Presidential Address: The political economy of mining and metallurgy

by S.J. Ramokgopa

Synopsis

The development of the modern State and the growth of capitalism involves a complex process of interaction between cross-cutting structural dimension: first between politics and economics and, second, between market and hierarchy. Central to such developments are political economies of scale.

Mineral specialization in the Third World developed within the framework of an international extension on oligopolistic structure of the advanced capitalist economies of Western Europe and North America. Up to the late 1960s, the world mineral and metallurgical industry was closely controlled by a handful of Western mining and industrial groups. To the extent that, foreign control of the mining sector was seen in the Third World producing countries both as the essence of foreign domination and as its major symbol.

In some newly industrializing countries, the State took a more direct role in tying the economy and society together. Central to this process was the growth of large-scale finance capital. From early 1959 to the mid-1970s, metal consumption in industrial countries expanded well beyond their domestic mineral endowments. And a free access to Third World minerals was a major element of the economic dynamism of these countries throughout that period.

With the change in the characteristics of international investment, Africa has become less important as an outlet for capital exports of European countries. Actually, the African continent now receives only a very minor share of direct foreign investments of Western enterprises.

International political economy is concerned first of all with the relationship between the economic and political domains across territorial boundaries. Second, attention should be drawn to the role of the State as the focus of decision-making in a system of competitive States, that is in turn, interdependent with a trans-national market economy in which mining and metallurgy are essential activities that affect the politics of the State, and how this in turn, rebounds on the politics of the international system. Understanding the role of the State must go beyond the glib pronouncements on the 'national interest'. How, and *whose* interest, the 'national interest' is determined, is precisely the problem.

This implies a third theoretical problem that must be addressed: the linkage between the domestic and international domains (or levels of analysis), given that political-economic processes clearly cut across the lines of political decision-making constituted by the institutional structures of the State. Situating the State and economic interests within this vast 'state-society' complex that we call the global order will be a crucial problem for any theoretical approach that involves mining and metallurgy.

Introduction

Since 1974, after nearly thirty years of rapidly expanding consumption, the rate of growth has perceptibly slowed down. In a few cases world consumption has actually declined. Periods of sustained over-production have led to accumulation of excessive inventories. Prices have been weak even when industrial growth has resumed and consumption has risen.

Heavy financial losses were sustained by mineral producers during the severe recessions of 1975 and 1981–82. Numerous mines and processing plants were closed, workers lost their jobs, and the economies of entire regions were undermined. Governments of countries substantially dependent on mineral production as a factor in their national economies suffered adverse effects as tax revenues and earnings of foreign currencies from mineral exports declined sharply.

The structure of the mineral industries was being transformed even before 1974. New countries had emerged as important centres of production, capturing market share from established producing nations. Control of mining enterprises had shifted. In many countries the host governments had formed public-sector companies to operate properties previously controlled by foreign investors. In other cases firms not previously in non-fuel mineral operation had acquired substantial mining companies. The incursion of major petroleum companies into the United States copper industry was a notable example of this trend.

With the altered status of the mineral industries since 1974 new managements faced baffling problems. For them and for governments of mining countries, the markets appeared to be not only unpredictable but at times irrational. Even the market system had undergone profound transformations with the collapse of the *laissez-faire* of the 1930s and the construction of the post-war economic

 SA ISSN 0038–223X/3.00 + 0.00. Address presented at the Annual General Meeting of the Institute held on 8 August 2002.

system which, in turn, underwent significant transformations in the 1970s. These transformations in the market system have all been intimately bound up with important changes in the political domain. Not surprisingly, therefore, it has become largely accepted by most scholars in political economy, whether domestic or international, that there is an intimate and reciprocal connection between control of significant resources, not least of which are minerals, in the market economy and the exercise of political power, even in democratic societies. There is however, considerable debate concerning the substance of this relationship.

Money, mining and metallurgy

Risk factors in mineral investments

Before minerals can be made available to meet consuming needs, substantial sums must be invested in opening mines, building processing facilities and providing the supporting infrastructure that assures adequate transportation, power, housing and other needed facilities. When considering a new mineral project investors face a myriad of uncertainties such as: What will be the future demand for the product? Will other firms also be starting new projects, raising the spectre of potential over-capacity? How competitive will the new venture's costs be? What is likely to happen to product prices? What risks are contained in the political or military environment?

There are no certain answers—only assumptions.

Nevertheless, there are characteristics of the minerals' industry which must be considered in making investment decisions.

Mining operations are subject to world pricing. The products of one producer are essentially fungible with the identical products of its competitors. Unlike manufactured products, questions of style and brand preference have little relevance in the marketing of minerals. Buyers are motivated primarily by price considerations.

