The Mintek Small Mine Case Study — Venmag

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Introduction

Although it is often said that South Africa does not have suitable deposits, or the potential to develop mines on a small scale, a recent survey by the Chamber of Mines[1] showed that, out of a sample of 641 producers, 41 per cent had between 10 and 19 employees, and a further 29 per cent had between 20 and 29 employees. This goes to show that minerals-related small, medium, and micro-enterprises (SMMEs) do exist, and can play an important role in the development of rural industries in South Africa.

Nchaka Moloi of the Department for Mineral and Energy Affairs defined the various categories of SMMEs as shown in Table I[2]. An enterprise could be placed in a certain category as long as two of the variables, employees, capex or production applied.

Table I

Definition of SMME categories

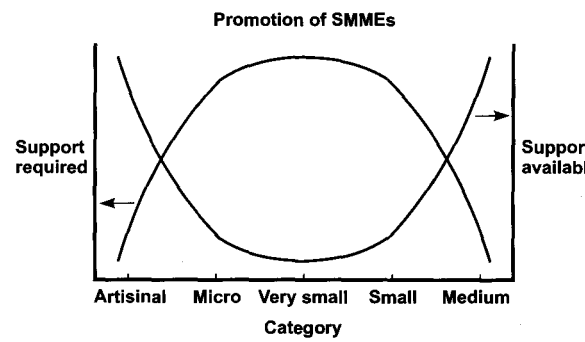
Category	No. of employees	Capex R'000	Production tons/yr
Artisinal	<5	<5	<2
Micro	6–20	5–99	2–9,9
V. small	21–49	100–7999	10–99,9
Small	50–99	8 000–24 999	100–249,9
Medium	100–999	>25 000	>250

Mintek provided support for these small metallurgical enterprises in previous years on a reactive basis. However, at the beginning of 1994 Mintek initiated a small mines program with much enthusiasm and little experience. Mintek has now developed a far more proactive attitude in its dealings with these enterprises. Mintek is at present active in three different areas:

- Direct support for existing SMME operations with the aim of improving levels of technology, and ensuring their long-term sustainability. Mintek has had some success in this area.
- Involvement with the Regional Institutional Support Management Committee (RISMAC), with the broader aim of providing multi-disciplinary capacity to State Departments, the Provincial Legislatures, and local governments for the implementation of the social and economic programmes being introduced by the Government of National Unity. RISMAC is finding its feet especially in the Northern Cape Province but has as yet had no success in establishing a small mining operation.
- Identification of opportunities for the creation of medium-scale metallurgical operations through the exploitation of wastes, residues, dump materials, or mineral deposits that are not being developed by the large mining houses.

Progress in these three areas has added to our understanding of SMMEs, and an attempt will be made in this paper to highlight the major barriers that appear to be retarding the expansion of minerals-related SMMEs.

The support required by the various-sized enterprises is not the same. Figure 1 shows that artisinal and micro ventures require little support from the managerial, financial, technical, and marketing point of view as do the medium size enterprises who are well extended in the formal sector. It is the very small and small ventures which require these skills while little seems to be available[3]. Some training is however possible through the RISMAC members such as the HSRC.



Source: DTI paper on Local Service Centres

Figure 1—Support by various-sized enterprises

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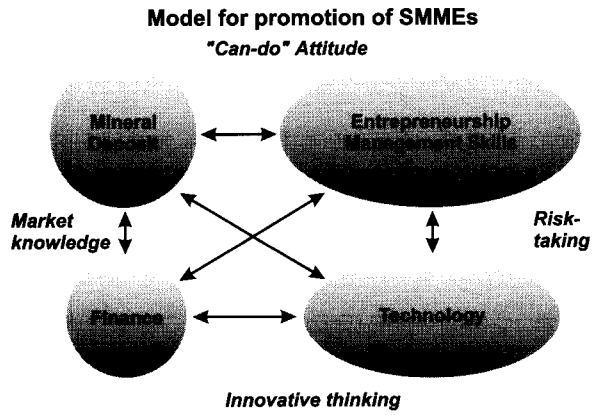


Figure 2—Barriers to entry

Barriers to entry

The major barriers are viewed as being access to appropriate mineral deposits, managerial and entrepreneurial skills, technology, and finance (Fig. 2). Of these four barriers, access to minerals deposits and entrepreneurial skills appear to be the most important. If an entrepreneur has secured a suitable mineral deposit, technology is freely available (from organisations such as Mintek, or from equipment vendors), and there appear to be sufficient risk-takers who are prepared to supply capital for the right project.

