



# Mine downscaling and closure: an integral part of sustainable development

by Jacinto Rocha and John Bristow

**Environmental concerns have increasingly led governments to implement legislation which ensures that mining companies plan for the depletion of non-renewable resources and the eventual closure of mining operations.**

**Focusing on South Africa, this paper will make proposals for how to plan for the reorientation of the lives of those affected by mine closure or downscaling.**

This article and the following on p. 21 by M. Solomon are outputs from the policy research conducted at the Minerals and Energy Policy Centre (MEPC), in Johannesburg, South Africa.

Since the article was written both authors have left the MEPC. Jacinto Rocha is with the Department of Minerals and Energy in Pretoria and John Bristow is an independent consultant in the diamond sector. Communications should be sent to the Minerals and Energy Policy Centre (MEPC), P.O. Box 395, WITS, 2050 Johannesburg, South Africa. E-mail: info@mepc.org.za

All human activity has an impact upon the environment and mining is no exception. Potential benefits to mankind derived from the efficient recovery of minerals from the earth must be balanced against the long-term effects of the mining process upon the environment. It is equally important to consider and plan for the eventual long-term effects of mine downscaling and closure on human beings and their society.

Mining is a catalyst for local economic development, and from this perspective, encouraging the development of minerals projects is a key economic issue. Of equal importance is the question of sustainable development. Minerals are a wasting asset and therefore every mine must eventually die. This means that unless there is a concerted effort at developing a sustainable economy around a mine during its life, once the resources are depleted the economic structure around may also die, while the infrastructure that accompanied the establishment of the mining operation may, or may not, be dismantled. This is a tragic waste, but the more disastrous consequence is the unemployment created through mine downscaling or closure.<sup>1</sup>

Mineral wealth is created by the combination of resources, capital and labour, managed by the investors and mining companies with the co-operation of the state, the mineral rights owner and the affected communities. Mineral resources can generate substantial wealth in this way but they are depletable and non-renewable. For sustainable development these resources need to be managed so that the wealth they generate can effectively substitute for the depleting mineral asset. This management is especially important in those countries largely dependent on minerals for their economic development.

## Background

In most countries, mining operations require the operator to obtain a mining licence. The general requirements for applying for a mining licence include the

submission of a plan of operations which addresses details of the manner and method of mining. A reclamation plan which presents the details of the licence holder's plans for the fate of the mining area after the operation is over is generally also required. For instance, in Ontario, Canada, companies are required to file closure plans for new mining operations and to ensure that financial assurance is in place for carrying out mine rehabilitation.<sup>2</sup> Some countries only require the submission of an informal reclamation plan for review but may demand a formal environmental report if the operation is judged to have potentially significant environmental impacts. Other countries require by law that all miners prepare a formal Environmental Impact Statement (EIS) report for approval before commencement of activities. The reclamation plan and Environmental Impact Assessment or Statement provide the basis for government's decisions on whether mining in a prospective area is environmentally acceptable.<sup>3</sup>

In contrast to these well-established practices, few governments have yet developed policies or guidelines which require mining companies to file a socio-economic impact closure plan. Though it is debatable as to whether simple economic forces should apply, in developing countries mine downscaling and closure often creates lasting social legacies which may impact significantly on other important economic sectors, including the environment. In this respect guidelines for long-term social plans relating to eventual mine closure are considered appropriate. When one further considers Southern African mining operations, particularly in remote areas such as the Northern Cape, Northern Province (South Africa), and Botswana, in nearly all cases there has been massive investment by the mining companies in every sphere of activity, from mining and business through to living quarters. Though this approach has probably been both necessary and desirable in the past, it has

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**Table 1. Sudbury economic summary**