Without doubt, mining has always been a capital-intensive business. In the past three decades capital costs of new mineral projects have soared spectacularly, far outstripping the rate of inflation. Inflation, which hitherto had been a stimulus for growth, beneficent alike to business and organized labour, now, at higher rates and with declining profit margins, became perceived by the minerals' industry as inhibiting investment.

Demand for minerals is volatile. During upturns in the business cycle it rises more steeply than the average of industrial activity. During downturns in the business cycle it falls more precipitously than the average in industrial activity.

By contrast, changes in supply are relatively sluggish. More managements prefer to operate their properties at maximum rates of output in order to achieve economies of scale. High capital costs and high overhead costs tend to be fixed. Hence the cost per unit of production is lowest when it is divided by the largest feasible volume of output. Thus, even though sales volume may slacken in periods of economic recession, managements are reluctant to change operating rates.

Hence, visible stocks of minerals rise significantly during business downturns and are sharply reduced when demand increases. These inventory fluctuations are the root cause of the unstable and unpredictable price behaviour of many minerals. Unstable prices, in turn, mean that the profits and losses of mining houses follow highly erratic patterns that contrast unfavourably with the financial outcomes of less cyclically vulnerable industries.

Traditionally, mining projects were financed either by drawing on retained earnings or by the sale of equity. Since the mid-sixties this has changed dramatically. Because of reduced earnings and soaring capital costs, mining companies have increasingly resorted to funded debt to finance expansion. In the mid-sixties and through the early seventies, banks and other lenders had access to abundant funds. They competed eagerly to finance mining and metallurgical projects. Following the energy crisis of 1974, the changed economic environment in the mineral markets caused them to scrutinize such projects more conservatively. As for equity investments, the new high tech industries looked more attractive to risk-taking entrepreneurs.

Both corporations and governments have relied increasingly on debt financing. Furthermore, debt has to an increasing extent become foreign debt. There was a time when it could be said that the extent of public debt did not matter because 'we owed it to ourselves'. However plausible the attitude may have been it no longer applies. Governments now have to care about their international credit ratings.

As the proportions of State revenue going into debt service rises, governments have become more effectively accountable to external bond markets than to their own populations. Their options in exchange rate policy, fiscal policy, and trade policy have become constrained by financial interests linked to the global economy. Mining corporations are no more autonomous than governments. In certain instances, the closing of plants and the cutting of thousands of jobs were hardly prompted by a particular malevolence. It was intended, by appearing as a token of the corporation's new plan to increase competitiveness, to forestall a down-grading of its bond rating, which could have increased the corporation's cost of borrowing. A large corporation, a flagship of the US economy, is shown to be a tributary to the financial manipulators of Wall Street. Finance has become decoupled from production, to become an independent power, an autocrat over the real economy.

Political risks for private investors considering mineral projects have increased. In several instances governments have insisted on re-negotiation of concession agreements after production has begun. In other cases, exchange controls have been imposed, limiting or prohibiting repatriation of profits to foreign investors. New discriminatory tax measures have been enacted by some countries. In some cases of expropriation, private investors have found they have limited scope for negotiating equitable arrangements with sovereign governments. Added to unfavourable market developments, these political uncertainties have acted to reduce the flow of private funds into many countries.

An increasing share of mineral production, particularly in developing countries, is now in the hands of State-controlled organizations. These have access to financial assistance from international lending institutions established to promote their industrial diversification. In some instances financing has

been obtained for projects that the private sector companies would not have considered viable.

Emergence of public sector companies

Sweeping changes have occurred in the control of mineral production since 1950. Then, private sector corporations were the dominant factor in the world's mineral industries. Private corporations representing United States, Britain, Belgium, Dutch, Canadian and South African capital not only owned mineral enterprises in the industrialized nations, but they also controlled much of the output of minerals in the developing countries of the Third World.

Today's industry structure is very different. Changes in control occurred both in the newly independent States that had been colonies of the industrialized nations and in developing countries that had been politically independent but whose industries had been dominated by foreign capital.

It is not hard to understand why the changes happened. Mineral resources are considered as part of the national heritage. Control of that heritage by foreigners is seen as depriving the State and its citizens of resources and profits to which they are rightfully entitled. In many instances politicians accused foreign companies that they had deliberately understated the value of exports and profits in order to transfer wealth abroad. It still happens today. To correct this, they proposed to seize control of the mineral industry.

