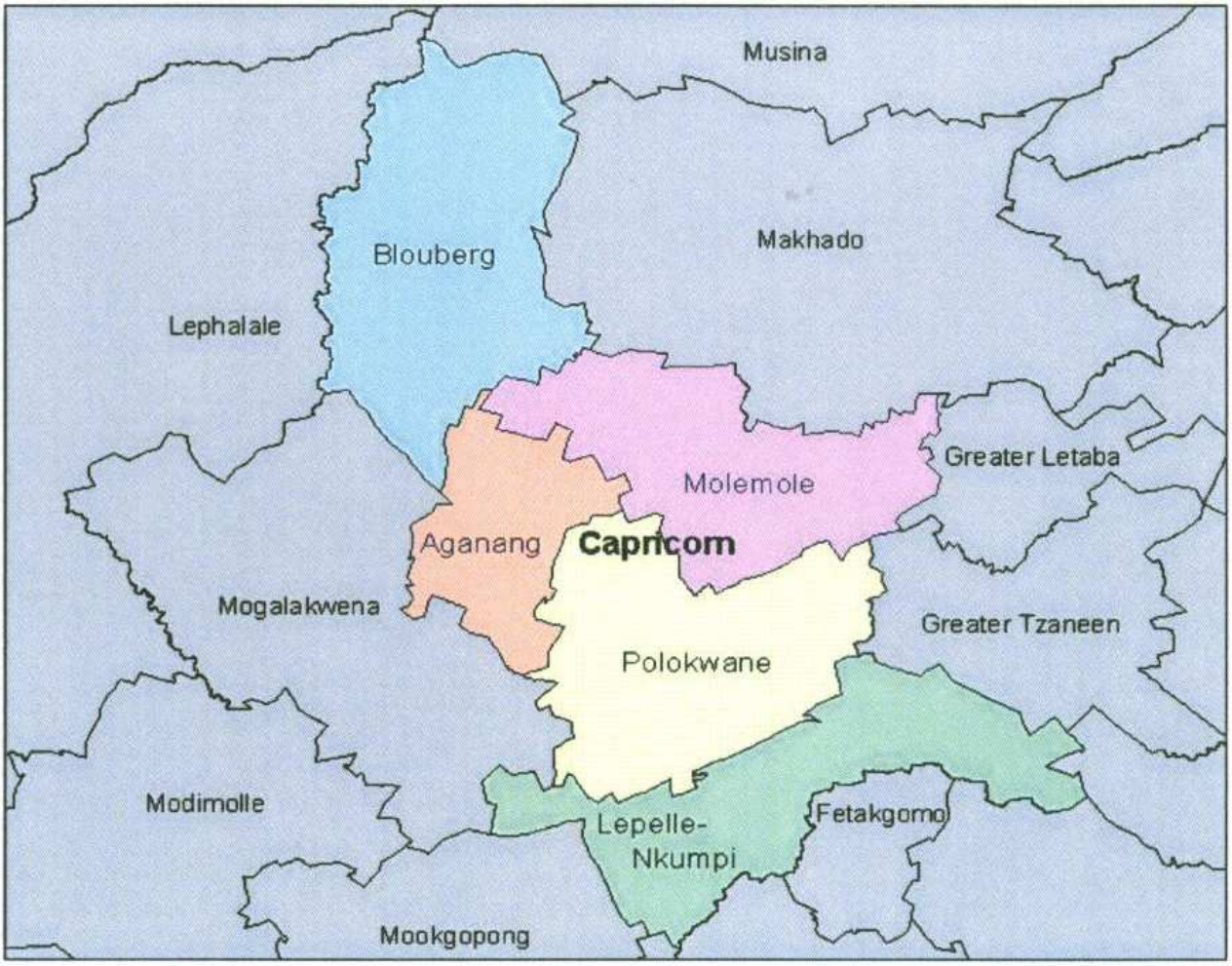

Fig. 1. Location map of the Molemole Local Municipality in the Limpopo Province (www.demarcation.org.za).

The MLM shares a boarder with the following local municipalities: Makhado and Blouberg in the northern part, Aganang in the western part, Polokwane in the south, and Greater Tzaneen and Greater Letaba in the eastern part.

1.2 ECONOMY

The economy of the Limpopo Province is based on extensive agricultural and mineral resources. The mineral resources found in the Limpopo Province include the platinum group metals, iron ore, chromium, coal, diamond, antimony, phosphate, copper, gold, vermiculite, silicon and mica. Base commodities such as dimension stone (i.e. black granite), corundum and feldspar are also found. There are known occurrence or deposits of a wide variety of minerals in the MLM, however, there is currently no major mining activities taking place. According to the CDMEP (October, 2008) mining is the smallest contributor to the CDM economy, having contributed 0.7 %. Mining is also the only sector in the CDM that has experienced negative growth (Table 1) in the last decade.

Table 1. Average annual growth rate during 1996-2007 (CDMEP, October 2008).

	Sector	Average annual growth rates
1	Agriculture	3.5%
2	Mining	-5.5%
3	Manufacturing	2.5%
4	Electricity	2.4%
5	Construction	4.3%
6	Trade	5.4%
7	Transport	9.3%
8	Finance	4.5%
9	Community services	3.5%

Sectors that contributed the most to the CDM economy in decreasing order were finance, community services, trade, transport, manufacturing, agriculture, electricity and mining (CDMEP, October 2008). The average annual economic growth rates of the CDM for the period 1996 to 2007 shows that transport, trade and finance grew the

fastest, and electricity, manufacturing and mining showed the lowest average annual growth (Table 1).

1.3 PURPOSE OF THE STUDY

This report provides an overview of the mineral occurrences and deposits in the MLM. The main aim is to stimulate interest in and development of the mineral deposits in the MLM, thereby creating employment and improving the standard of living in the affected areas. The study is also aimed at providing up to-date information on the status of the mining/quarrying and mineral exploration projects in the MLM. This study is based on data from South African Mineral Deposits Database (SAMINDABA), published and unpublished reports, geological maps and their explanations, etc.

2. GEOLOGICAL SETTING

The geology of MLM area is covered on the 1: 250 000 scale, 2328 Pietersburg map produced by the Geological Survey of South Africa, now the Council for Geoscience. The geology of the area covering the Molemole municipality is described in detail amongst others by Brandl (1986) and Bullen *et al*. (1995). The map showing the geology and the distribution of the mineral occurrences and deposits in the Molemole municipality is attached to this report.

2.1 GOUDPLAATS GNEISS

The Goudplaats Gneiss represents the oldest rock type in the Molemole municipality area. The Goudplaats Gneiss includes the gneiss, banded gneiss and migmatite associated with leucocratic granite in varying propotions. According to Brandl (1986) the colour of the gneiss ranges from dark to light grey. The metalonocratic bands generally consist of biotite, hornblende, oligoclase, quartz and hyperstene. The prevalent migmatic layering within the Goudplaats Gneiss is defined by alternating bands of melanocratic and leucocratic material several centimeters in width (Brandl, 1986). The melanocratic bands generally consist of biotite, hornblende, oligoclase, quartz and hypersthene whereas the leucocratic material is composed of perthite, oligoclase and quartz with biotite, garnet, sillimanite and magnetite as accessories.

The Goudplaats Gneiss is thought to have formed the basement to the Bandelierkop Complex and the Pietersburg Group (Brandl, 1986).

2.2 PIETERSBURG GROUP

The rocks of the Pietersburg Group occur as two narrow, linear arcuate belts and as numerous scattered xenoliths enveloped by granitoid rocks (Brandl, 1986). The rocks belonging to the Pietersburg Group have been divided into six units of which the Mothiba, Eesterling, Zandrivierspoort and Vrischgewaagd Formations have been recognized. In the Molemole municipality, this group is represented by the Mothiba and Zandrivierspoort Formations.

2.2.1 Mothiba Formation

The Mothiba Formation forms the base of the Pietersburg Group. This formation is the most widespread lithostratigraphic unit and usually forms moderately high ridges. The main rock types are the talc-chlorite and amphibole-chlorite schists, talc-schist and serpentinite. According to Brandl (1986) chemical analyses indicate that the amphibolites were derived from tholeiitic basalts. They are very similar to the amphibolites in the Eesterling Formation but are tentatively still retained in the Mothiba Formation. Thin banded ironstone and ferruginous quartzite are locally interbedded with the ultramafics and the amphiboles.

2.2.2 Zandrivierspoort Formation

The Zandrivierspoort Formation is named after the farm Zandrivierspoort 851 LS located in a prominent chain of hills known as the Rhenosterkoppies some 25 km north of Polokwane. This formation is not spatially connected with the main outcrop of the Pietersburg Group. It is considered on the basis of lithological similarities to represent a lateral equivalent of the Eesterling Formation. The Zandrivierspoort Formation consists mainly of metakomatiite and metatholeiite with interlayered banded iron-formation units (Minnitt, 1988). The banded iron formation units (magnetite

quartzites) occur as discreet bands interbedded in the metasediments and mafic volcanics.

The Zandrivierspoort Formation rocks are developed in a complexly folded outlier, approximately 32 km in length and up to 8 km wide (Collins, 1986). These rocks are surrounded by tonalitic gneiss. The mafic rocks belonging to the Zandrivierspoort Formation consists of chlorite, actinolite, hornblende and garnet, and the metamorphic grade varies between upper greenscist and lower amphibolite facies metamorphism.

2.3 BANDELIERKOP COMPLEX

The Bandelierkop Complex which constitutes a typical greenstone belt succession of metasedimentary and metavolcanic rocks has been subdivided into mafic, ultramafic rocks plus metaquartzite and marble. In the Bandelierkop Complex, the ultramafic rocks are present as strings of rounded bodies which once probably belonged to a continuous basal layer (Brandl, 1986). These massive, weekly foliated rocks include peridotite, dunite, metapyroxenite and hornblendite. Fresh metapyroxenites and a body of ultramafic rocks on Lemoenfontein 443 LS which contains chromite segregations.

The mafic rocks include mafic granulite and amphibolite. The mafic granulite which is a medium-grained, black and white mottled rock is composed of plagioclase, augite, orthopyroxene and green to brown hornblende. According to Brandl (1986) ore minerals and quartz are only minor constituents. The amphibolites are dark coloured, have a well-developed banding and are composed of light-to dark-green hornblende, plagioclase and quartz, with some minor augite, sphene and epidote. These rock types are considered to have been derived from basaltic lavas of tholeiitic and partly komatiitic type.

Magnetite quartzite and metaquartzite: Both varieties sporadically occur. It is said that where the magnetite quartzite is in contact with politic rocks it contains, in addition to quartz and magnetite, some garnet and orthopyroxene/ortho-amphibole.

The metapelite are purplish in colour and very resistant to weathering. They weather to form dark-brown, flat barren pavements or large boulders. These rocks are characterized by concordant bands or streaks of leucocratic anatectic material imparting a distinctly migmatitic appearance. They are composed of plagioclase, quartzite, biotite, garnet, cordierite, potassium feldspar, spinel and kyanite. The leucocratic bands in the metapelite are composed of quartz, plagioclase and orthoclase together with very minor garnet and sillimanite.