**Population:** Sudbury City: 92 000; Sudbury Region: 158 000.

<b>Activity</b>	<b>Comments</b>
<b>Tourism</b>	<ul style="list-style-type: none"><li>• Generates &gt; \$150 m revenue annually</li><li>• Sudbury Snowtrail plan: annual economic spin-off \$20m</li><li>• Mining museums, mine tours</li><li>• Science North, IMAX theatre (sparked major tourists influx)</li><li>• Organised hunting, fishing, camping and canoeing</li></ul>
<b>Retail centre</b>	<ul style="list-style-type: none"><li>• \$74m downtown development. Conference Centre</li></ul>
<b>Financial and business services</b>	<ul style="list-style-type: none"><li>• Major centre for business, commerce, and government</li><li>• Healthact - Canada's first popular health claims network</li><li>• Major banking sector</li><li>• Northern Ontario Teleconferencing Network</li></ul>
<b>Mining technology</b>	<ul style="list-style-type: none"><li>• Major centre for mining technology, R &amp; D and manufacturing</li><li>• Numerous organisations, associations, and key companies</li></ul>
<b>Medical</b>	<ul style="list-style-type: none"><li>• Major medical referral centre for NE Ontario</li><li>• NE Ontario Regional Cancer Centre - \$61m project will create 250 jobs.</li></ul>
<b>Government</b>	<ul style="list-style-type: none"><li>• Major government centre</li><li>• Ministry of Mines and Northern Development recently relocated to Sudbury, along with other ministries; created 540 jobs</li></ul>
<b>Education and training</b>	<ul style="list-style-type: none"><li>• Major education and retraining centre</li><li>• Several important universities, colleges and training centres</li><li>• Key centre for mineral and mining training</li></ul>
<b>Environmental technology and land rehabilitation</b>	<ul style="list-style-type: none"><li>• World centre for environmental science</li></ul>
<b>Manufacturing</b>	<ul style="list-style-type: none"><li>• Diversified manufacturing centre</li><li>• Many new firms opened in recent years; others have completed major expansions</li></ul>

**Sources:** Sudbury Regional Development Corporation, Annual Report 1993- 1994, Civic Square, 200 Brady Street, Sudbury Ontario, Canada, PZE 5K3; SRDC; SRDC, The Sudbury Region, 1994; SRDC, Regional Municipality of Sudbury Economic Summary, June 1994.

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commonly created a culture of benevolence, which stultifies entrepreneurship and makes closure more difficult to manage. Given the current mature or old sta-

tus of the large-scale mining industry in South Africa, addressing the problems of downscaling and closure is a major concern for all stakeholders.

### **Using mineral resources depletes them**

It is interesting to note that the Brundtland Commission in their 1987 report were optimistic about the supply of non-fuel mineral resources, stating that "non-fuel mineral resources appear to pose fewer supply problems. Studies done before 1980 assumed that an exponentially growing demand would not create supply problems until well into the next century. Since then, world consumption of most metals has remained virtually constant, which suggests that the exhaustion of non-fuel minerals could be deferred. The history of technology development also suggests that industry can adjust to scarcity through greater efficiency in use and exploitation, recycling, and substitution."<sup>4</sup>

Increasingly over the last decade, sustainable development, in terms of environmental conservation and protection, is being addressed from the perspective of affected communities, as well as that of national economies. Mining can also contribute to the process of creating sustainable economic development by making provisions for the socio-economic well-being of the communities affected once the mineral resources are depleted. Although the strategies for achieving this may differ from one country to another, consensus on general guidelines towards a global generic approach to the issue could be achieved.

### **Examples of effects of downscaling on communities**

Mineral deposits, by their very nature, eventually become depleted, uneconomic or exhausted in either physical or economic terms, and the facilities and communities which have come into existence because of them no longer have any purpose.

In Southern Africa, mine closure and downscaling is already a factor in the gold mining sector and many towns e.g. Virginia and Welkom, have witnessed, or are now witnessing a serious downturn in economic growth as a consequence of this. However,

the problem extends well beyond the gold fields, to areas such as the Northern Cape, and also Namibia, e.g. Uis.

Virginia, a mining town in the Free State in South Africa, grew up around the Harmony Gold Mine. Today, the population in the town is estimated at about 45 000 people with another 14 500 workers housed in mine compounds. The mine is the town's major employer, rate-payer and homeowner. In 1992, the mine paid about R 25 million/month in wages, of which half were spent in Virginia; it paid R6 million to the electricity utility company, Eskom, and spent about R17 million on stores and materials, mainly in the Orange Free State.<sup>5</sup> Despite the existence of other smaller mines in the vicinity of Virginia, the town's future is inextricably linked to that of Harmony.

Until 1988, the Harmony mine employed approximately 32 000 workers. However, by early 1993, it had cut the work force by over fifty per cent to 14 586.<sup>6</sup> This retrenchment of workers has not only affected the local communities, but also those migrant workers from Lesotho and other parts of South Africa who supported their families back home through their remittances. Moreover, businesses which do not have mine contracts but rely on services to the mine's employees have been severely affected. Virtually every retail business in Virginia has thus suffered as a consequence.