In many cases mineral properties were nationalized—tin in Bolivia and Indonesia, bauxite deposits in Guyana, copper mines in the old Zaire and Chile. In other instances the governments negotiated for a share ownership (usually over 50%), sometimes paid cash and in other instances taking shares in lieu of royalties or taxes. In other countries—Brazil and Mexico are examples—legislation was adopted to encourage the sale of control by private sector foreign companies to private sector national companies.

On recent projects, in some instances joint venture arrangements are worked out between the host governments and private firms, whether national or foreign. These sometimes involved technical and operating management by the private sector investors, with broad policy direction and marketing responsibility exercised by government.

Several academics of the minerals industry have strongly advocated arrangements under which ownerships of mineral resources is held by the host government with foreign multi-national firms providing experienced management in exchange for liberal fees. At least two major industrialized mineral exporting countries—Canada and Australia—have also manifested nationalist tendencies. To reduce foreign control of domestic mineral deposits, they have required expatriate investors to seek out domestic partners. South Africa has followed suit in the form of Black Economic Empowerment especially in the dilution of local control by the handful of white hands. Tax incentives and export controls have been devised to foster local processing and beneficiation of minerals instead of exportation of raw materials.

During the sixties and the early seventies politicians claimed that they had invested for the indigenous population the share of mineral riches to which they were entitled. More recently a degree of disillusionment has set in among Third World governments. Like the oil companies, they have learned that markets for minerals are unpredictable. Revenues and profits derived from mineral activities since 1974 have fallen far short of expectations. Funds to finance new projects are not readily available to debt-ridden governments and many existing mines have run at substantial losses.

As a consequence many governments of developing nations are once again offering inducements to foreign private investors to bring in fresh capital for mineral projects.

A typical example is the Chilean copper industry. The government of Eduard Frei in the late sixties had negotiated with the US owners to acquire interests in the country's four largest copper mines. When the socialist regime of Salvador Allende took office in 1970 it expropriated these properties. Modest compensation was offered for one recently completed mine on the grounds that the foreign companies had already earned excessive profits. When the right-wing military junta under General Pinochet took over, a new corporation, Codelco, was formed to operate the mines for the government but compensation for all properties was negotiated with the former owners to reassure foreign investors of equitable treatment. The Pinochet government has adopted an investment code to induce the private sector to develop these properties and has issued assurances that their tenure will be secure.

In some other countries public sector firms have been unable to maintain the levels of production attained under private ownership. Bolivia, one of the first countries to expropriate mineral properties, took over its three largest tin mining operations in the early fifties. Production has declined precipitously since then. Huge financial losses have been sustained even though, for much of the time, tin prices have out-performed prices of other base metals. By contrast, the smaller mines in the country that remained in private hands have been more successful in maintaining production, despite the highly inflationary conditions under which they operated.

The Zambian copper industry has not been able to duplicate the achievements of the Chilean industry. A basic problem has been the shortage of technical experts. Many expatriate engineers have left the country and not enough Zambian nationals have been trained to replace them. The country's acute foreign exchange problems has meant that the government has been unwilling to earmark sufficient funds to purchase needed equipment or spare parts for the copper mines. Production has been gradually declining, new reserves have not been developed and recently the prospects for the Zambian copper industry have been considered gloomy by many.

In general, public sector corporations have not devoted much effort to exploration for new mineral deposits. One reason, of course, is that unfavourable mineral markets have left them short of cash. Because, of the acquired promising, but as yet undeveloped, deposits from former expatriate owners, their managements have had little incentive to try to find more reserves. In addition, they recognize that the capital cost of expanding production at an existing mine with good reserves is markedly less than the cost of launching new 'greenfields' projects with expensive requirements for infrastructure.

On the other hand, public sector firms have aggressively increased domestic capacity to process mineral raw materials. Mineral exporting countries have long deplored what they consider to be an inferior role as suppliers of unprocessed raw materials to the major consuming nations. By establishing domestic capacity to process ores and concentrates, they can increase employment and enhance foreign exchange earnings. Moreover, the existence of domestic metallurgical and chemical industries may encourage the development of downstream manufacturing facilities, thereby adding to national industrialization.

On the whole, it has not been difficult for developing countries to finance projects for processing capacity. In addition to international organizations such as the World Bank and the various regional development banks, most governments of industrialized countries have created national institutions to provide loans for projects that will increase their machinery exports and to obtain engineering and construction assignments for their contracting firms.

As a result, numerous projects have gone forward in the developing countries to provide aluminium plants, copper, lead, zinc, nickel, tin, platinum smelters, installations to convert chrome and manganese ores to ferro-manganese and chemical facilities to produce agricultural fertilizers from phosphate, potash, sulphur and other indigenous resources. Not least of which is the production of titanium oxide from ilmenite.