It is access to raw materials that is important and this area is still a sensitive issue in South Africa with private ownership of some of the smaller deposits by major mining houses and private citizens, preventing them being worked by SMMEs. The Department of Mineral and Energy Affairs is well aware of this problem and has taken a very pragmatic approach in trying to rectify the situation.

Embedded within the four major elements (Fig. 2), are elements of risk taking, innovative thinking, market knowledge and can-do attitudes. The entrepreneur has to get access to technology appropriate for a small scale operation. Often this technology is improved and leads to risk taking. He has to obtain finance, which is usually available if the financier has a firm understanding of the potential of the project and how the markets for the product operate.

The Venmag Magnesite Project is an excellent example of the success that can be achieved when all four barriers are surmounted. A brief history of the project follows as a case study to illustrate the growth of a minerals-related SMME through innovative thinking coupled with societal and environmental concern. Venmag has in fact grown from a micro to a small mining operation over the past two years.

History

In 1987 and 1988 Geocapro Services were carrying out small-scale calcining of magnesite in 200-litre drums heated by burning wood. They decided that there was a big enough market for them to enter with increased production, and asked Mintek for assistance.

During a visit to Venda, a number of potential magnesite deposits were identified, each of them having been mined previously and then closed down. The deposit at Folovhodwe (North of Thohoyandou in Venda) showed the most promise as it was situated near a small river and a