Another example of a community beset with problems by downscaling was Copperton, south west of Prieska. Here, when mining ceased, the village and infrastructure were effectively shut down and torn down. Consequently many local rural people who had previously benefited from copper mining were left with less income and new challenges, and the local larger centre of Prieska likewise experienced a downtrend in income and business as a consequence of this closure.

Kimberley in the Northern Cape Province also faces mounting pressure as De Beers diamond mines downscale, with

**Table 2. Kimberly Economic Summary**

**Population:** Kimberly: 167 060; Northern Cape Province: 763 900.

<b>Activity</b>	<b>Comments</b>
<b>Tourism</b>	<ul style="list-style-type: none"> <li>• Major tourist potential, but underdeveloped</li> <li>• Unique geological site: diamond route; historic diggers, small miners</li> <li>• High quality museums and historical sites</li> <li>• Game parks</li> <li>• Hunting, camping, and canoeing</li> <li>• Tourists unaware of full potential, seldom stay more than a day - poorly advertised</li> <li>• Logistics poor, e.g. air services</li> </ul>
<b>Retail</b>	<ul style="list-style-type: none"> <li>• Shown small growth in recent years</li> </ul>
<b>Financial and business services</b>	<ul style="list-style-type: none"> <li>• Poorly developed</li> <li>• Many head offices of banks, parastatals and private companies moved elsewhere</li> </ul>
<b>Mining technology</b>	<ul style="list-style-type: none"> <li>• Poorly developed</li> <li>• Some local suppliers, service groups and repair facilities</li> </ul>
<b>Medical</b>	<ul style="list-style-type: none"> <li>• Key medical facilities: state hospital and two private clinics</li> <li>• Possibility for expansion of this sector</li> <li>• Services extensive area</li> </ul>
<b>Education and training</b>	<ul style="list-style-type: none"> <li>• Significantly underdeveloped</li> <li>• University of Orange Free State has a small local branch; small technical college; nurses college</li> </ul>
<b>Manufacturing</b>	<ul style="list-style-type: none"> <li>• Some small scale activity</li> <li>• Single small diamond cutting work, second factory now closed</li> </ul>

**Sources:** Central Statistical Services, 1991; SATOUR, *Kimberley: The City that Sparkles*, 1995

De Beers Mine having already closed, and the remaining three (Dutoitspan, Bultfontein and Wesselton) all becoming increasingly difficult to mine as ore reserves become depleted. Equally on the west coast, Kleinzee (current employment approximately 3000) will in all probability close in about the year 2004.

**Addressing downscaling**

In the case of Kimberley, it is interesting to compare its current status and efforts to plan beyond mining with towns such

as Sudbury (Canada), and Bendigo, Ballarat and Kalgoorlie (Australia). All of these had their origins as mining towns and have to date survived through periods of boom and bust. Today, with the exception of Kalgoorlie, they face ongoing and in fact severe downscaling of the mining industry, with Bendigo and Ballarat having experienced no active mining for many years. In the case of Sudbury the town has also had to address harsh environmental problems.

*Vaal Reefs No 4. Shaft underground drilling in a stope.*

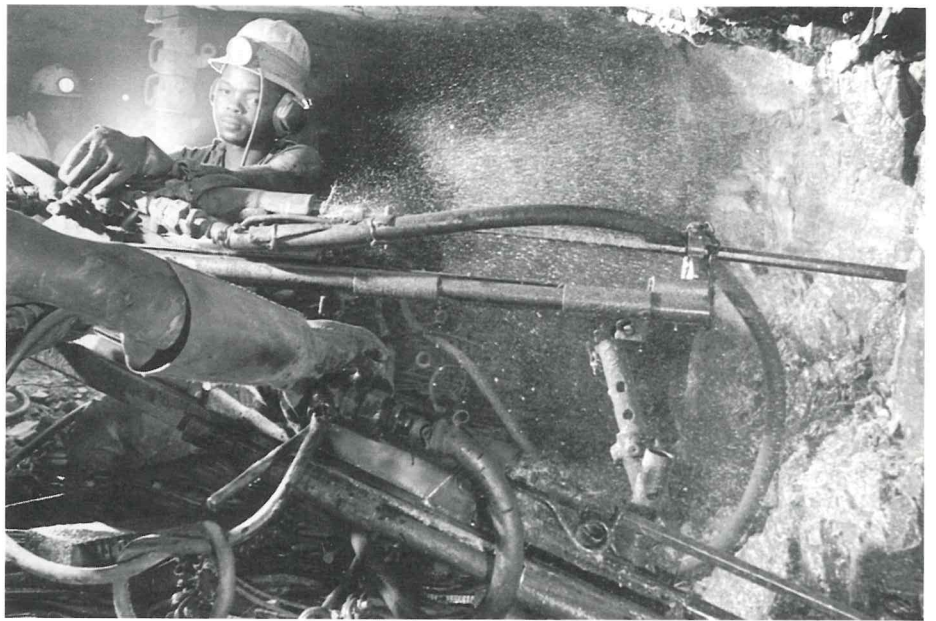
Current economic activities of Sudbury are summarised in Table 1 and those of Kimberley in Table 2. Of interest is the fact that Kimberley has many potential strengths and opportunities which the authors maintain are not being utilised, expanded and developed. One of these is undoubtedly tourism potential. In comparison Sudbury, also once a key mining town, has embarked on an aggressive drive to expand its economic base well beyond mining, though mining has been used as the initial kick start. To achieve and sustain this, Sudbury has formed a Regional Development Corporation (SRDC, Sudbury Regional Development Corporation)<sup>7</sup> to help promote new and exciting business opportunities locally, within Canada, and abroad. As a consequence of this effort and initiative, Sudbury has diversified its economic base over the last two decades, and during the recent recession it emerged healthier than Ontario as a whole.