Lending institutions apparently regard processing facilities as less risky than new mining projects, which are considered speculative because of uncertainties about grades and tonnages of ore deposits and extreme oscillations of mineral prices. Yet, although some processing projects in developing countries have turned out well, in other cases the investments have not been viable, due to ore reserves being insufficient to provide assured feed for the plant or capital and operating costs being unsustainable.

For most developing countries, labour intensive projects will create more lasting benefits than capital intensive projects—as the countries of south-east Asia have clearly demonstrated in recent years. Their superior economic performances in comparison with the countries of Africa and Latin America are not unrelated to the priority they have given to development of labour intensive activities.

The structure of globalization

The State during the 1930s had to assume the role of agent of economic revival and defender of domestic welfare and employment against disturbances coming from the outside world. Corporatism, that is, the union of the State with productive forces at the national level became the model of economic regulation. The crises of the post-war order accelerated the shift from Fordism to post-Fordism—from economics of *scale* to economics of *flexibility*.

The large integrated plant employing large numbers of semi-skilled workers for the mass production of standardized goods became an obsolete model of organization. The new model was based on a core-periphery structure of production, with a relatively small core of relatively permanent employers handling finance, research and development, technological organization and innovation, and a periphery consisting of dependent components of the production process.

While the core is integrated with capital, the fragmented components of the periphery are much more loosely linked to the overall production process, spread among different geographical sites in many countries. Global production as manifested by corporations such as Anglo American, BHPBilliton, Tio Tinto, etc. are able to use territorial divisions of the international economy, playing off one territorial jurisdiction against another so as to maximize reductions in costs, savings in taxes, avoidance of anti-pollution regulations, control over labour and guarantees of political stability and favours. On the other hand, global finance has achieved a virtually unregulated and electronically connected twenty-four-hour-day network. The collective decision-making of global finance is centred in world cities rather than states—New York, Tokyo, London, Paris, Frankfurt—and extends by computer terminals to the rest of the world.

In many respects the institutional state is where the domestic political economy and the international political economy meet. As the international political economy impinges more and more on domestic interests, the State must attempt to reconcile the two. This has proven to be no easy task especially when the institutional State itself can be divided with different segments tied into competing parts of the domestic economy and society.

When events in the international political economy lead to the mobilization of domestic interests, the institutional state invariably finds its autonomy reduced and options that might otherwise have been open to it in dealing with domestic and international issues become foreclosed. Loss of autonomy can also arise as parts of the State become internationalized. The state is being converted into an agency for adjusting national economic practices and policies to the perceived exigencies of the global economy. The State becomes a transmission belt from the global to the national economy. Hence the central agencies of the State, such as the finance ministries, the central banks, the offices of the prime ministers and presidents have become increasingly linked to each other and to international institutions such as the IMF and, as a consequence, have been increasingly forced to adopt policies that reflect international as much as domestic imperatives. The agencies more closely identified with domestic clients—ministries of industry, labour, health, etc.—become subordinated.

States do more than mediate between the domestic and international political economies. They are, themselves, market actors and represent a kind of a national firm, or cartel, operating directly in the transnational environment. Therefore, states have a direct and indirect role to play in the global economy. They act as 'national firms', at the same time shaping the domestic market through laws and regulations and the international market through treaties and agreements. Thus, as the global economy has expanded over a few decades, the activities of the states have become increasingly complicated. The growth in the global economy, especially in the 1980s has created problems for the state as the global economy has become more complex and the transnational political and economic linkages have expanded, seemingly exponentially, the state tasks of monitoring and, where appropriate, attempting to control events and non-state actors have been in many cases made more difficult. The capacity of the institutional state, in terms of its resources, knowledgeable people, and legislative authority, has not always kept pace in both the international and domestic political economies. State actors are finding themselves scrambling to keep up with events.

Political risks and the private investor

As developing countries turn to foreign investors for the exploitation of their mineral resources, private sector managements necessarily weigh the risks of committing funds beyond those already invested abroad. The events of recent times clearly indicate the need for caution.

Not so long ago, many private sector companies strove to obtain 100% ownership of promising mineral deposits abroad, only to find in the long run that they were politically exploited and vulnerable to takeover. As a result, few executives today wish to go it alone on foreign projects. The preference is to form joint ventures with other private sector concerns, sometimes with participation on a minority basis by the host government.

Whether the host government is an equity participant or whether its stake in the venture is in the form of royalties and/or taxes, modern operators are always conscious of the intentions of government. Gone are the days when private management unilaterally decided on questions of operating rates, labour policies, new capital investment or marketing strategy. Governments expect a voice in all such decisions before they are made.