Marble and calc-silicate rocks: The calc-silicate rocks form only a few very small outcrops. These are pale-to dark-green, banded rocks composed of diopsite, seriticized plagioclase, sphene and epidote. The marbles are grey and pink coloured, coarse-grained rocks composed of calcite and/or dolomite and pyroxene which is invariably serpentinised.

2.4 HOUTRIVIER GNEISS

The Houtrivier Gneiss (also referred to as the Geyser granite) which is intrusive into the Pietersburg Group comprises leucocratic migmatite and gneiss, grey and pink hornblende-biotite gneiss, grey biotite gneiss and pegmatitic rocks. A number of massive granites, ranging in age between 2 400 and 2 600 Ma, form batholiths and stocks which are characterized by their resistance to weathering. The gneisses are fine-grained and dark coloured or coarse-grained and leucocratic, but they are invariably biotite–rich (Minnitt, 1988).

Leucocratic migmatite and gneiss consist typically of dominant quartzo-feldspathic layers and thin parallel streaks, mainly of biotite. According to Brandl (1986) good exposures can be seen on Groothoek 129 LS and in the bed of the Hout River on Bethesda 208 LS. On Groothoek 129 LS the leucocratic gneiss carries garnets, arranged in streaks and clusters.

In the Mogwadi (formerly known as Dendron) area the common variety is a medium- to coarse-grained, pinkish grey and pink leucocratic gneiss composed of orthoclase and quartz with minor plagioclase, biotite and hornblende.

2.5 MATOK GRANITE

The Matok Granite forms a major batholithic intrusion and several stocks north of the Rhenosterkoppies. This is characterized by the presence of a mafic and a younger granitic phase. The mafic phase can be divided into the older enderbitic and a younger charno-enderbitic phase.

The enderbite is typically fine-grained and dark coloured whereas the charno-enderbite is paler and coarser-grained. The mineralogy of both these granites is similar, composed of plagioclase and biotite with subordinate augite, hyperstene, orthoclase and quartz. The only difference is the pyroxene content, which is less in the charno-enderbite (Brandl, 1986).

The younger phase of Matok Granite is represented by various granitic rocks which range in composition from adamellitic to granodioritic. According to Brandl (1986) the main variety is a grey and pink, coarse-grained porphyritic granite made up of microcline phenocrysts, plagioclase, quartz and biotite. Minor varieties include a medium-grained hornblende granite and a pink, medium-grained biotite granite.

2.6 TURFLOOP GRANITE

The Turfloop Granite is a major batholithic intrusion and it flanks the southern edge of the Pietersburg Group forming numerous isolated hills. This is a medium- to coarse-grained, grey to pinkish biotitic rock of adamellitic to granodioritic composition. It contains orthoclase, microcline, quartz, sodic plagioclase and biotite with sphene and zircon as accessory minerals.

2.7 SMITSKRAAL GRANITE

The Smitskraal Granite is pink coloured, coarse-grained biotitic rock of granitic composition. Fine-grained and porphyritic varieties do occur in places.

2.8 QUATERNARY DEPOSITS

Quaternary age deposits include residual soils, alluvium, calcreate and scree.

3. ECONOMIC GEOLOGY

The rocks underlying the MLM area are associated with a variety of minerals. These include gold, copper, graphite, nickel, iron ore, chromite, beryllium, corundum, asbestos and feldspars. Resources of dimension stone (i.e. black granite) are also found. Although there is an occurrence of a wide variety of minerals in the Molemole municipality area, there is currently no large scale mining activity. Most of the occurrences or deposits are small which renders them uneconomic or suitable for exploitation by small-scale miners. A list of farms also showing the mineral occurrences and companies that have mineral rights in the MLM is shown in Appendix A and B. A description of the mineral occurrences/deposits in the MLM is provided below:

3.1 ASBESTOS (ANTHOPHYLLITE)

Asbestos is a term applied to a number of silicate minerals which occur in a fibrous form (The Mineral Resources of the Union of South Africa, 1959). The most common varieties of asbestos are: chrysotile, crocidolite, amosite, tremolite, actinolite and anthopyllite. In the Molemole municipality, the occurrences of anthophyllite are reported on farms Weeskind 786 LS, Doornlaagte 787 LS and Erste Geluk 790 LS.

Like other forms of asbestos, anthophyllite poses a serious health threat. Several decades ago, health authorities and scientists have confirmed anthophyllite as a human carcinogen*. When people come into contact with anthophyllite asbestos and inhale or ingest its fibers, the fibers have the potential to become lodged in mesothelial lining of the lungs, heart, abdomen or testicles. The fibers can eventually lead to the development of lung cancer and other life-threatening cancers and illnesses. Due to health and other problems associated with asbestos mining, South Africa stopped mining asbestos in 2002. As such the occurrence of asbestos is the Molemole is considered as of no economic importance.

*A known human carcinogen means there is sufficient evidence of a cause and effect relationship between exposure to the material and cancer in humans.

3.2 BERYLLIUM

The beryllium-bearing minerals usually occur in pegmatite, especially granite pegmatite, and lithium minerals such as lepidolite and spodumene (The Mineral Resources of the Union of South Africa, 1959). Beryl is present in intermediate zone associated with quartz, cleavlandite, spodumene and other lithium minerals (Boelema, 1998). Beryllium is used as an alloying agent in producing beryllium copper. Beryllium copper is used extensively for springs, electrical contacts, spot-welding electrodes, and nonsparking tools. It is applied as a structural material for high-speed aircraft, missiles, spacecraft, and communication satellites. Other uses include wind shield frame, brake discs-support beams, and other structural components of the space shuttle. In the Molemole municipality area beryllium is found associated with feldspar on farm Kalkfontein 615 LS.

3.3 SAND

Sand forms the raw material or part of the raw material, for many important industries. Sand is mainly used in the manufacture of glass, in foundry works and in the building industry. Other uses are for filtering water, as an abrasive, as engine sand, as fibre/furnace sand. In the Molemole municipality area most (if not all) sand is used in the building industry. Sand for use in the construction industries is obtained from many localities in the municipality area. There is a recorded occurrence of building sand on farm Fort Klipdan 852 LS. It is generally obtained as unconsolidated deposit in the river valleys, and in some cases such sand is washed and classified for special purposes (i.e. plastering).

3.4 CHROMITE

Chromium is one of the most important industrial metals. Pure chromium metal is used for making several nonferrous alloys. Chromium is also used to harden and toughens

steel and increases its resistance to corrosion, especially at high temperatures. Most stainless steel contains about 18 % chromium; some cutting tools and wear-resisting alloys contain as much as 33 %. There is an occurrence of two prominent chromite-rich zones in serpentinite of Swazian age on farm Lemonfontein 443 LS. This small circular (300 m in diameter) occurrence has been worked to a depth of 9 m (Bullen *et al.*, 1995). According to Schürmann *et al*. (1998) the chromite ore here is described as massive, high grade, nodular and pod-like in places. Tectonically layered and disseminated ore is also present. This deposit was abandoned because of the very small quantity available (Coertze and Coetzee, 1976). According to Bullen *et al*. (1995) the reserves were calculated at approximately 7 000 tons grading at 34 % chromite and with a Cr/Fe ratio of about 2,3.

3.5 COPPER

Copper is used in electrical cables and wires, switches, plumbing, heating, roofing and building construction, chemical and pharmaceutical machinery, etc. Copper deposits and/or occurrences are reported on farms Kalkbult 183 LS, Goedgenoeg 185 LS, Kraaifontein 186 LS, Bethesda 208 LS, Droogebult 799 LS, Zevenfontein 798 LS, Roodewal 808 LS and Kalkbank 1171 LS.

Prospecting for copper in the Bandelierkop hills exposed finely disserminated chalcopyrite, malachite and chrysocolla in a shear zone and similar mineralization was observed in the neighbouring farms (Hammerbeck and Schoeman, 1976). Some of the copper is found associated with gold and nickel (i.e. Doornhoek 480 LS).

3.6 CORUNDUM DEPOSITS

Corundum is a crystalline mineral with the chemical composition aluminum oxide. This mineral is found in a variety of colours of which the most common are grayish-white, bluish-grey, blue, black, brown, reddish-brown and pink (de Villiers, 1976). Corundum is the hardest known substance next to diamond. It is mainly used as an abrasive for metal surface finishing, optical grinding, for grinding and polishing building and ornamental stones, gemstones, and plate glass or in the manufacture of abrasive

paper and grinding wheel. Corundum is also used as a refractory and in the manufacture of nonslip treads for stairs, pavements, floors, etc of public buildings, such as railway stations, that carry a large volume of pedestrian traffic.

Corundum is found in two fields (Bandelierkop and Mogwadi) in the Molemole municipality area (Fig. 2). Corrundum occurrences and deposits are reported on a number of farms including Bellevue 122 LS, Klein Collie 123 LS, Geluksfontein 127 LS, Potsdam 128 LS, Wurthsdorp 134 LS, Koniggratz 135 LS, Grootfontein 136 LS, Westphalia 139 LS, Welvarend 167 LS, Badburg 168 LS, De Loskop 205 LS, Bok 356 LS, Enkelput 442 LS, Lemoenfontein 443 LS, Oog van Driefontein 522 LS, Bodensteinshoop 765 LS, Grobler 776 LS, Driefontein 777 LS, Zoekmekaar 778 LS and Waterval 793 LS.

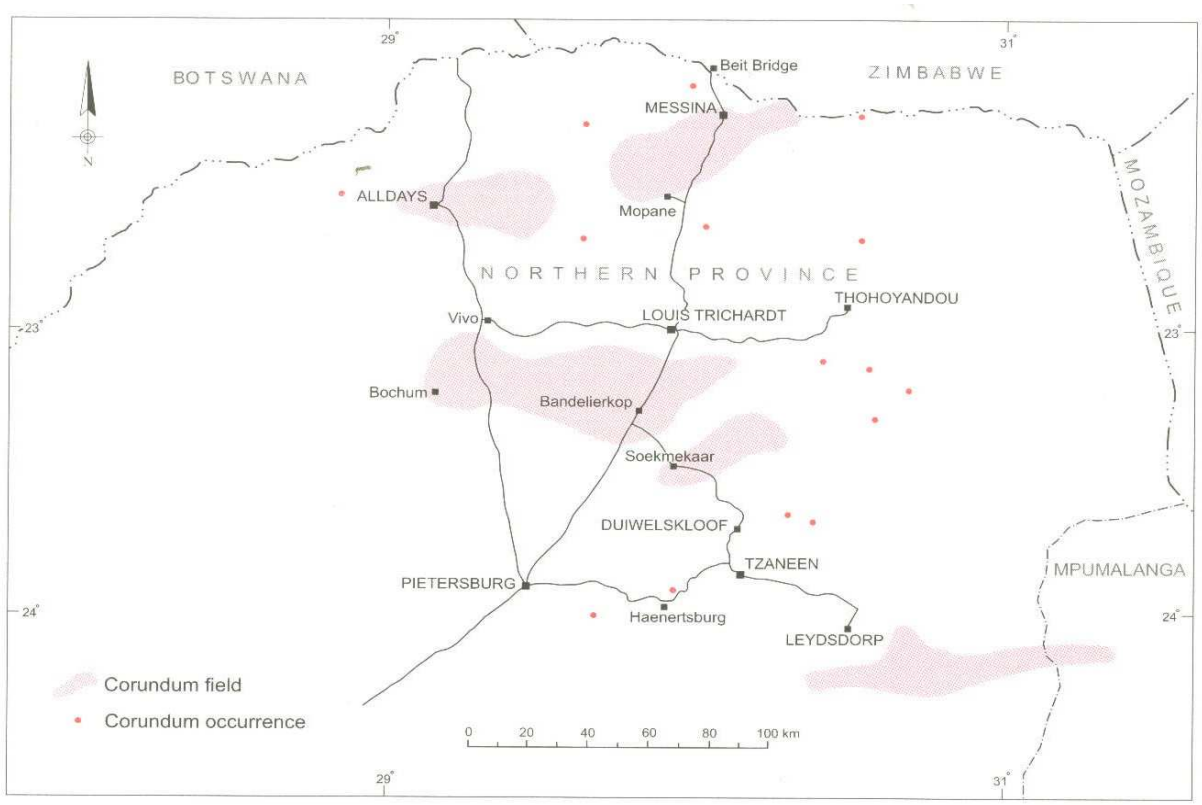

Fig. 2. Distribution of corundum deposits in the Limpopo Province (Oosterhuis, 1998a).