In similar fashion to Sudbury, towns such as Bendigo and Ballarat in Australia have also faced up to the problem of downscaling and closing of mines with success. As in the case of Sudbury they have broadened their economic base and both Bendigo and Ballarat have also sought to expand in the field of training and development of knowledge skills, which has in turn helped to develop high value, knowledge-based industries.

Considering local and international models, the following measures and strategies are seen as important in the planning and managed implementation of mine downscaling and closure.

### **Proposed generic measures**

- **Reskilling:** Miners have become experts in what they do through repetitive work, and experience. The process of re-skilling calls for the training of miners or mine workers into areas that will make them marketable in the job market once the mine has been closed or they have been retrenched due to mine downscaling. Improving the general and functional literacy and numeracy levels of mine



labourers should also form the basis of the policy of reskilling.

- **Establishment of small and medium enterprises:** The mine is usually responsible for establishing and maintaining the infrastructure of the surrounding community. This has traditionally been the case in South Africa. As a result the communities often become dependent on the mining company for providing services.

The new vision requires that small and medium enterprises be established independent from the mining company, which will survive after the closure of the mine. Encouraging entrepreneurs could create jobs other than those related to mining. For example, one of the problems being faced in South Africa is the imminent downscaling and closure of Anglo-American gold mines around Welkom, in the Free State Province. The mines employ approximately 32 000 workers. If productivity is not increased, these mines are scheduled to downscale or shut down by the end of this year. Ideally planning for this eventuality should have started years ago.

As a first step towards sustainable development, however belatedly, De Beers is currently working on a plan to privatise services at Kleinzee and thus create a service industry, through assisting employees

to take over functions currently managed by the mine. These service industries could in the future form the core of new economic activity that will outlive the mine through the redeployment of resources.

- **Utilisation of infrastructure:** Mining operations usually lead to the development of infrastructure that could form the basis for development beyond the life of the mine. This infrastructure could be wasted upon closure of a mine if it is not put to innovative use. For example, in Pomfret, in South Africa, formerly an asbestos mine, the existing infrastructure is being used as a military base. Another innovative use of existing housing infrastructure on a mine is in Stilfontein, South Africa, where the mining village has been turned into a retirement village. Unused underground mines could also serve as a storage facility for radioactive material, provided care has been taken to protect underground water from contamination. The mining infrastructure could also be made available to small operators to mine the remaining ore, provided it is done in a controlled manner taking into account health and safety issues. The reuse of the mine will create some job opportunities for those who have been retrenched.

- **Tourism:** The development of tourism around mining should be considered

as part of sustainable development. On the negative side, mining damage can destroy delicate ecologies and environments that may provide tourist interest. But the considerable infrastructure created through mining can also give access to remote areas, which facilitates tourism, or can be converted to use by the tourism industry on cessation of mining, such as the "Big Hole" in Kimberley.<sup>8</sup> In another example, De Beers has an active wildlife conservation programme near Venetia diamond mine in the Northern Province. This activity could attract many tourists to the region in the future which in turn could bring in revenue and create alternative job opportunities for the community.