In recent joint ventures many of the larger undertakings have involved private sector companies from different countries. The rationale behind such arrangements is that the host governments are more likely to be cautious in dealing with investors from several different nations than in dealing with investors from a single nationality.

Similarly, in borrowing funds for new projects the effort is usually made to borrow from banks in several countries as well as from international institutions, as governments are uneasy about making moves that impair their credit ratings if several of the principal capital markets are involved.

Despite the existence of mining codes or other regulations defining a government's policy in dealing with foreign investments, investors undertaking major projects frequently find it wise to negotiate a bilateral agreement setting forth the conditions under which they are prepared to commit funds. Usually such agreements cover a stated period—typically the time required to pay off the original debt and recapture the equity investment. Thereafter, the project becomes subject to the general regulations governing mineral operations.

Because many developing countries levy high duties on machinery (not as a protectionist device but as a means of collecting revenue), frequently the bilateral agreement provides for the waiving of such duties which would otherwise add considerably to the capital cost of the programme. Another area that requires careful definition is the treatment of foreign exchange earned by the project after start-up of production. Private sector managements will seek assurance that they will have foreign currency needed to procure supplies, pay salaries to expatriates, and discharge debt obligations. Repatriation of funds for dividends is also a significant topic for inclusion.

However carefully drawn, such agreements may be, the investor can never forget that he is dealing with a sovereign government. During the period of negotiation, the host government is anxious to attract capital to its industry and is prepared to offer inducements to ensure completion of the investment. Once the project has emerged from the construction sphere into the actual operation, a suitable shift in the balance of power occurs. Now the investor is committed; the funds have been spent.

Not infrequently, the host government will request a re-negotiation of terms—sometimes on the grounds that the conditions have changed radically since the original agreement was made; for instance, a country achieving independence from foreign control and rule, or the overthrow of a corrupt government.

Because governments of developing countries have harboured deep suspicions that the commodity process is manipulated by the consumer countries, a frequent demand by such governments is that they control the marketing of exported minerals, even though produced by private sector companies. Controversy and disagreements seem, inevitably, to be involved at the interface between the government and the private sector—no matter how anxious both parties may be to maintain good relations. Several learned academic consultants have suggested a possible solution to the problems of producing minerals from deposits located in developing countries and this would be for ownership to rest with the host government but actual international mining firms would be paid a generous management fee.

However, in the few instances where such arrangements have been tried difficulties have arisen. If a generous fee is agreed by the host government this will inevitably attract strong criticism from opposition politicians who are prone to suggest corruption on the part of the government officials originally involved. Or if inflation drives up commodity prices and the fee is based on a percentage of production or sales, the officials who negotiated the agreement may later demand a drop in the rate of the fee.

Most commentators on international affairs have paid far too little attention to structural change, particularly to change in the structure of production in the world economy. Most of the changes in world politics, however unrelated they may seem on the surface, can be traced back in large part to certain common roots in the global political economy. We see a common driving process of structural change behind the liberation of Central Europe, the disintegration of the Soviet Union, the intractable payments deficit of the United States, the Japanese surpluses and the U-turns of many developing countries' governments from military or authoritarian government to democracy and from protection and import substitution towards open borders and export promotion. Most obvious of the structural changes acting as a driving force on mining and metallurgical firms and governments alike were those in technology of industrial production and related to them were changes in the international financial structure. The accelerating base of technology change has enhanced the capacity to supply the market with new and successful products and/or to make them with new materials or processes. At the same time product and process life-times have shortened, sometimes dramatically. Meanwhile, the costs to the firm of investment in research and development—and therefore, of innovation— have risen. The result is that all sorts of mining and metallurgical activities that were until recently comfortably ensconced in their home markets have been forced, whether they like it or not, to seek additional markets abroad to gain the profits necessary to amortize their investments in time to keep up with the competition when the next technological advance comes along.

It used to be thought that internationalism was the preserve of large, privately owned Western multinational or transnational corporations. Today, thanks to the imperatives of structural change, these have been joined by many small firms and also by state-owned enterprises based in developing countries. Thus, it is not the phenomenon of the transnational corporation that is new, but the changed balance between firms working only for a local or domestic market and those working for a global market, and in part producing in countries other than their original base.

Besides the accelerating rate of technological change, two other critical developments contributed to the rapid internationalization of production. One was the liberalization of international finance, beginning, perhaps, with the innovation of Eurocurrency dealing and lending in the 1960s and continuing unchecked with the measures of financial deregulation initiated by the United States in the mid-1970s and early 1980s. As barriers went down, the mobility of capital went up. The old difficulties of raising funds for investment in offshore operations and moving it across the exchanges vanished.