Numerous small corundum deposits were exploited in greenstone remnants and gneiss in the belt between Senwabarwana (Bochum) and Elim. According to de Villiers (1976) the production declined during the late 1950`s, not as a result of inadequate reserves, but probably due to the rising production costs and the availability of richer shallow (a

maximum of 40 m) deposits. The corundum is always associated with ultramafic rocks and occurs where these rocks are surrounded by granitic material (Brandl, 1986). Corundum is mainly developed in the contact zone which is several meters wide.
Bandelierkop and Mogwadi are amongst the previous major producers of corundum; however synthetic material and other substitutes have largely replaced corundum in most applications. The possibility of small scaling the mining operations extracting corundum from eluvial and colluvial corundum deposits for the refractory alumina market should be investigated to replace or augument the Zimbabwe imports.

3.7 DIMENSION STONE AND STONE AGGREGATE/GRAVEL

Dimension stone incorporate all naturally occurring rock material cut, shaped or selected for use in blocks, slabs, sheets or other construction units of specified shape or size, and employed for exterior or interior parts of buildings, foundations, kerbing, paving, flagging or for other architectural or engineering purposes (Stone in Southern Africa, 1999). It encompasses building stone, ornamental stone and monumental stone. According to Oosterhuis (1998b) the chief requisites of dimension stone include its suitability for the application, its durability (hardness, chemical stability, resistance to weathering, strength), and its colour and aesthetic appeal.

The term granite which geologically refers to igneous rocks of specific mineral and chemical composition is applied more loosely in the dimension stone industry to rocks such as gneiss, syenite, granodiorite and even anorthosite. The term Black granite and grey granite are trade terms encompassing rock types such as gabbro, norite, dolerite and diorite. The granitic rocks that can be quarried and used as dimension stones are common in the Molemole municipality area (i.e. Matoks and surrounding areas).

Dolerite dykes and sills are common geological features in the southwestern portion of the municipality. The dolerite is currently mined by Phalaborweni Marble and Granite processing on farm Escatre 907 LS outside the Molemole municipality area close to the boundary. For marketing purposes, this dolerite is called the Limpopo Black Granite. The potential for producing this type of granite exist in the southwestern portion of

the MLM. However, it should be noted that dimension stone production from dolerite dykes poses a number of challenges (Stone in Southern Africa, 1999). The wider dykes, although more favourable for the extraction of large blocks, have a tendency to be less uniform in both colour and texture. They commonly vary from black, fine-grained and thus high-quality material at the centre. Narrower dykes, apart from imposing obvious restrictions on extraction of suitable block sizes, sometimes tend to be more brittle and thus more easily fractured, due to being finer-grained.

The waste produced from the dimension stone operation can be crushed and used as aggregate. Other dimension stone quarries such as the Machaka Quarries already have plans to crush the waste from the dimension stone operation for use as aggregates. Our records indicates that there was a stone crusher on farm De Gladde Klipkop 763 LS. The current status of this crusher project is not known.

3.8 FELDSPAR

Feldspar is used as a source of alkalis and alumina in the manufacture of glass (Boelema, 1998). The chemical requirements are that the Fe_2O_3 content of the feldspar may not exceed 0.1 % in the manufacture of the colourless high-grade glass and 0.3 % Fe_2O_3 for lower grade products. Feldspar is found associated with berrylium, vein quartz (silica), lithium and mica in the Zandriviersport Formation on farm Kalkfontein 615 LS. On farms Eerste Geluk 790 LS and Salamis 807 LS feldspar is found associated with mica in the Goudplaats gneiss. According to Boelema (1998), potential feldspar reserves in the Molemole municipality area include the Kalkfontein 615 LS (Boelema, 1998).

3.9 GOLD

Gold was discovered from the Harlequin Mine on Goedgenoeg 185 LS about 55 km north-northwest of Polokwane from quartz veins in the Hout River Gneiss. Here gold occur associated with copper in a vertical lode which can be traced for 180 m at surface. According to Hammerbeck (1976) fragments of the load material lying

scattered on the surface show much malachite staining (Fig. 3). A total of 12 kg of gold was extracted from 3 350 tons of ore (Bullen *et al.*, 1995). During the time of active exploitation difficulty was experienced in the extraction of the gold, with the result that the tailings dump is said to contain considerable quantities of the metal (Hammerbeck, 1976). According to Hammerbeck (1976) no copper is known to have been recovered from the Goedgenoeg deposit. As such the tailing might also contain appreciable quantities of copper. Rock exposures are few in the area, except for a basic dyke which is not considered to be genetically related to the reef.

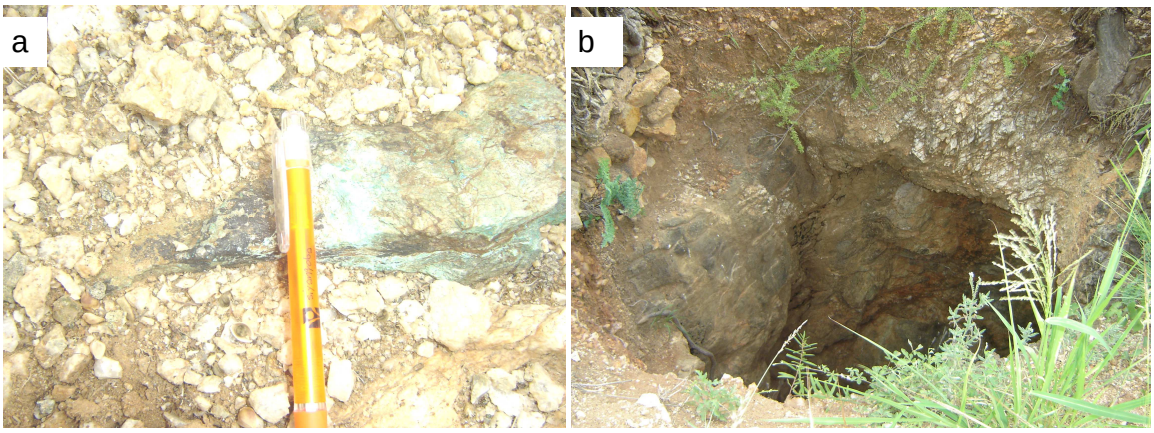

Fig. 3. Pictures taken at the abandoned gold mine situated on farm Goedgenoeg 185 LS. (a) Waste rock at the surface showing malachite staining and (b) the mine opening which was used to gain access to the deposit.

According to Willie Beeker (Goedgenoeg 185 LS farm owner) Rio Tinto did some exploration work in the area in the early 1990`s. And this work resulted in about 15 drill holes been drilled. According to Willie Beeker, Rio Tinto stopped the exploration work because they considered the project as not viable. However, one has to take into consideration that what larger companies considers as project that are not viable might be viable to small-scale miners. As such the area is considered as a potential target for gold and copper that can be exploited by small-scale miners. Some occurrences of gold are reported on farms Kraaifontein 186 LS, Bethesda 208 LS and Roodewal 808 LS associated with copper.

Gold was also mined on farm Doornhoek 480 LS towards the boundary of the Molemole and the Makhado municipality. Here gold is found associated with copper within the Bandelierkop Complex.

On Bochum 143 LS just outside the Molemole municipality boundaries, a small mine exploited a brachiated quartz lode in the Hout River Gneiss and gold, silver and bismuth were recovered (Bullen *et al.*, 1995). This mine operated from 1954 to 1961 (Ward and Wilson, 1998). The adjacent farms might also have the potential for gold, silver and bismuth.

3.10 GRAPHITE

Graphite has been mined on farm Nooitgedacht 489 LS. Here graphite occurs as disseminated graphite flakes in altered basic rocks (Bullen *et al.*, 1995). Known reserves are almost depleted (The Mineral potential and mining development in the Black Homelands of South Africa, 1977). Graphite uses include pencil lead, in oil, stove polish, in some paints and also lubricant.

3.11 IRON ORE

The magnetite quartzite of economic importance occur as discrete bands interbedded in metasediments and mafic metavolcanics of the Zandrivierspoort Formation (Collins, 1986). A map of the Zandrivierspoort magnetite deposit is shown in Fig. 4. The drill hole section through the isoclinically folded Zandrivierspoort Formation showing the principal rock types associated with the banded iron-formation is shown in Fig. 5. Based on the drilling and geological mapping data a section through the upper units of the Zandrivierspoort Formation illustrating the nature of the isoclinal folding which is responsible for the repetition of the main banded iron-formation as well as associated rocks was drawn (Fig. 6). The central vertical column depicts a borehole through the sequence, a core log which is shown in Fig. 5 above.