- **Education and Training:** Mining is today a high-tech business and consequently practically any mining town will have industries and businesses that demand people with good technical skills. The establishment of training centres such as technical colleges and Universities thus provides key business opportunities in many such towns. In this respect good examples can be found in Sudbury, Kalgoolie, Bendigo and Ballarat. In contrast, Kimberley in South Africa is short of training facilities.

- **Agribusiness:** Many mining operations and mining companies have large associated land holdings, often in unique environmental areas. Where possible and if viable, the development of agricultural enterprises should be encouraged. For example, Alexcor, a State-owned diamond mining operation in Namaqualand, Western Cape Province, has started a programme of cultivation of oysters in worked out diamond trenches, co-operative ostrich farming schemes, agriculture along the Orange River, and various other non-mining developmental schemes.

- **Mine Dumps:** The potential exists that the treatment of mine dumps be used to generate wealth for retrenched workers. Their expertise gained while working for mining companies can be used to develop entrepreneurial skills.

- **Drive-in-drive-out operations:** Where feasible, labour for new mining enter-

prises could be transported from nearby towns and villages to avoid creating a new settlement which would probably be neglected in the future. An example exists in South Africa where De Beers busses workers from a nearby town to the Venetia diamond mine. This approach enables the existing settlement to develop and serve the mine and surrounding communities.

- **Diversification:** Attempts could be made to diversify the local economy in anticipation of mine closure. Serious consideration should be given by all developing mineral economies to this concept. The establishment of small, medium and large enterprises independent of the mining company would create new entrepreneurs and job opportunities which could release the mining company from the responsibility of being the sole provider of services to the community. This would also ensure that future generations in the area need not be entirely dependent on mining as their forefathers were.

- **Subsidies:** Some argue that subsidies should be used to prolong the life of a declining mine. In most cases, however, subsidies have proved to be a short-term solution to a long-term problem. For example, in Canada, subsidies have been used to support uneconomic coal and gold mining operations to ease the social disruptions in dependent communities caused by the decline of these two industries. It is generally agreed that the Canadian experience with subsidies has not been satisfactory.<sup>9</sup> Subsidies tend to create conditions which postpone and ultimately prevent the implementation of necessary measures aimed at facilitating inevitable adjustments needed to accommodate declining mining activity.

Approaches such as these could assist in the survival of a settlement, its inhabitants and a country's economy as a whole once mines have closed. However, they require good management, commitment and innovation from all parties involved, and cannot be successfully implemented

individually by one or other of the parties. In South Africa, the past all-encompassing activities (e.g. providing housing, schooling, clubs, business, shops) and benevolence of mining companies has made it more difficult for businesses and communities to address the problem of downscaling. By way of comparison, the Sudbury example shows that if properly managed, downscaling can provide many new opportunities. Significantly many of these opportunities and business developments offer greater value added than does actual mining, e.g. high-tech industries.

## Conclusions

Mines are typically located in areas where they constitute the main economic resource; the closure of such operations therefore has significant socio-economic impact. The conversion of the workforce and the local community dependent on the mining operations should be encouraged if local conditions permit. Close cooperation between mining companies, governmental authorities and local communities is recommended to solve these problems in the best possible manner.<sup>10</sup> Canada is a good example where government, industry and labour have formed partnerships in order to tackle the problems facing the Canadian mining industry. Governments alone cannot solve the socio-economic problems created by mine downscaling and closure.

It is, therefore, suggested that mining companies should:

- plan for recycling of infrastructure at the design stage;
- manage the downscaling and closure of mines with a view to redeployment of resources, particularly the workers;
- extend the life of whatever mineral resources remain;
- encourage the discovery of new resources through investment in exploration
- encourage the exploitation of known, but unexploited, mineral deposits;
- increase focus on the optimisation of mineral exploitation;

- encourage sub-contracting and outsourcing;
- support local training/educational institutions; and
- ensure ongoing training and reskilling of the workforce.

Local governments should in conjunction with mining companies create a climate in which economic opportunities peripheral to core mining activities lead to sustainable economic development. Programmes should focus on encouraging entrepreneurs and skills training that will create an efficient and productive workforce. Trust funds could be created that will assist development and provide bridging funds to retrenched workers after the mine is closed, in the same fashion as mine-specific rehabilitation funds are required at present. Lastly, serious consideration should be given to utilising the infrastructure left behind by the mining activity to create a substitution economy.

Communities should be incorporated from the outset into government and mining plans which will address eventual downscaling. Given the nature of mining and the general uncertainty of the life of mines, development plans must be dynamic and transparent.