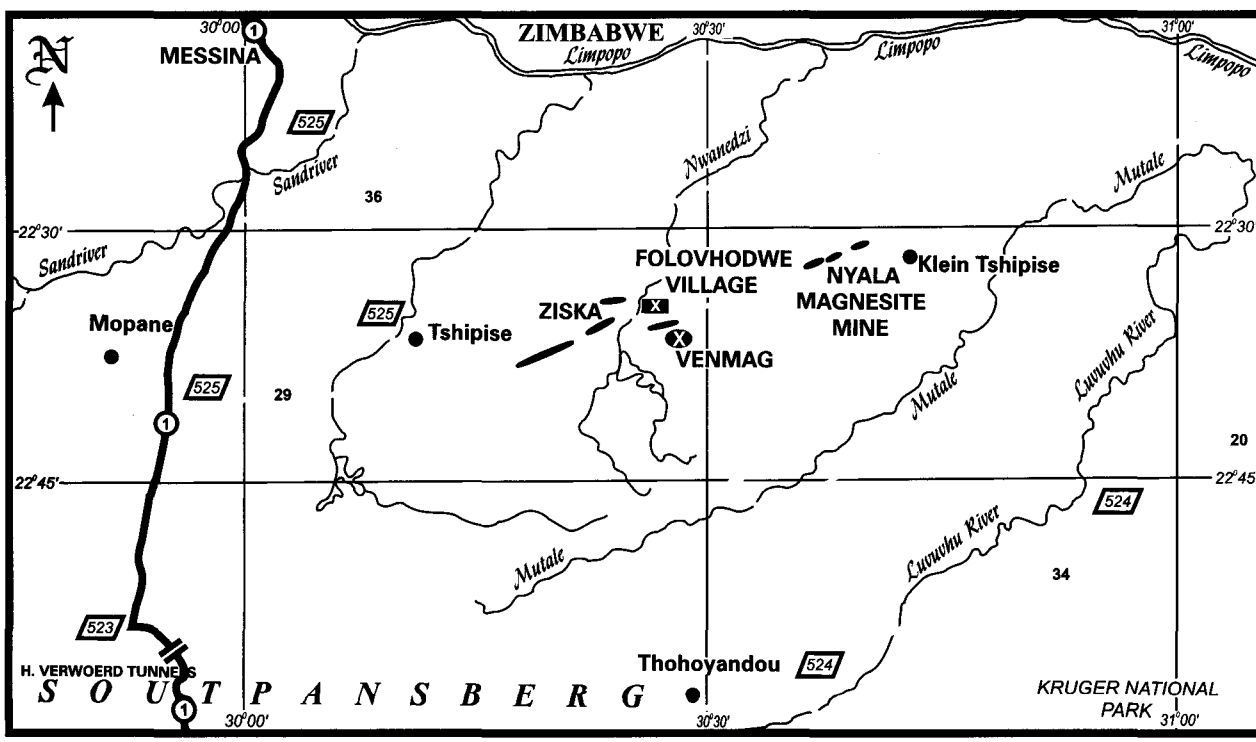


Figure 3—Map

The TLB has opened up an area for collectors to pick up magnesite

village which could supply people to work on the plant, and to mine the magnesite as free agents (Fig. 3). The magnesite in that area is in a soft clay-like matrix, and fairly easy to mine by hand. Magnesite deposits in the area do not occur deeper than the water table, therefore making it suitable for artesian miners. Geocapro requested a simple process because they wished to create job opportunities by being as labour intensive as possible.

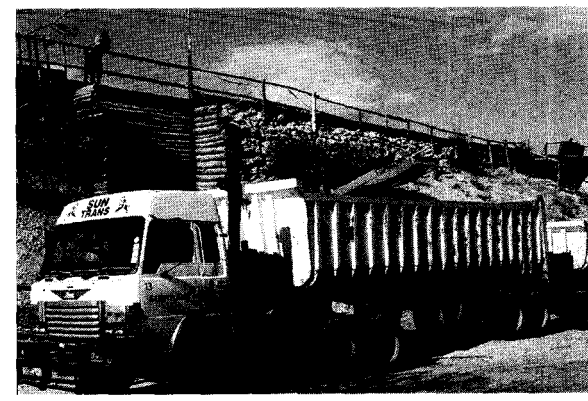
The testwork showed that it was possible to produce magnesite of acceptable grade using a simple scrubbing and desliming process. Testwork on sintering of the magnesite and its conversion from calcined magnesite to periclase was also done.

Geocapro involved JIC as partners and formed the company Venmag. They obtained the mineral and mining rights to a number of deposits from the then Venda Government, and built a plant which included a scrubber and a vertical shaft kiln.

Technical Operations

Both the mining and the operation of the plant have been designed to be labour intensive. In a few areas the collectors

Large trench filled and covered with top soil for rehabilitation



Product being loaded for transport to the market

'pig root' using picks, shovels, and wheelbarrows, but the main mining is carried out using tractor loader backacters (TLBs) to open up the soft earth and make the magnesite available to the collectors. The TLBs are then used to replace the earth in the pit and cover it with topsoil as part of the rehabilitation drive.

The collectors build up a pile of magnesite of about 2 t which is then loaded into a trailer and transported to one of two bunkers, i.e. 40 t (old) and 100 t (new). These were constructed by the mine with a steel-mounted inverted-pyramid discharge at the bottom, and walls made from treated eucalyptus poles. The product is loaded into transport trucks and trailers by conveyor. These trucks are also used to transport coal from Witbank to the Messina district and a reduced transport rate is therefore given to Venmag, otherwise the trucks would have to drive back empty.

The material which is to be calcined is washed and upgraded using a scrubber. The washed material is lifted to the top of the kiln by a small mechanical hoist and fed by hand into the kiln. The kiln is fired with coal, which is also loaded into the separate burning chambers by hand. The ash is removed with wheelbarrows. All fine magnesite is run by gravity into small slimes dams or paddocks. After drying it is removed and stored in heaps to be used when a market for it becomes available. Because all power is supplied by a 200 KVA generator, gravity is used wherever possible to transport feed and products.

To increase production of calcined magnesite, Venmag are installing a second free-standing kiln. They have also tried various labour intensive methods such as the primitive methods used to fire bricks. Magnesite and coal are piled in layers into a box-shaped heap, and then clay used to seal the walls and top before lighting the bottom of the heap. If this is found to be successful, family units at outlying deposits will be trained in its use and paid for production of calcined materials. Preliminary tests into this method by Venmag have been partially successful with sufficient heat being generated in some areas of the heap to produce periclase.