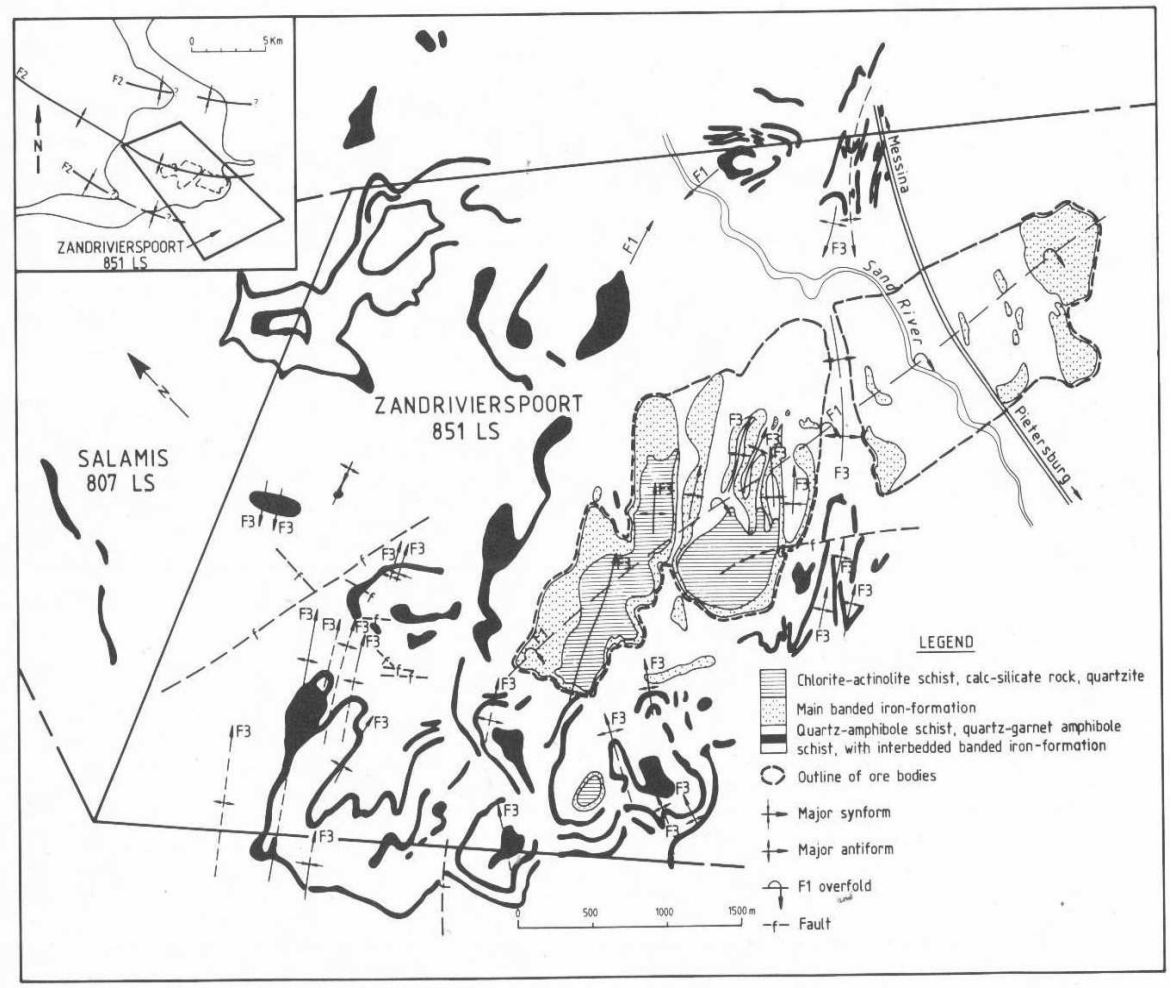

Fig. 4. Map of the Zandrivierspoort magnetite deposit showing components of the stratigraphy and the structure of the area (Collins, 1986).

The economically important iron deposits are known to occur on farm Zandrivirspoort 851 LS and in the adjacent farms (i.e. Lekkerlach 206 LS, Bethesda 208 LS, Waterval 553 LS, Kalkfontein 615 LS, Swartlaagte 749 LS, Kopje Allen 803 LS, Roodewal 808 LS, Ruigedraai 809 LS and Fort Klipdam 852 LS) some 30 km north of Polokwane. The economic potential of the magnetite quartzite as an iron ore was recognized in 1974 (Collins, 1986) and investigated by Iscor (Minnitt, 1988). The banded magnetite-

quartzite occurrence on Zandrivierspoort 851 LS and surrounding farms is considered as part of the Pietersburg Greenstone Belt. According to Bullen *et al*. (1995) magnetite and hematite concentrations vary from 40 % and 10 %, respectively. Much of the deposit on Zandrivierspoort outcrops or is close to surface and is relatively flat-lying, thus enhancing prospects for low-waste stripping (Collins, 1986). Hematite is said to be more abundant in oxidized areas where it can constitute up to 54 % of the rock. Detailed work which included core drilling, logging and sampling was conducted as early as the 1980`s in order to determine the size, quality and mineralogy of the deposit. Collins (1986) reported the average chemical analysis (in wt %) for the main iron ore zone as follows:

Total Fe	37
SiO_2	42.4
Al_2O_3	0.3
CaO	2.1
MgO	1.6
MnO	0.2
TiO_2	0.01
K_2O	0.03
Na_2O	0.05
S	0.10
P_2O_5	0.07

Zandrivierspoort Iron project, is a 50:50 joint venture between Kumba Iron Ore and Arcelor Mittal South Africa. The former Kumba Resources acquired a 50 % interest in the Pietersburg Iron Ore Company (Pty) Limited in the 1980s and has conducted extensive exploration and technical studies to develop the project. This company owns the surface rights for the Zandrivierspoort iron ore project. Phelps Dodge sold its 50 % interest in Pietersburg Iron Ore Company (Pty) Limited to Mittal Steel in December 2004. Since then, the parties have developed a framework for a

Fig. 5. Drill hole section through the isoclinically folded Zandrivierspoort Formation showing the principal rock types associated with the banded iron-formation (Collins, 1986).

pre-feasibility study, commenced with exploration activities in 2005 and have progressed to the evaluation of alternative processing and final product options in 2007. The parties intended to commit to a detailed bankable feasibility study in 2008, if interim studies prove a robust and viable business case. If the project gets

the go-ahead, Zandrivierspoort will enter production in 2013 and reach one million tons a year (Campbell, 2008).

According to Collins (1986) about 520 Mt of ore have been indicated by drilling. Beneficiation tests have also indicated that approximately 40 % of the ore will be recovered as a magnetite concentrate containing in excess of 70 % iron. Recent resource calculations have indicated that 447 Mt (Table 2) of iron at an average grade of 34.9 % (Anglo American Annual Report, 2007).

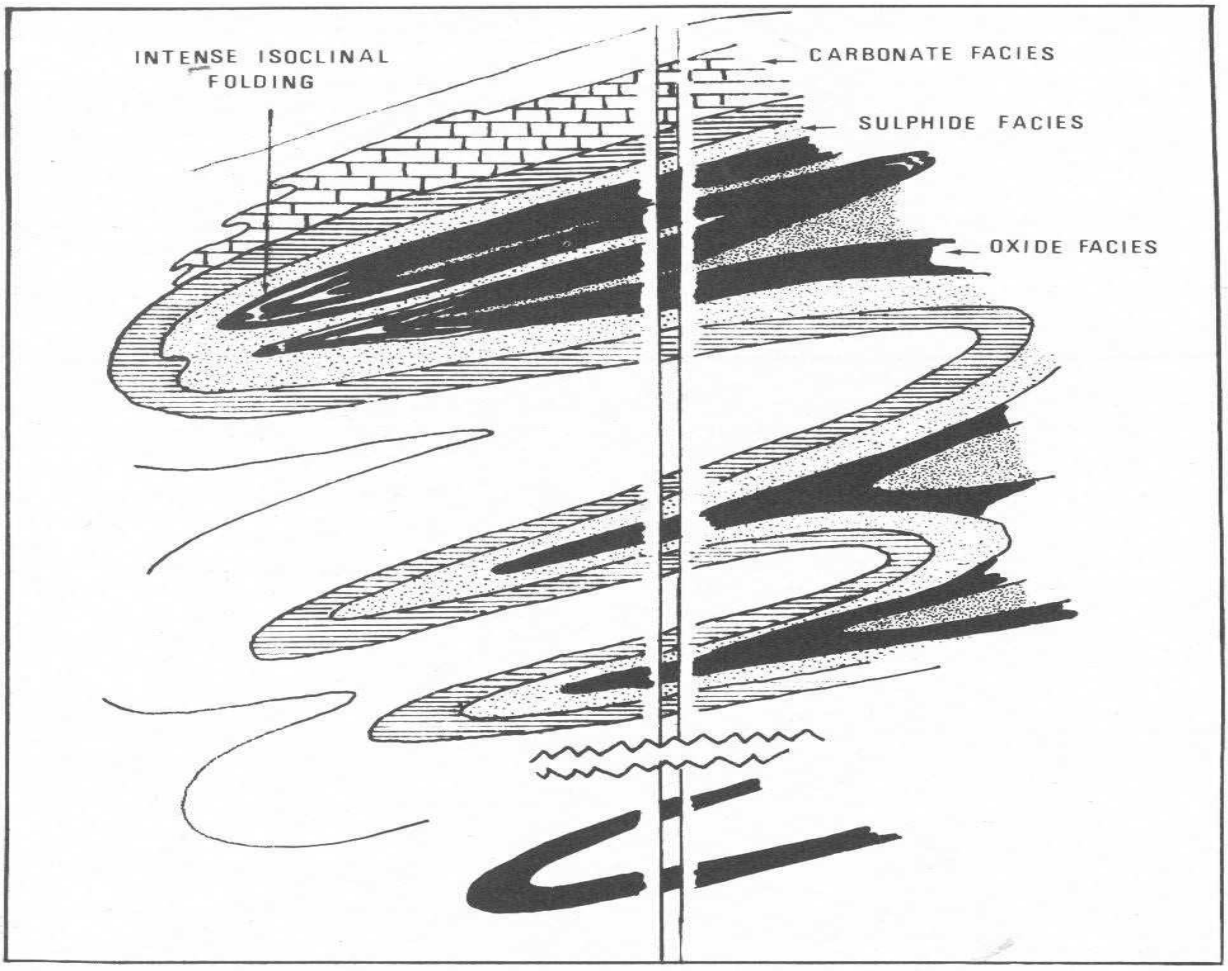

Fig. 6. Idealized section through the upper units of the Zandrivierspoort Formation illustrating the nature of the isoclinal folding which is responsible for the repetition of the main banded iron-formation as well as associated rocks. The central vertical column depicts a borehole through the sequence, a core log which is shown in Fig. 5 above.

It is assumed that the Zandrivierspoort product could support Arcelor Mittal South Africa `s domestic demand for raw material input to their steel works. Investigations have shown that the Zandrivierspoort magnetite concentrate could comprise up to 5 % of a sinter mix, which yields improved production rates in the iron ore sintering process (www.kumba.co.za/reports/kumba_afs_08/pdf/res_minerals.pdf). This product would only support a limited market and alternatives of green micro-pellets or baked mini-pellets, both as a sinter ore replacement, or conventional pellets are being investigated to increase the market size for Zandrivierspoort.

The magnetite quartzite of the Zandrivierspoort Formation also outcrop on De Loskop 205 LS, 50 km north-northwest of Polokwane (Astrup *et al.*, 1998). The magnetite-quartzite layer is 40-100 m thick and has a vertical disposition. The reserves are estimated at 200 Mt, with grade and beneficiation properties similar to the Zandrivierspoort deposit (Astrup *et al.*, 1998).

Table 2. Iron ore mineral resources at the Zandrivierspoort project (Anglo American Annual Report, 2007).

Classification	Million tonnes		Grade	
Measured*	-	-	-	-
Indicated**	447	447	34.9	34.9
Measured and indicated	447	447	34.9	34.9
Inferred***	-	-	-	-

* Measured Mineral Resource: that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence. It is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are spaced closely enough to confirm geological and grade continuity.

** Indicated Mineral Resource: that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated

with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are too widely or inappropriately spaced to confirm geological and/or grade continuity but are spaced closely enough for continuity to be assumed.