For their part, central governments (particularly those of mineral dependent developing countries), need to devise strategies on a national level to facilitate these initiatives. All aspects of mine closure and downscaling must be addressed, including a sustainable business planning and development to replace the declining contribution of mining to the economy. Closure planning incorporating all the issues discussed, including sustainable development of mine infrastructure, deployment and reskilling of the workforce, and social reconstruction, should be an adjunct for mining authorisations, in much the same manner as the EIA/EIS is in terms of environmental planning and management. Equally important is that local communities and miners should be consulted when compiling

such plans, in the same way as interested and affected parties are consulted in the course of Environmental Impact Assessments.

The new definition of sustainable development in mining should therefore incorporate not only environmental protection and conservation on behalf of future generations but also ways of addressing the socio-economic impact of eventual mine downscaling and closure on present and future generations.

### Notes

1. Solomon & Bristow, 1995, p.12.
2. Ontario, 1990, p.183.
3. Intrapravich & Clark, 1994, p. 60.
4. Brundtland Commission, 1987, p. 59.
5. Seidman, 1993, p. 4.
6. Seidman, 1993, p. 2.
7. SRDC, 1993/94, p 3.
8. Solomon & Bristow, 1995, p. 15.
9. Buck & Elver, 1970, p11.
10. UNEP/IEPAC, 1991, p. 47.

### References

- ANC, *Draft Minerals and Energy Policy Discussion Document*, Johannesburg, November 1994
- Auty, R. and Warhust, A., *Sustainable Development in Mineral Exporting Economies*, Resource Policy, vol. 19, no. 1, March 1993, pp. 14-29
- Buck, K. W. and Elver, R. B., *An Approach to Mineral Policy Formulation*, Paper presented at United Nations Mineral Economics Seminar, Nakara, Turkey, October 12-24, 1970, pp. 1-15
- Brundtland Commission, *Our Common Future*, New York, United Nations, 1987
- Central Statistical Services, Census, Pretoria, 1991
- Intarapravich, D and Clark, L., "Performance Guarantee Schemes in the Minerals Industry for Sustainable Development", *Resource Policy*, vol. 20, no. 1, March 1994, pp. 59-69
- Koch, E., *Successfully Implementing Multi-skilling in Mines: an Effective Process to Productivity and Efficiency*, Paper presented at the Strategic Mine Management in South Africa Conference, November 1993
- Litten, J. A., & Strachan M. A., "Aspects of the Closure of Capper Pass and Son", *Minerals Industry International*, May 1995

*als Industry International*, May 1995

Moolman, A., Legal Developments in Environmental law: Liability for the Mining Industry, Paper presented at the Strategic Mine Management Conference in South Africa, November 1993

Ontario, Canada, *Mining Act*, 1990.

UNEP/IEPAC, *Environmental Aspects of Selected Non-ferrous Metals Ore Mining: A Technical Guide*, Technical Report Series no. 5, 1991

Nemitz, F.K. R., "Future Problems of, and Opportunities for, the Mining Industries of Europe", *Minerals Industry International*, May 1995

SATOUR, *Kimberley: The City that Sparkles*, 1995

Scott, A and Pearse, P., "Natural Resources in a High-Tech Economy: Scarcity versus Resourcefulness", *Resource Policy*, vol. 18, no. 3, Sept 1992, pp. 154-65

Seidman, G. W., "Shafted: The Social Impact of Downscaling on the Free State Gold-fields", *South African Sociological Review*, vol. 5, no. 2, April 1993, pp. 14-34

Solomon, M. and Bristow, J., *The Minerals Industry and Land Linkages in the Northern Cape and Namaqualand*, MEPC unpublished paper, Johannesburg, April 1995

Sudbury Regional Development Corporation, *Regional Municipality of Sudbury Economic Summary*, June 1994

Sudbury Regional Development Corporation, *Annual Report 1993/1994*

Sudbury Regional Development Corporation, *The Sudbury Region*, 1995

UNEP, UNCTAD, ICME and World Bank, *Development, Environment and Mining: Enhancing the Contribution of the Mineral Industry to Sustainable Development* ( Post Conference Summary), The International Conference on Development, Environment and Mining, June 1 -3, 1994, Washington DC, pp 12 -13

von Below, M. A., Sustainable Development Hampered by Low Mineral Prices, *Resource Policy*, vol. 19, no. 3, Sept 1993, pp. 177-81. ■