The third contributing factor to the internationalization of production and finance that has often been overlooked is the steady and cumulative lowering of real costs of transborder transport and communication. Without these reduced costs, central strategic planning of far-flung affiliates would have been riskier and difficult, and out-sourcing of components as in car manufacture would have been hampered.

Vision of the future

What lies ahead for the minerals industry? As constituted today it bears little resemblance to the industry projected in studies fifty years ago. These studies anticipated that dwindling supplies would be overtaken by a tidal wave of consumption. This view was shared by the 1972 report of the Club of Rome which anticipated that resources shortages would impose severe 'limits to growth' by the turn of the last century.

The very fact that shortages had been predicted triggered a massive and successful mineral exploration in the post-oil crisis of 1973. Major advances in exploration geo-sciences, better positioning for airborne geophysical surveys by orbiting satellites, and development of less costly methods of drilling, have reduced the high risk venture capital required for mineral exploration projects.

Because the rate of discovery has exceeded the rate at which consumption is currently expanding, growing backlog of identified deposits of many minerals has been established and is awaiting exploitation. Thus the decades of the fifties through the seventies saw the emergence of major new world producers of such minerals as copper, bauxite, lead and zinc which firms. Even beach sand has proved itself as a source of titanium oxide!

Investment climate for minerals

Many factors have contributed to the restricted number of new mineral projects initiated in recent years. These include:

- Uncertainities in the political sphere
- The erratic courses of prices at a time of inflationary cost increases
- The financial problems facing corporations and governments involved in mineral undertakings
- The high interest rates that add severe capital cost component in the calculation of cash flows; The widespread impression among investors that their most attractive opportunities lie in high technology and service industries rather than in a capital intensive business such as mining.

Each of these elements has played a role in the slow-down of capital expenditure on new mining projects.

But without doubt, the overriding factor weighing heavily on prospective investors in their perception of prospects for future world consumption of the minerals involved—be it aluminium, copper, platinum, phosphates or whatever. This is readily demonstrated by observing the readiness with which capital continues to flow into new gold mining ventures. Managements of these companies believe that gold will continue to command a ready market as a store of value. From time to time the market for base metals or non-metallics may witness temporary spurts of buying interest when demand includes quantities not needed for immediate consumption. Security considerations may induce governments to buy minerals for national stockpiles. Or speculators, anticipating price increases, may make purchasers in the hopes of realizing capital gains.

For investors considering long-term commitments to major new mineral projects, other than precious metal mines, the prospects for actual consumption of the specific mineral over an extended period must be a major pre-occupation.

In the changed economic atmosphere following the energy crisis caused by advancing oil prices of 1974, most previous estimates of future mineral consumption trends have been sharply reduced. Previous forecasts had largely been based on extrapolation of prevalent trends, such as sustained growth in aluminium consumption at a compound rate of 8 per cent. More recently, somewhat sophisticated methods have been adopted; one of them being a study centred on what economists call 'intensity of use'. Intensity of use increases rapidly as countries become industrialized, particularly in the phase of developing infrastructure. Once this basic infrastructure is in place, the theory of intensity of use is that per capita consumption of minerals may actually decline as an economy becomes increasingly bound to high technology and service industries.

Thus, many observers judged that prospects for future vigorous expansion in mineral consumption would rest largely on the extent to which developing nations emerged from the first stage of industrialization of these countries; expectations ran high. But in the years that followed, the distortions in world trade called for sober re-appraisals. Rising interest rates complicated all international financial transactions. As two severe recessions created extensive surplus plant capacity in the industrialized countries, incentives to create still more capacity in the developing countries was greatly diminished.

Market loss to new materials

Concepts of future mineral consumption trends have also been significantly affected recently by rapid technological developments in composite materials and ceramics. These are being evaluated as substitutes for metals in many of their traditional markets. To the extent that they succeed, they will require large amounts of some non-metallic minerals and petroleum-based feedstocks.

Substitution of these new materials is not, as had earlier

been predicted, due to soaring mineral prices resulting from exhaustion of low-cost reserves, but as a consequence of performance characteristics. Composite materials and ceramics are being considered in industrial applications for their weight savings, greater resilience to fatigue or corrosion resistance.

Competition between minerals is vigorous and manufacturers will continually evaluate the merits of rival materials before deciding which commodity combines the best performance characteristics with the greatest economy. The existence of their competition should dispel concerns previously held that monopoly or cartel control of raw material can be used unfairly to exploit the public interest for private profit.