*** Inferred Mineral Resource: that part of a Mineral Resource for which tonnage, grade and mineral content can be estimated with a low level of confidence. It is inferred from geological evidence and assumed but not verified geological and/or grade continuity. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes which may be limited or of uncertain quality and reliability.

3.12 KIESELGUHR

Kielselguhr deposit occurs on farm New Hanover 124 LS. This occurs in the diatomaceous limestone (Bullen *et al.*, 1995). According to Bullen *et al.* (1995) this deposit does not appear to be of economic interest. None of the occurrences in the Pietersburg (Polokwane)-Vivo field (Fig. 7) have proved to be of economically viable, mainly due to their small size (Strydom, 1998).

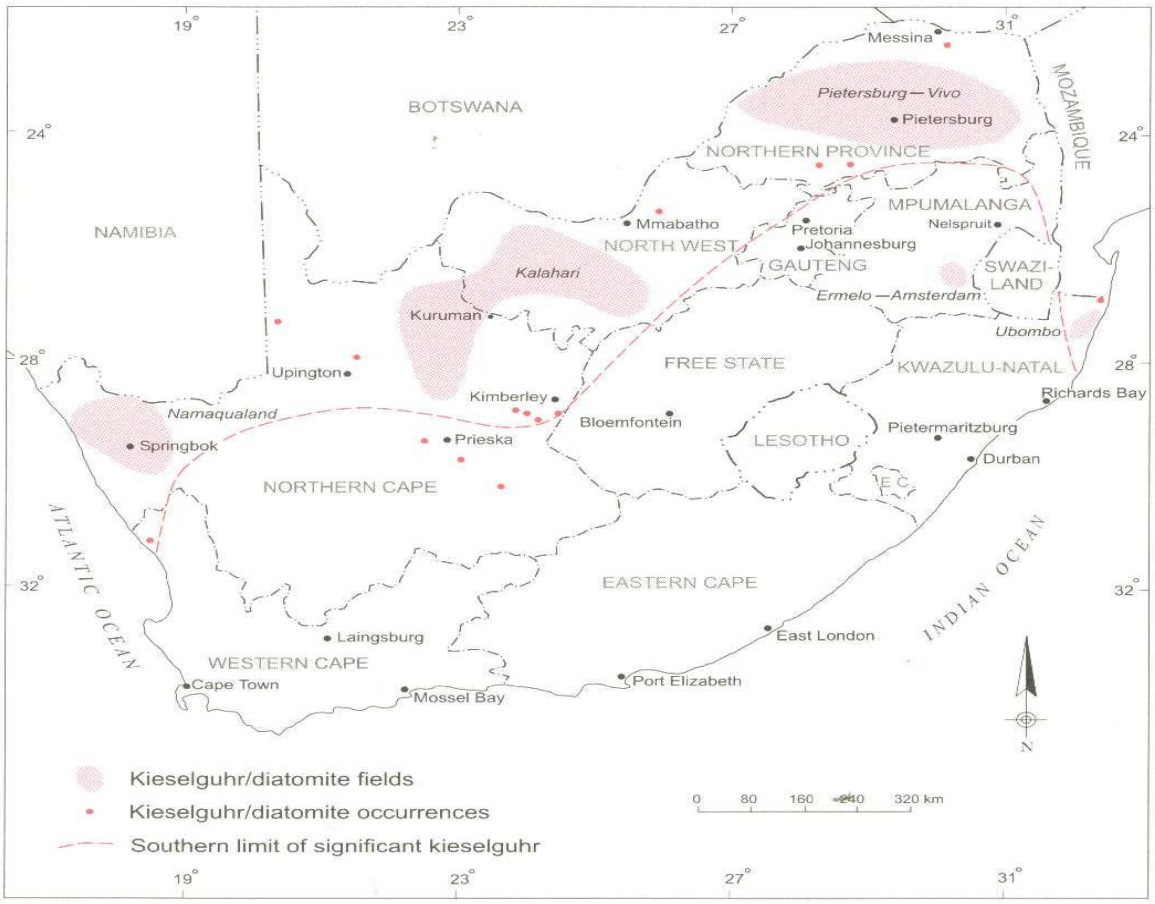

Fig. 7. Kieselguhr/diatomite fields of the Republic of South Africa (Strydom, 1998).

3.13 KYANITE AND SILLIMANITE

Kyanite and sillimanite are the structural polymorphs of the anhydrous silicates of aluminum and are used in the manufacture of high-grade refractories and ceramics. When heated these minerals change to mullite. Mullite is in demand for its high melting point, good electrical and thermal insulating properties, low coefficient of expansion and high resistance to mechanical and thermal shock. These minerals are therefore used in the manufacture of refractories for furnaces, boilers, oil and gas fire boxes, combustion tunnels, cement kiln linings, and for the manufacture of special ceramics used in high-tension insulators, electrical appliances, spark plugs, chemical apparatus, and enamel and chinaware. The occurrence of sillimanite and kyanite

(gemstone) in the Molemole municipality area is reported in the corundum fields on farm Koniggratz 135 LS.

3.14 LIMESTONE

Limestone and its derivative, lime finds most of its applications in industry than any other natural product (Martin and Coetzee, 1976). Limestone is used in the manufacture of cement, as a flux in smelting operations, as a neutralizer in acid soils, and to some extend as a building stone. However, it should be noted that the suitability of limestone for a particular application depends on its properties. The most important factor controlling the suitability of limestone for the manufacture of Portland cement is its magnesium oxide content. The maximum permissible is 5 % in the finished cement (Martin and Coetzee, 1976). Limestone in the municipality area is known to occur on farm Loskop 205 LS. Details of the size and the quality of the limestone occurrence on Loskop are not available.

3.15 LITHIUM

Lithium applications include ceramics, multipurpose greases, air conditioning, metallurgy, welding and brazing, laundry bleaches, synthetic rubber and in the production of hydrogen. According to Keyser (1976) some increasing applications of lithium are in space flights (lithium hydroxide) and for structural materials (light lithium-magnesium alloys). Spodumene which is the only lithium mineral occurring in South Africa (Keyser, 1976) in exploitable quantities is spodumene. Spodumene is known to occur on Kalkfontein 615 LS, Roodewal 808 LS and Ruigedraai 809 LS. The economic importance of these occurrences is not known.

3.16 MICA

Mica refers to a group of minerals characterized by excellent cleavage, platty habit, a high degree of flexibility and elasticity, high dielectric strength, low heat conductivity and chemical and thermal stability. Commercially the most important micas are muscovite and phlogopite (de Villers and Hugo, 1976). Mica occurs on farms

Kalkfontein 615 LS, Eerste Geluk 790 LS, Salamis 807 LS, Roodewal 808 LS and Ruigedraai 809 LS in association with feldspar and lithium.

3.17 NICKEL

No deposit of nickel is known in the Molemole municipality area. Only minor occurrences are found associated either with gold, copper and chrome. The occurrences are reported on farms Goedgenoeg 185 LS, De Loskop 205 LS, Lemonfontein 443 LS and Doornhoek 480 LS. That means that nickel can only be extracted as a by-product together with copper from gold mining operations in the area, unless discoveries of nickel deposits are made.

3.18 SHALE/BRICKCLAY

Brickclay is the term used to describe clay and shale used in the manufacture of structural clay and products, such as facing and engineering bricks, pavers, clay tiles for roofing and cladding, and vitrified clay pipes. Brick manufacture is the largest tonnage use (Bloodworth *et al.*, 2007).

In the Morebeng (Soekmekaar) area the subtropical climate and consequent deep chemical weathering have produced a thick, clay-rich weathered gneiss (saprolite) which belongs to the Goudplaats gneiss stratigraphic unit (van Strijp, 1998). On Zoekmekaar 778 LS this clay was mined by Soekmekaar Stene and used as a material for brickmaking. Investigations for suitable clay deposits for brick manufacture should be undertaken in and around Morebeng.

3.19 SILICA AND SILICON

Silica is used in the manufacture of glass, refractories and ceramic products, and for foundary work, abrasives and filter materials. Vein quartz (silica) occurrence is recorded on farm Kalkfontein 615 LS. Catnis Construction (Pty) Ltd is mining silicon on farm Fort Klipdam 852 LS.

3.20 STONE CRUSHER/AGGREGATES

Aggregate constitutes the bulk filler in concrete, mortar and plaster in various building applications (Roux, 1998). It also plays an important role in the determination of the physical property and behavior of manufactured products. Aggregates can be grouped into the fine (sand) and coarse (stone). The occurrence of a stone aggregate/gravel deposit is reported on farm De Gladde Klipkop 763 LS.

Fresh unweathered crushed rock can be used for coarse aggregates in concrete, road and other pavement construction industries, as well as for railway ballast (Roux, 1998). These can be used in road building, buildings and other concrete constructions. The crusher dust (if in large quantity) can be used for the manufacture of bricks. However, it should be noted that the price of the material and the following properties of the aggregates are taken into consideration when a choice of aggregate is taken for a particular purpose:

(a) Toughness (resistance to impact)
(b) Hardness (resistence to compression)
(c) Abrassivenes (resistence to wear)
(d) The adherence of the butiminous film on the aggregate
(e) The type of fracture: cubical or flaky

Rocks that can be crushed and used for crusher stone are present in the MLM. Waste generated during dimension stone quarrying and processing can also be crushed and screened to the required size for used as aggregates.

3.21 VERMICULITE

Most people experience of vermiculite is as a growing medium for plants which are bought from nurseries. A lot of vermiculite is used for horticulture and in the agricultural and forestry industries in general (where it is used as a fertilizer carrier, soil conditioner and moisture retainer). In construction; vermiculite is used as a light weight aggregate, thermal insulator and fire retardant, as well as in plaster mixes, to

obtain both sound and heat insulation. In the Molemole municipality, vermiculite occurrence is known on farm Welvarend 167 LS.

4. CURRENT MINING/QUARRYING AND PROSPECTING ACTIVITIES

Previously, the mineral rights in South Africa were owned either by the State or the private sector. This dual ownership system represented an entry barrier to the potential new investors. The current Government `s objective is for all the mineral rights to be vested in the state, with due regard to the constitutional ownership rights and security of tenure. The Mineral and Petroleum Resources Development Act (MPRDA), No 28 of 2002 transferred ownership of privately held mineral rights to the State to enable any third party to apply to the Department of Minerals and Energy for new order prospecting or mining rights over these previously privately held minerals. In order to promote security of tenure and to secure existing prospecting and mining rights, affected entities were given five years to submit applications for the conversion of old order mining licences to new order mining rights. Up to two years were granted for the conversion of old order prospecting permits to new order prospecting rights (by 30 April 2006). Furthermore, in respect of unused old order rights, the MPRDA granted to the holder of such a right a one–year exclusive right to apply for a new order prospecting or mining right.

In order for one to investigate /explore or mine for minerals in the Republic of South Africa an individual or a company has to apply for one of the following:

PROSPECTING RIGHT can be defined as a right to prospect granted by the Department of Minerals and Energy under the MPRDA. Under the MPRDA, a reconnaissance permission may be applied for to search for minerals by way of geological and geophysical surveys. Such permission is valid for two years and is not renewable. A prospecting right may be granted for up to five years and may be renewed once for a period not exceeding three years. The holder of a prospecting right has the exclusive right to apply for a mining right.