Primitive method being tested to calcine magnesite

Plant upgrades

Crushing

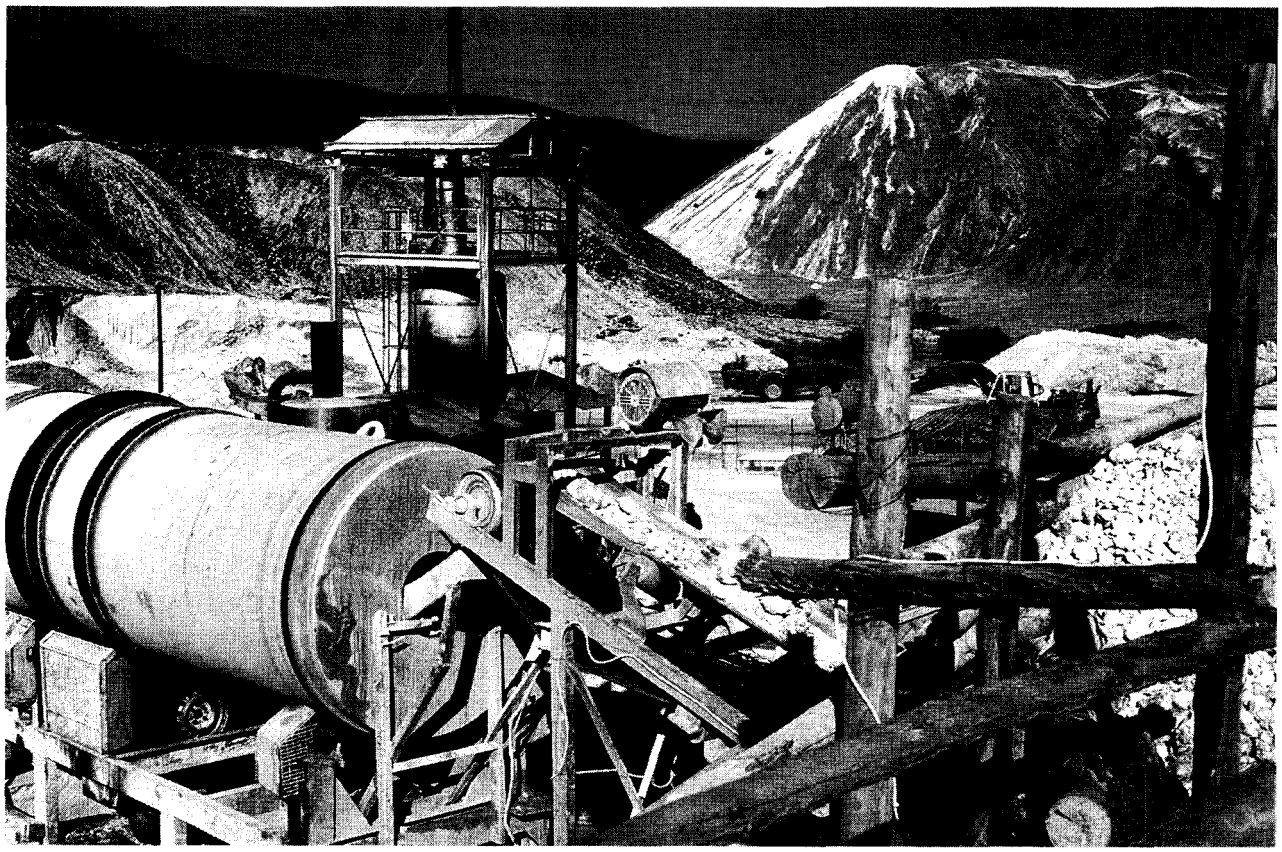
In 1995 Venmag found that their orders for a range of products had increased considerably and they needed to produce a finer product of -20 +3 mm. To assist them Mintek undertook a crushing exercise in which 30 t was put through the Mintek crushing plant to gather design parameters for a crushing and screening plant at Venmag. Based on this data, Venmag were able to purchase various crushers and screens, mainly second-hand, and produce the material required by the market.