How will minerals fare in this robust competitive atmosphere? Is their role in the world's economy facing a period of stagnation or eventual decline? Some believe that the markets for metals will shrink even in periods of general economic growth. The difficulties of forecasting long-term consumption patterns have been illustrated by the Paley Report experience of 1951 and the 1972 Club of Rome.

To many observers, however, it seems highly unlikely that the momentum for mineral consumption is about to come to a full stop. Undoubtedly there will be substantial erosion of some mineral markets. Yet the diversity of minerals' use is so great and the pressure of population growth so persistent that the probabilities favour continued, though slower, increases in quantities of non-fuel minerals required by world industry.

Stability in mineral prices

Despite efforts to achieve stability, mineral prices will continue to be highly volatile. However, the fluctuations will remain within the ranges that have prevailed since World War II for the major minerals, after adjusting for inflation.

To the extent that supplies continue to be relatively inflexible in the face of volatile cyclical demand, the problem of price-depressing, burdensome inventories will continue to plague minerals, producers—particularly producers of metals.

Demand and prices respond quickly to the economic environment. Unfortunately in the minerals, business, production and costs have difficulty in adjusting with sensitivity to changing economic circumstances. Mines are reluctant to curtail operations or close activities when demand dwindles and there are inevitable time lapses in increasing output when demand revives.

Given this outlook, managements of mineral enterprises must be prepared to face hard decisions at periods of marked imbalance between supply and demand or when costs are out of phase with prices. To those whose experience with the industry has been relatively brief, the complexities and seeming disparities of the minerals industry must come as a considerable shock.

Perhaps somehow, sometime, somewhere, a magical formula will be devised that will avoid excessive volatility in mineral prices while retaining a degree of responsiveness to radically changing circumstances. That would mark the period of peace and happiness for the minerals, industry.

The need to make choices

In the years ahead the mineral industries will have to accommodate themselves to the constantly shifting priorities of governments and the general public. The principal agreed goals appear to be:

- Peaceful relationships among nations
- Improvement in world living standards
- Protection of the environment
- Conservation of non-renewable resources
- Free and open trade.

These objectives appear highly desirable but measures taken to implement one may cause problems realizing another. Two examples come to mind.

To protect the environment, stringent rules have been adopted governing the operation of processing plants recycling lead scraps. Because many of these operations are in the hands of small, inadequately financed concerns that lack the capital to invest in pollution control devices, they have closed. Thus, environmental regulations would in effect defeat conservation objectives.

In the same way, free and open trade in minerals may cause the loss of mineral reserves by forcing some mines to close in a manner that will inhibit future recovery of their remaining reserves.

There is also the chance, that measures taken for environmental reasons may actually be proctectionist in both motivation and effect. Developing countries have suffered badly from disguised protectionism in the past; their fear that environmental regulations will be a Trojan horse containing new trade barriers is not surprising.

What concerns the managements of many mineral enterprises is that all too often governments decide on courses of actions to achieve one objective without sufficiently analysing the side effects their decisions may have on other objectives. Realities are seldom divided between black and white.

One certain forecast we can make about the future of the mineral industry is that it will continue to experience change.

Bibliography

BURAWOY, M. *The Politics of Production: Factory regimes under Capitalism and Socialism,* Verso, London. 1987.

CENTENARY ISSUE: *Jnl of The S.A. Inst. of Min. and Metall*. vol. 94, no. 3, Mar, 1994.

DAVIES R. H. Capital, *State and White Labour in South Africa 1900–1960,* An historical material analysis of class formation and class relations, The Harvester Press Limited, Brighton. 1979.

DEPARTMENT OF MINERALS AND ENERGY. South Africa's Mineral Industry 1996/97/98/99.

GOLD 100, vols. 1 and 3, Symposium Series S8. *The S.A. Inst. of Min. and Metall.* Eds. G. Gafner and R.P. King. 1986.

HEAVY MINERALS 1999. Symposium Series S23. *The S.A. Inst. of Min. and Metall.* Ed. R.G. Stimson. 1999.

LANG, J. *Power Base: Coal mining in the life of South Africa.* (Ed. J. Ball), Johannesburg, 1995.

PARK JNR, C.F. and FREEMAN, M.C. *Affluence in jeopardy. Minerals and political economy.* Freeman, Cooper and Company, California, 1970.

POLITICAL ECONOMY AND THE GLOBAL ORDER.(Eds. R. Stubbs and G.R.D. Underhill), MacMillan, London 1994.

STRAUSS, S.D. *Trouble in the third kingdom: The Minerals Industry in Transition, Mining Journal Books Ltd,* New York, 1986.