RETENTION PERMIT: The issuing of a retention permit will be considered in cases where the holder of a prospecting right cannot proceed to mining because of unfavourable prevailing market conditions. It is valid for up to three years and may be renewed once for a period not exceeding two years. The holder of the retention permit has the exclusive right to apply for and be granted a mining right over the retention area.

MINING RIGHTS are granted for a maximum of 30 years but are renewable for an indefinite number of further periods, each of which may not exceed 30 years. Old-order rights held under the previous dispensation are required to be converted to new-order rights recognised under the MPRDA. In accordance with the transitional arrangements of the MPRDA, all applications for prospecting permits, mining authorisations, consent to prospect or mine and all environmental management programmes made under the Minerals Act but not finalised or approved before May 1, 2004 (the date on which the MPRDA took effect), are treated as having been made under the MPRDA. Beech states that the effects of the critical period of applications, in respect of unused old-order rights between May 1, 2004 and May 1, 2005, are still being felt.

MINING PERMIT: A mining permit is a document issued by the Department of Minerals and Energy which allows one to conduct mining operations. Mining permits are not transferable. A mining permit is valid for the period specified in the permit, but may not exceed two years. It may however be renewed for three more periods of no more than a year each. A mining permit may only be issued if:

- the mineral in question can be mined optimally for two years
- the mining area does not exceed 1.5 hectors in extent
- no other person holds a prospecting right, mining right, mining permit or retention permit for the same mineral and land.

Details of the prospecting and mining activities in the MLM are provided in the section below. Most of this information is provided by the Department of Minerals and Energy, Limpopo Regional Office on the 21 May 2009.

4.1 PROSPECTING RIGHTS

IRON ORE: Iron ore deposits or occurrences in the Molemole Local Municipality are currently under investigation for their economic potential. There are five companies that have prospecting rights in the municipality area. They are:

Sekoko Resources (Pty) Ltd holds prospecting rights for iron ore on farms Vuurteenlaagte 868 LS, Uitkoms 864 LS, Roodewal 808 LS, Ruigedraai 809 LS, De Loskop 198 LS and Kalkfontein 615 LS. Sekoko plans to mine the iron ore from a series of open pits by conventional drill, blast and loading into trucks for hauling to the primary and secondary crushers (www.sekoko.co.za).

Sishen Iron Ore Company (Pty) Ltd holds prospecting right for iron ore on farm Zandrivierspoort 815 LS. This is a 50:50 joint venture project between Kumba Iron Ore and Arcelor Mittal South Africa. Exploration in this project is at an advanced stage.

Lyndou Trading has a prospecting right for iron ore on farms Bethesda 208 LS, Witklip 556 LS and Schuinsdraai 805 LS.

Copper Sunset Trading has a prospecting right for iron ore on portions of farm De Loskop 198 LS.

Tuquoise Moon Trading 157 (Pty) Ltd has a prospecting right for iron ore on farms Westheim 191 LS, Meanderthuc Persie 200 LS and Van Wyksput 201 LS.

LITHIUM ORE: **Lengana Health (Pty) Ltd** has submitted the prospecting rights for lithium on farms Kalkfontein 615 LS, Rooderwal 808 LS and Ruigedraai 809 LS. Their application is in the process.

COAL: **Sekoko Resources (Pty) Ltd** holds prospecting right for coal on farm De Loskop 198 LS. **Nesongozwi Mining Corporation** has submitted a prospecting right for coal on Malietzie Location 606 LS. This application is in process.

MANGANESE: **Tuquioise Moon Trading 157 (Pty) Ltd** has a prospecting right for manganese on farms Westheim 191 LS, Meanderthuc Persie 200 LS and Van Wyksput 201 LS.

ALL MINERALS: Nkgapu Resources was issued with a prospecting right for all minerals on farms Bethesda 208 LS and Goedgenoeg 185 LS.

4.2 MINING PERMITS

SILICON: **Geluk plot no.7 Pietersburg (Pty) Ltd** hold three mining permits for silicon on farm Fort Klipdam 852 LS. **Catins Construction** also has a mining permit on portion of farm Fork Klipdam 852 LS.

GRAVEL: **Geluk plot no.7 Pietersburg (Pty) Ltd** hold three mining permits for gravel on farm Fort Klipdam 852 LS.

SAND: **Catins Construction** also has a mining permit on portion of farm Fork Klipdam 852 LS.

QUARTZ: **Rebone Mining** has a mining permit for quartz on portion of farm Fork Klipdam 852 LS.

4.3 MINING RIGHTS

There are several dimension stones quarries operating in the Molemole municipality area. These include the following:

Earthstone Granite (Pty) Ltd has identified a huge deposit of dimension stone (Fig. 8) in the area approximately 70 km north of Polokwane in the Botlokwa region on farm

Tarentaaldraai 493 LS. A mining right covering the entire Tarentaaldraai farm was issued to Earthstone Granite in November 2007. According to Earthsone Granite, the resources available are sufficient for 25 years lifespan of the project based on the current projected production rate. This quarry has a capacity to produce 600 m^3 of granite blocks (both black and coloured) per month. Three different types of granites are produced by Earthstone Granite (www.machaka.co.za) which are:

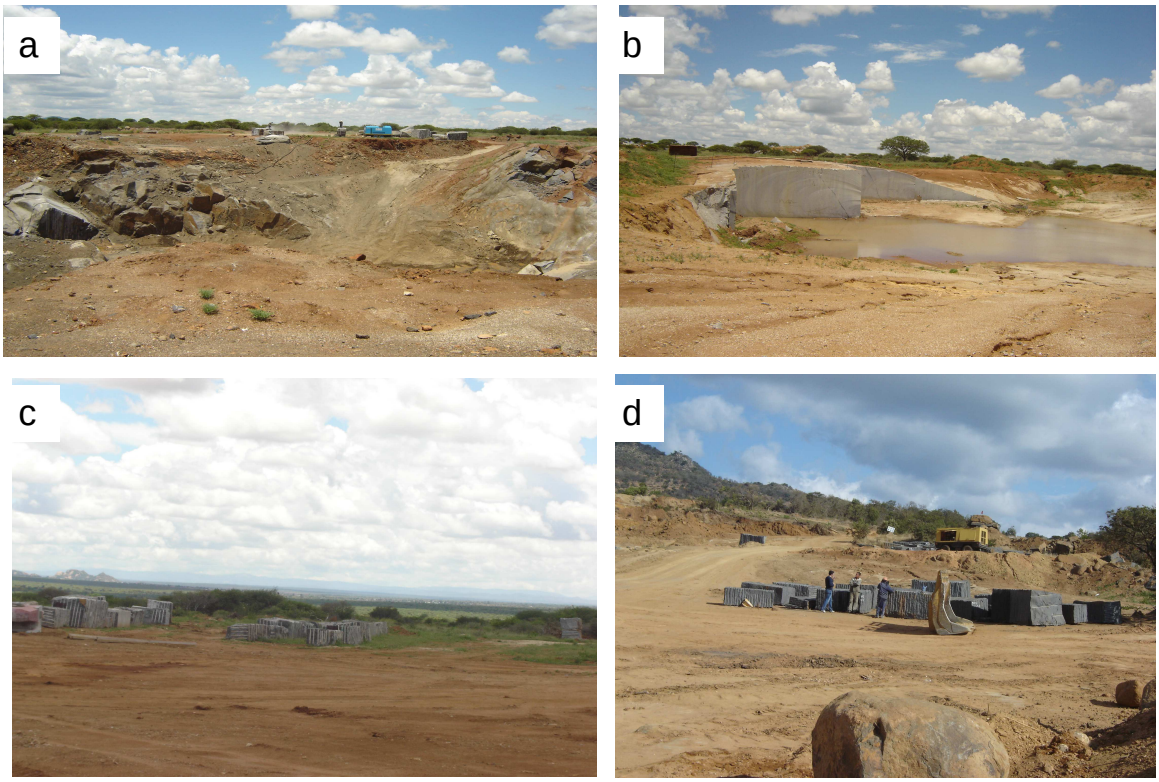

Fig. 8. Granite workings at the Earthstone Granite and Phalaborwene Marble and Granite. Site preparation to open up the granite; (b) granite face ready for granite block extraction (c) Granite blocks ready for processing or for transportation to a processing plant or selling (d) Black granite blocks from Phalaborwene Marble and Granite.

(i). Matok Leopard, like its animal counterpart, mottled and flecked, quiet, strong, yet peaceful. It takes a particularly handsome mirror like polish and cleans easily. This rock type is ideally suited for the house, for kitchen tops and the bathroom.

(ii). Royal Midnight is the purest black granite quarried at Earthstone. The material is tough and has a general hardness in excess of 7 (www.machaka.co.za). Royal Midnight encompasses a pure black background with a hint of fine gold dust hidden in its inner core and when polished it opens the realm of Black night with a fine speckled gold reflection very much sought after in the dimension stone market today.

(iii) Machaka Black. Earthstone Granite defines this type of granite as a pelite, born from marine mud. Squeezed and compressed by tectonic forces it was converted to a tough black colored rock at a regional scale bespeckled with mica and in places vermiculite (www.machaka.co.za).

Kelgran Africa (Pty) Ltd is operating dimesion stone quarries on farms The Grange 471 LS and Hugomond 118 LS (Portion 2).

Marlin Corporation Ltd quarries the Archaean basement granite on the farm Leeudoorn 472 LS close to the boundary of the municipality area. This granite is commercially known as Capricon Tropicale and Eidelweiss. It is migmatitic in nature and comprises of alternating bands of grey gneissic material containing veins and streaks rich in mafic minerals, and pinkish, coarser grained leucocratic portions (Oosterhuis, 1998b). The neighboring farms are considered as having the potential for dimension stone.

4.4 SAND (RIVER SAND, BUILDING AND PLASTER SAND)

Sand for building industry is obtained from too many locations in the MLM. It is mostly obtained from unconsolidated deposits in river valleys. There are many illegal sand mining activities in the municipality area. All the illegal sand miners who have been visited by the author of this report have indicated that they obtain permission to mine from the Tribal Offices. And some have also indicated that they are required by the

Tribal Office to pay certain amount of money per month to the Tribal Office for them to continue with their mining operations. The problem with the illegal mining activities is that in most cases the mined-out areas are left unrehabilitated (Fig. 9a) and they are also not fenced to prevent access. It is required by law that every mine/quarry should have a mining license before mining commences and this license is issued by the Department of Minerals and Energy.