Further calcining capacity

The next stage of the expansion program at Venmag was due to the increased demand for calcined magnesite. Venmag needed to expand their calcining capabilities. If a fairly simple kiln could be constructed, a family unit could operate it as a small business and be contracted to calcine magnesite, being paid per ton produced. Mintek carried out a fairly extensive literature survey on vertical kilns, mainly for the burning of limestone. Various old kilns, some national monuments, were also located and a design suggested to Venmag who have now built a prototype. Should this be successful a battery of 6 kilns will be built for the manufacture of magnesium cement. This will probably be incorporated into the side of an old tailings dump rather than free standing. The benefits of this are that the tailings dump could be used to support side-tipping cocopans on a ropeway system for transporting the feedstock to the top of the kiln.

Benefits to the local community

At the opening ceremony in March 1994, 30 people were on the Venmag permanent payroll and a further 40 people were outside contractors or collectors who were paid by the ton of magnesite collected. In June 1996 this had increased to 102 permanent staff and about 350 outside contractors who dig and collect by hand at 3 different sites. The mine uses TLBs to loosen the ground which also leads to the collectors being able to increase their daily production.



View of plant showing scrubber in foreground with kiln behind it, the dump in the background was left by previous mining companies

The previous companies who mined the area left extensive environmental damage and huge tailings dumps. Venmag is filling up the old workings and has a rehabilitation scheme operating at their new diggings, backfilling as they move ahead. Seeds of local grasses will be sown on the rehabilitated areas.

Because Venmag are mining at three different areas, people living in villages near each deposit are able to mine magnesite near their homes and this is collected by tractor and trailer and transported to the bunkers, from where it is loaded into trucks for transport to the various markets. Venmag have now started using terraces in their mining plan. This assists the collectors to be more efficient, and aids in rehabilitation.

The area has expanded in the past 2 years with obvious signs of new houses having been built. The signs are that heads of families are moving back to their homes from other districts now that work is available in their own area. Extra classrooms have had to be built onto the existing primary school near Venmag to cope with the population growth.

Another interesting feature is the noticeable improvement in the quality of many of the homes. Some of the inhabitants, particularly those employed by Venmag, have started building brick homes as opposed to the standard African-style hut which is prevalent in most of the nearby areas. These houses, and many of the huts, have also been enhanced by painting them with fine magnesite which is used much like a lime wash. The farmers and shopkeepers in the area have also benefited by the increased buying power of the local inhabitants. One entrepreneurial shopkeeper is delivering bread to the mine and selling it directly to the workers there.

Venmag has formed a committee with members of the local community to discuss items of mutual interest to both the community and the mine (excluding labour relations). A levy has been set on each ton of magnesite sold and this goes into a fund, controlled by the committee, and used to sponsor good athletes, assist schools and churches and other community activities.

Venmag have also made their workshop available to the local people, who bring in broken farming equipment for repairs. Because there is no electricity laid-on in the area, Venmag has requested Eskom to lay a line to the mine. This would also be used for the inhabitants of the Folovhodwe village, and Eskom has asked Venmag to control the sale of electricity to the villagers using a debit card system.

This area started out as an extremely poor area with mainly goats and a few vegetable lands near the river, and where families existed on the money sent home by the breadwinner, usually the head of the household. This has changed into an area which is attracting people who see the job opportunities and where the average family has a better life-style and money in their pockets.

Conclusions

The importance of the role of the entrepreneur in the development of minerals-related SMMEs cannot be over-stressed. Mintek is not a development agency, and has learnt very quickly that it cannot 'create' SMMEs. Mintek's strategy is to promote itself as a reliable and innovative supplier of technology that is pitched at the appropriate level, and will work together with the entrepreneur. We are compelled to charge for our services, in order to protect ourselves from the criticism that State funds are used to support selected individuals, thereby creating unfair competition and possibly upsetting delicately poised market forces. In order to keep our costs as low as possible, the scope of any testwork is kept to the barest minimum, but the entrepreneur is informed of the higher degree of technical risk.