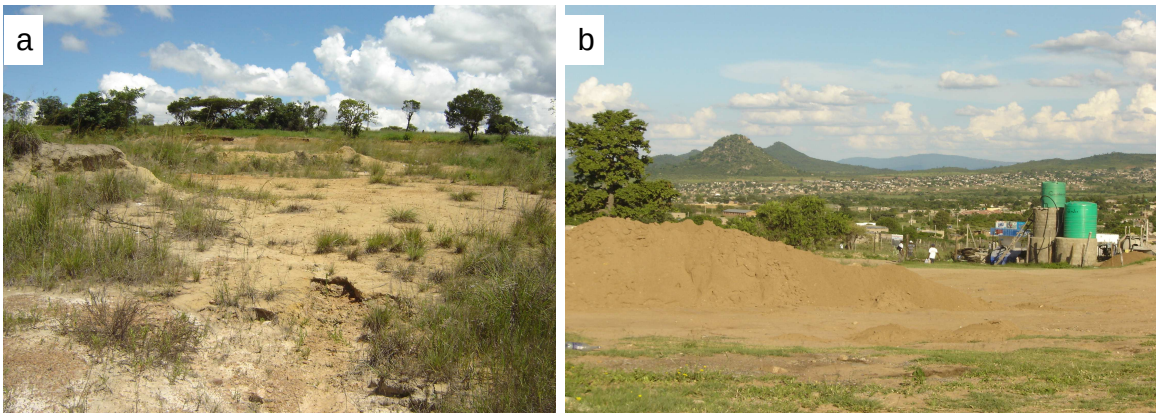

Fig. 9. Sand mining in the Molemole municipality area (a) illegal sand mining area that is not rehabilitated or fenced close to Morebeng traffic testing centre and (b) Sand from illegal miners ready for delivery to customers.

As part of the mining license application, the Environmental Impacts Assessment (EIA) are conducted followed by the compilation of the Environmental Management Plan (EMP). The EMP clearly states how the identified potential environmental impacts will be avoided or minimized. The illegal miners do not conduct the environmental impacts assessment before commencing with the mining operations and the methods they employ are often environment-unfriendly. The municipality can encourage the formation of legally registered entities/associations of sand miners that will work closely with relevant authorities to curb illegal sand mining in the MLM.

5. SUMMARY AND RECOMMENDATIONS

A variety of minerals are known to occur in the MLM. Some of these minerals are currently mined (i.e. dimension stone) or explored by different companies. Most of the

mineral occurrences/deposits are small in size which renders the occurrence/deposit uneconomic or suitable for exploitation by small-scale miners. The MLM has the potential for minerals that include the following:

5.1 IRON ORE

The iron ores in the Zandrivierspoot area have the potential to support a large scale mine. Sekoko Resources (Pty) Ltd and Sishen Iron Ore Company (Pty) Ltd are currently evaluating the economic potential/viability of exploiting these deposits. Unlike other mineral occurrences in the MLM, the iron ores have the potential to support medium-large scale mining projects.

5.2 GOLD

There are gold deposits in the MLM area. Most of these deposits were mined and abandoned because of the small size of the deposits and low gold price. The gold price has shown some improvements in recent years. Detailed geological investigations need to be conducted in order to determine the economic viability of exploiting these deposits. Copper can be produced as a by-product from the exploitation of these deposits. Because of the small size of the deposits, most of them can be exploited by small-scale miners.

5.3 DIMENSION STONE (GRANITE) AND CRUSHER STONE

Dimension stone quarrying is the current major mining activity in the municipality and it has potential to grow. Depending on the demand of the dimension stone and the production costs, the MLM can grow to become one of the largest suppliers of dimension stones. Currently the quarries export rough blocks. The opportunities exist for the dimension stone producers in the MLM to start beneficiating on a bigger scale. They can at least export finished/semi-finished products. Processing of the dimension stones quarried in South Africa is done outside the South African borders. According to Augus Auchterlonie a senior minerals economist at Mintek, the relocation of processing into South Africa is an opportunity for additional training and production

(www.miningweekly.com/article). Processing of the granite blocks from the vicinity of quarrying will reduce the transportation costs, thereby increasing profits from such operations. This will also help in job creation. The municipality with help from the Provincial Government can facilitate the development of a granite beneficiation project. The project can involve cutting and polishing of granite slabs and tiles for both local and export market.

Waste generated from the dimension stone quarries can be crushed and used as aggregates. To our knowledge, none of the dimension stone quarries in the MLM crush their waste for use as aggregates. Earthstone Granite plans to crush the waste generated on a temporary basis. The crushed stone will be used in road construction, building construction, brick making, etc. Earthstone Granite has indicated that they have already entered into agreement with a Black Economic Empowerment company that will do the crushing. If all the dimension stone quarries in the MLM do the same, some jobs will be created, as such reducing the poverty level in the municipality.

5.4 SAND

Bricks for the building of inexpensive houses (i.e. RDP) are brought in from other areas. Municipality should consider making bricks using locally sourced materials and labour. Paving bricks can also be produced using river sand. These projects can manufacture bricks (paving and building), supply sand (river sand, bou and plaster sand) for use during construction of RDP houses within the municipality. The municipality can also support small-scale sand miners and brick yards by encouraging contractors who are awarded the RDP houses construction project to purchase the material from within the municipality. However, it should be noted that for these brickyards to grow they first must be legalized. This involves application of the necessary permits (mining permit or right from the Department of Minerals and Energy (DME). Organisations such as the Council for Geoscience and other private consultants do assist in compilations of these applications. The Environmental Management Plan is also submitted to DME as part of the application. This describes how the identified environmental impacts will be avoided or minimized.

5.5 BRICKCLAY/SHALE

The potential for brickclay in and around Morebeng (Soekmekaar) has to be investigated.

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APPENDICES

Appendix 1: List of farms in the Molemole Local Municipality

Farm name	Number	Reg. division	Com 1	Com 2	Com 3	Ownership*	Mineral status**
Goosensrust	117	LS				Privately owned	-
Hugomond	118	LS				Privately owned	-
Tommy	119	LS				Privately owned	-
Jan Antonie	121	LS				Privately owned	-
Bellevue	122	LS	Cm			Privately owned	-
Klein Collie	123	LS	Cm			Privately owned	-
New Hanover	124	LS	Ki			Privately owned	-
Bloempjes Vley	125	LS				Privately owned	-
Waldburg	126	LS				Privately owned	-
Geluksfontein	127	LS	Cm			Privately owned	-
Postdam	128	LS	Cm			Privately owned	-
Groothoek	129	LS				Privately owned	-
Baviaanspoort	130	LS				Privately owned	-
Jongdraai	131	LS	Cm			Privately owned	-
Stettin	133	LS				Suid Afrikaanse Ontusktelingstrure	-
Wurthsdorp	134	LS	Cm			Government of Lebowa, Provincial Government and Molemole Municipality	-
Koniggratz	135	LS	Cm			No data available	-
Koniggratz	135	LS	Sl	GKy		Government of Lebowa	-
Grootfontein	136	LS	Cm			National Government of the Republic of South Africa	-
Westphalia	139	LS	Cm			Privately owned	-
Koekoek	140	LS				Government of Lebowa and Privately owned	-
Schellenberg	142	LS				Privately owned	-
Devonia	146	LS				National Government of the Republic of South Africa	-
Overdyk	147	LS				Privately owned	-

Brilliant	155	LS			Department of Co-operation and Development	-
Schoonveld	157	LS			Privately owned	-
Bouwlust	158	LS			Privately owned	-
Brussels	159	LS			Suid Afrikaanse Ontwikkelingstruss	-
Reinland	160	LS			Privately owned	-
Lissa	161	LS			Government of Lebowa	-
Weltevreden	162	LS			Government of Lebowa	-
Combro	163	LS			National Government of South Africa	-
Boomzien	164	LS			Marobala-o-Itsose Communal Property Association	-
Inderhiken	165	LS			Marobala-o-Itsose Communal Property Association	-
Tweefontein	166	LS			Privately owned	-
Welvarend	167	LS	Cm	Vm	Privately owned	-
Badburg	168	LS	Cm		Privately owned	-
Duitschland	169	LS			Privately owned, NTK Limpopo Agriculture Ltd and Government of the Republic of South Africa	-
Anexalion	170	LS			Privately owned	-
Didemus	171	LS			Privately owned	-
Grootwater	172	LS			Privately owned	-
Kalkfontein	173	LS			Privately owned	-
Lagerdraai	174	LS			Privately owned	-
Rechtdaar	175	LS			Privately owned	-
Sterkstroom	176	LS			Privately owned	
Wildebeest	177	LS			Privately owned	-
Platklipfontein	179	LS			Privately owned	-
Draaifontein	180	LS			Privately owned	-
Verdwaalpan	181	LS			No data available	-
Kalkbult	183	LS	Cu		Privately owned	-

Goedgenoeg	185	LS	Au	Cu	No data available	-
Goedgenoeg	185	LS	Cu		No data available	prospecting right granted
Kraaifontein	186	LS	Cu	Au	Privately owned	-
Kwaggasbult	187	LS			Privately owned	-
Meanderthal	188	LS			Privately owned	-
Appelfontein	189	LS			National Government of South Africa	-
Patrijspan	190	LS			Privately owned	-
Westheim	191	LS			No data available	prospecting right granted
Triest	192	LS			Government of Lebowa	-
De Loskop	198	LS	Fe		Privately owned	prospecting right granted
Persie	200	LS			No data available	prospecting right granted
Van Wyksput	201	LS			Privately owned	prospecting right granted
Zandbult	202	LS			Privately owned	-
Tarantaalpan	203	LS			Privately owned	-
Soho	204	LS			Privately owned	-
De Loskop	205	LS	Cm	Ni	No data available	-
De Loskop	205	LS	Ls		No data available	-
Lekkerlach	206	LS	Fe		Privately owned	-
Bethesda	208	LS	Cu	Au	No data available	prospecting right granted
Bethesda	208	LS	Fe		No data available	prospecting right granted
Onverwacht	209	LS			Privately owned	-
Maroelaknop	210	LS			No data available	-
Brakspruit	211	LS			No data available	-
Hoogepan	212	LS			No data available	-

Kalklaagte	214	LS			No data available	-
Haakdoornbult	215	LS			No data available	-
Nooyensfontein	338	LS			Privately owned	-
Dassieshoek	339	LS	GKy		No data available	-
Cambrais	352	LS			Privately owned	-
Commissiedraai	354	LS			No data available	-
Bok	356	LS	Cm		Privately owned	-
Boscluishoek	377	LS			Privately owned	-
Zwartkopjes	438	LS			Privately owned and the Republic of South Africa	-
Petronella	439	LS			Privately owned	-
Legkraal	440	LS			Privately owned	-
Laagpan	441	LS			Privately owned	-
Enkelput	442	LS	Cm		Privately owned	-
Lemonfontein	443	LS	Cm		Privately owned	-
Lemonfontein	443	LS	Cr	Ni	Privately owned	-
Boerlands	444	LS			Privately owned	-
Rondeboschje	445	LS			No data available	-
Nooyenslaagte	446	LS			Privately owned	-
Eendekuil	447	LS			Privately owned	-
Ganspan	448	LS			Privately owned	-
Dikbastlaagte	450	LS			No data available	-
Dorstfontein	451	LS			No data available	-
Driedoornhoek	452	LS			No data available	-
Mierhoopbult	453	LS			No data available	-
Gelykveld	454	LS			No data available	-
Kameeldoornspruit	455	LS			No data available	-
Schoonlaagte	456	LS			No data available	-
Vaalkopje	457	LS			No data available	-

Ruigeveld	458	LS			Privately owned	-
Haakdoorndraai	459	LS			Privately owned	-
Deonderstewagendrift	464	LS			Government of Lebowa and Privately owned	-
The Grange	471	LS			Government of South Africa and Privately owned	-
Doornhoek	480	LS	Au	Cu	No data available	-
Zoutfontein	483	LS			No data available	-
Wakkerstroom	484	LS			Privately owned	-
	488	LS			No longer exist	-
Nooitgedacht	489	LS	Gr		No longer exist	
Rietfontein	490	LS			Republic of South Africa	-
Tarentaaldraai	493	LS	MQ		No data available	Mining right granted for dimension stone
	494	LS			No data available	-
Leewdoorns	495	LS			No data available	-
Bittervlei	496	LS			No data available	-
Zoetwater	497	LS			No data available	-
Leeuwlaagte	498	LS			No data available	-
	501	LS			No data available	-
Duikerspruit	502	LS			No data available	-
Tijgerfontein	503	LS			No data available	-
Hartebeesthoek	504	LS			No data available	-
Leeuwkopje	505	LS			No data available	-
Leeuwpan	506	LS			No data available	-
Makouwpan	507	LS			No data available	-
Klipplaatdrift	508	LS			No data available	-
Biesjeslaagte	509	LS			Government of Lebowa	-
Matjiesgoedfontein	513	LS			Privately owned	-

Deelkraal	514	LS		Privately owned	-
Deelkraal	515	LS		Privately owned	-
Droogeloop	516	LS		Privately owned	-
Modderfontein	517	LS		Morebene Communal Property Association and the Republic of South Africa	-
Haasbult	518	LS		Government of South Africa and Private	-
Bosckopje	519	LS		Privately owned	-
Goedgedacht	520	LS		No longer exist	-
	521	LS		No longer exist	-
Oog van Driefontein	522	LS	Cm	Privately owned	-
Middagzon	524	LS		Government of South Africa and Private	-
Waterval	553	LS	Cm	No data available	-
Waterval	553	LS	Fe	No data available	-
Kalkgat	554	LS		Privately owned	-
Vischat	555	LS		Privately owned	-
Witklip	556	LS		Privately owned	prospecting right granted
Springforbi	557	LS		Privately owned	-
Ruigtevlei	559	LS		No data available	-
Groenvlakte	560	LS		No data available	-
Makouwlaagte	561	LS		No data available	-
Zuurbosch	562	LS		No data available	-
Kafferbosch	563	LS		No data available	-
Abrikooshoek	565	LS		No data available	-
Limoendraai	566	LS		No data available	-
Doorndraai	567	LS		Privately owned	-
Biesjeslaagte	568	LS		No data available	-
Oudoornbult	571	LS		Privately owned	-
Enkeldebosch	572	LS		Privately owned	-

Kalkfontein	573	LS				Privately owned	-
Malietzie Location	606	LS				Privately owned	prospecting right application submitted
Langgerekt	610	LS				Privately owned	-
De Put	611	LS				Privately owned	-
Uitkyk	612	LS				Privately owned	-
Maroelapan	613	LS				Privately owned	-
Maroelabult	614	LS				Privately owned	-
Kalkfontein	615	LS	Fe			Privately owned	Prospecting right granted
Kalkfontein	615	LS	Fs	Be	Li	Privately owned	prospecting right application submitted
Kareebosch	618	LS				Privately owned	-
Bylsteel	748	LS				No data available	-
Swartlaagte	749	LS	Fe			Privately owned	-
Groenvlei	751	LS				Privately owned	-
Klapperbosch	752	LS				No data available	-
Graspan	753	LS				Privately owned	-
Groenpan	754	LS				No data available	-
Zwartpan	755	LS				Privately owned	-
Eendvogelpan	756	LS				Privately owned	-
Withoutlaagte	757	LS				Privately owned	-
Holvlakte	758	LS				Privately owned	-
Vlakfontein	759	LS				No data available	-
Breipaal	761	LS				Privately owned	-
De Gladde Klipkop	763	LS	St			Government of Lebowa	-
Maroelaput	764	LS				Privately owned	-
Bodensteinshoop	765	LS	Cm			Privately owned	-

Vergenoegd	766	LS			Privately owned	-
Klipbok	767	LS			Government of Lebowa	-
Weeskind	768	LS			Privately owned	-
Uitkomst	769	LS			Privately owned	-
	770	LS			Ga-Mogale Communal Property Association	-
	771	LS			Privately owned	-
Uitdraai	772	LS			Ga-Mogale Communal Property Association	
Zwartfontein	773	LS			No data available	-
Locatie van Ramogoep	774	LS			Government of Lebowa	-
De Windam	775	LS			Privately owned	-
Grobler	776	LS	Cm		No data available	-
Grobler	776	LS			Privately owned	-
Driefontein	777	LS	Cm		No data available	
Zoekmekaar	778	LS	Cm		Privately owned	-
Zoekmekaar	778	LS	CS		Privately owned	-
	780	LS			Privately owned	
Pelgrimspruit	782	LS			Privately owned	-
Geluk	783	LS			Privately owned	-
Blinkwater	784	LS			Privately owned	-
Waterval	785	LS			No data available	-
Weeskind	786	LS	AP		Privately owned	-
Doornlaagte	787	LS	AP		Privately owned	-
Smitskraal	788	LS			Privately owned	-
Vrede	789	LS			Privately owned	-
Eerste Geluk	790	LS	AP		Privately owned	-
Eerste Geluk	790	LS	Fs	Mc	Privately owned	-
Vryburg	791	LS			Privately owned	-
Rietspruit	792	LS			Privately owned	-

Waterval	793	LS	Cm		Privately owned	-
Eerste Rechter	794	LS			No data available	-
Spitshoek	795	LS			Privately owned	-
Brakfontein	796	LS			Privately owned	-
Zoetfontein	797	LS			Privately owned	-
Zevenfontein	798	LS			Privately owned	-
Zevenfontein	798	LS	Cu		No data available	-
Droogebult	799	LS	Cu		Privately owned	-
Zuurfontein	800	LS			No data available	-
	802	LS			No data available	-
Kopje Alleen	803	LS	Fe		Privately owned	-
Langlaagte	804	LS			Privately owned	-
Schuinsdraai	805	LS			Privately owned	prospecting right granted
Hoogebult	806	LS			Privately owned	-
Salamis	807	LS	Fs	Mc	Makotopong Communal Property Association	prospecting right granted
Roodewal	808	LS	Cu	Au	Republic of South Africa	-
Roodewal	808	LS	Fe		Republic of South Africa	prospecting right granted
Roodewal	808	LS	Mc	Li	Republic of South Africa	prospecting right submitted
Ruigedraai	809	LS	Fe		Republic of South Africa and privately owned	prospecting right granted
Ruigedraai	809	LS	Li	Mc	Republic of South Africa and privately owned	prospecting right submitted
Platkopje	811	LS			Privately owned	-
Kalkfontein	812	LS			Privately owned	-
Zandbult	813	LS			Privately owned	-
Droogeground	814	LS			Privately owned	-
Mooiplaats	815	LS	Fe		Privately owned	prospecting right

					granted
Magataspruit	816	LS		Privately owned	-
Uitval	817	LS		Privately owned	-
Wilgeboschfontein	818	LS		Privately owned	-
Helpmalkaar	819	LS		Privately owned	-
Uitspanning	820	LS		Privately owned	-
Waterval	827	LS		Privately owned	-
Bloemtuin	828	LS		Privately owned	-
Bloomfield	829	LS		No data available	-
Net Recht	832	LS		Privately owned	-
Klein Begin	833	LS		Privately owned	-
Kleinfontein	834	LS		No data available	-
Hattingsburg	835	LS		Privately owned	-
Rietgat	836	LS		Privately owned	-
Damplaats	837	LS		Privately owned	-
Doornlaagte	838	LS		Privately owned	-
Maroelabult	839	LS		Privately owned	-
Zonderwater	840	LS		Privately owned	-
Brakfontein	841	LS		No data available	-
Uitvalplaats	842	LS		Privately owned	-
Bultfontein	843	LS		Privately owned	-
Maroelaknop	844	LS		Privately owned	-
Schuinsgelegen	845	LS		Privately owned	-
Du Preez Rust	846	LS		Privately owned	-
Kleimnfonteijn	847	LS		Privately owned	-
Schuinshoek	848	LS		Privately owned	-
Zandrivierspoort	851	LS	Fe	Privately owned	-
Fort Klipdam	852	LS	Fe	Privately owned	prospecting right granted

Fort Klipdam	852	LS	Fe	Privately owned	-
Fort Klipdam	852	LS	QB	Privately owned	-
Fort Klipdam	852	LS	Si	Privately owned	Mining permits issued
Palmietkuil	853	LS		Privately owned	-
	855	LS		Privately owned	-
Songloed	857	LS		No data available	-
Rietpol	858	LS		Privately owned	-
Uitkomst	864	LS	Fe	No data available	Prospecting right granted
Vuurteenlaagte	868	LS	Fe	No data available	Prospecting right granted
Kraalhoek	869	LS		Republic of South Africa and Privately owned	-
Kalkbank	1171	LS	Cu	Republic of South Africa and Privately owned	-
Swanesang	1175	LS		Agrivet (Pty) Ltd	-
Minaarsdraai	1177	LS		Morebene Communal Property Association	-

N.B.

Reg. division = Registration division

Com = commodity

* Information provided by the Department of Land Affairs

** Information provided by the Department of Minerals and Energy

See the attached geological map for the explanation of the abbreviations used for the commodities.

Appendix 2: List of companies that have mineral rights in the Molemole Local Municipality

	Company	Contact person	Address	Telephone	Fax
1	Catnis Construction	A. Saalman	P.O Box 1184 Polokwane 0700	015 295 5417/083 285 8487	N/A
2	Copper Sunset Trading	Allan Viljoen	P.O. Box 18 Safari Gardens Rustenburg 0300	014 5332585/082 8686 427	014 5331 316
3	Rebone Mining	Helen Jean	P.O Box 3901 Polokwane 0700	015 2636 831/072 2371 132	015 2636 231
4	Tuquoise Moon Trading 157 (Pty) Ltd	James Matodzi Nesongozwi	Box 4452 Mokopane 0601	015 4918 567/083 9222 271	015 4918 667
5	Sekoko Resources (Pty) Ltd	Timothy Tebeila	Postnet x 9307 Polokwane 0700	015 2956 513/083 2772 333	015 295 6455
6	Sishen Iron Ore Company (Pty) Ltd	Reeders Christo	P.O Box 9229 Pretoria 0001	-	-
7	Lengana Health (Pty) Ltd	Mokgohlwa Joel	P.O. Box 78138 Sandton 2146	011 8840 220/082 3320 553	011 8849 251
8	Lyndou Trading	James Matodzi Nesongozwi	Box 4452 Mokopane 0601	015 4918 567/0839222 271	015 4918 567
9	Nesongozwi Mining Corporation	James Matodzi Nesongozwi	Box 4452 Mokopane 0601	015 4918 567/0839222 271	015 4918 567
10	Nkgapu Resources	Noko Bejamin Kgomo	P.O. Box 361 Suite 103 Forum 2 Polokwane 0700	015 2913 820/082 7758 249	015 2914 6567