Experience has shown that most SMMEs will accept far higher levels of risk, while adopting the philosophy that any fault will be corrected during commissioning. This attitute is not compatible with the 'average' engineer, and the engineers assigned to Mintek's SMME program are carefully selected.

The Venmag case study is an excellent illustration of these aspects, and is an example of what Mintek is striving to achieve with its SMME Assistance Programme.

References

1. CHAMBER OF MINES NEWSLETTER, Issue number 2/6, 1994, p. 6.
2. MOLOI, N. Private Communication.
3. MINISTRY OF TRADE AND INDUSTRY .'Strategies for the Development of an Integrated Policy and Support Programme for Small, Medium, and Micro-enterprises in South Africa — A discussion document'. *Ministry of Trade and Industry,* October 1994. ◆

SAIMM Events

MOVUP/IOQ/SAIMM Surface Mining 1996 International Conference

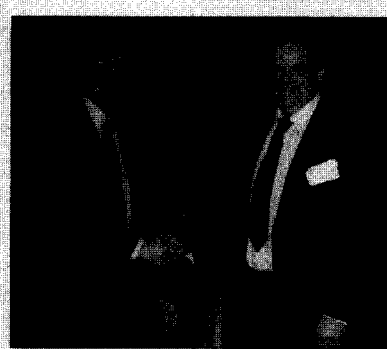
The objectives for the Conference included the need to update the available surface mining technology, to enable the publication of a SAIMM Monograph Series and a textbook for the education of the new generation of mining engineers, technicians and surface mine operators. In addition to meet our counterparts world-wide in an attempt to establish technology networks and to combine the event with the bi-annual ELECTRA Mining Exhibition.

54 of the 275 registered delegates came from countries as far afield as Jugoslavia, Chile, USA, UK, Germany, Netherlands, Turkey and Canada, ensuring a truly international touch.

The subjects convened during the 3½ days of technical presentations included papers on Project evaluation (6), Mining Planning, Design and Contract Mining (16), Selection of Mining Equipment and Maintenance Philosphy (6), Mining Operations, Drilling and Blasting and General (13), and, for the first time, (7) excellent Environmental Management related papers.

Steering Committee of the Surface Mining Conference

Hidden Wealth



Dick Graham, chairman of the Organising Committe, Hidden Wealth and Dr Nic Barcza

'Unlocking values from low grade and refractory ores and wastes'.

The programme was an adequate blend of practical and technical innovation, covering many areas of the conference theme. The Opening address by the President of SAIMM set an excellent stage for subsequent presentations. In this and the professional chairing of the sessions, the conference was a success, being well-received by delegates. A total of 97 delegates attended the Conference.

The social programme benefited from Rob Lindsay's handling of the 'Surface Mining 1996' functions in which Hidden Wealth delegates participated, and these were thoroughly enjoyable in all respects.

The input of the Technical Programme Committee, Extractive Metallurgy, is appreciated as well as the efforts of all involved in obtaining papers, organising visits, refereeing, chairing sessions, securing delegates, sponsors, etc. The current President and immediate Past President of SAIMM are thanked for the keynote address and closure respectively.

Outokumpu Travel Grant for Metallurgists

The Outokumpu Travel Grant for metallurgists in the metallurgical industry was established in 1996 and is seen by the Company as a gesture of 'putting something back' into the industry from which it makes its living in South Africa.

The first recipient of the grant was Zoë Francois of Rustenburg Base Metals Refiners. The award was made at the the closing of the Hidden Wealth Conference by Mr Richard Atkinson of Outokumpu Mintec.

The prize includes:

- A return air ticket to the continent.
- Accommodation for the entire duration (approximately 1 month) of the study tour.
- Assistance from Outokumpu with regard to visits to plants, manufacturers, universities, etc.
- A sum of money to cover out of pocket expenses.

The travel grant will operate under the auspices of The South African institute of Mining and Metallurgy, and the winner will be selected by a committee appointed by the Institute. ◆

From left to right: Richard Atkinson, Zoë Francois and Dr Nic Barcza