THE METALS AND MINERALS INDUSTRY IN SOUTH AFRICA, *The S.A. Inst. of Min. and Metall.* Ed. H.W. Glen, Johannesburg. 1989.

VERMAAK, C.F. *The Platinum Group Metals*. A Global Perspective, Mintek 1995.

6TH INTERNATIONAL SYMPOSIUM ON MINE MECHANIZATION AND AUTOMATION. Symposium Series S28, Sept. 2001, *The S.A. Inst. of Min. and Metall*. in association with Center for Mine Mechanization and Automation pp. 25–28. ◆

Wastewater biotechnology gets nod from Bioventures*

A home grown solution to treat wastewater is the latest investment to find favour with Bioventures Fund, South Africa's only biotechnology venture capital fund.

Gauteng-based Amandla Water has secured the exclusive rights to develop and market internationally a South African biological alternative to wastewater treatment and has attracted a R6-million investment from Bioventures. Bioventures' investment in Amandla Water follows hot on the heels of the announcement that the fund had committed R12-million to Shimoda Biotech which develops innovative drug delivery systems. The investment in Amandla Water will be split into two tranches of R3-million each.

Bioventures, which was launched a year ago, is an R80-million fund jointly managed by two of the country's most innovative investment groups—Gensec Bank and Real Africa Holdings. Manager of the fund Dr Heather Sherwin explained that Amandla provides wastewater solutions to local governments in the form of an environmentally friendly patented low cost water treatment system called PETRO,

'PETRO, an acronym for Pond Enhanced TReatment and Operation, is a pond-based biological wastewater treatment system. The appeal of this technology is that it has a low capital cost and low operating costs when compared to other solutions. It produces final effluent that comfortably meets the new proposed standards for wastewater and sludge treatment in South Africa, which are among the moste stringent in the world. The attractiveness of the PETRO system is that it combines the best of two worlds. It is a low tech system which delivers a high tech performance'.

Charles Polson, the director of operations at Amandla Water said that through its appropriate technology choice Amandla is improving the quality of life for communities and is having a positive effect on human health.

He added: 'The system is suitable for phased development and retrofitting, is odour-free and is both environmentally and aesthetically friendly'.

The technology was co-patented in 1992 by the Water Research Commission (WRC) and Pieter Meiring of the firm of consulting engineers, Meiring Turner and Hoffmann. Mr Meiring has over 40 years' experience in the South African waste water industry and has consulted all over the world. The WRC sponsored the research and development for the process that was undertaken by Pieter Meiring and Dr Oleg Shipin.

Currently 17 PETRO systems are operated commercially worldwide with most plants in South Africa. The world's largest pond system (190 megalitres/day) in Melbourne, Australia was upgraded to the PETRO technology and will eventually treat wastewater for 1,6 million people.

According to Dr Sherwin Bioventures has chosen to invest in Amandla Water, not only because of its excellent technology, but also because Amandla's management team combines strong business and marketing experience with technical skills.

'We are particularly excited by this project as it is our first investment which aims to commercialize technology developed within one of the goverment-funded science agencies. We believe there is tremendous potential within the universities and other research organizations that have world class technology just waiting to be commercialized. Historically, the stumbling blocks to the commercialization of this technology were finding the right management team and giving that management team access to capital.

'A rewarding aspect of Bioventures is our ability to provide access to capital to those with commercial technology and to assist in developing their management teams.'

Mr Polson added: 'We are very happy to announce our partnership with Bioventures. We believe that the Bioventures team adds more than just capital in the sense that we now have access to thier extensive networks within the local and international biotechnology community. Our aim is to build a world-class water treatment company using various bio-remediation technologies and with Bioventures as our partner we feel we can achieve this'.

Bioventures fact sheet

Bioventures is the first niche biotechnology venture capital fund in South Africa. The fund has R80-million of committed capital. Investors are:

- Gensec Bank
- Genbel Securities Limited
- Real Africa Holdings (RAH)
- Industrial Development Council (IDC)
- International Finance Corporation (IFC).

The fund is managed as a joint venture between Gensec Bank and RAH.

Investment focus and philosophy:

Bioventures will invest broadly in the biotechnology and life sciences area. It will not focus on any specific area within these industries.

Bioventures will look for early stage start up biotech companies that have:

- A clearly defined market opportunity
- A proprietary, or exclusive access to, a proprietary technology or organism
- A preference will be given to a multi-product rather than a single product focus
- Scalability of the product/ technology for the export market
- An energetic management team with the skills to successfully grow the business.

Bioventures will take an equity stake in the company of between 10% and 75% depending on the circumstsances. In all instances Bioventures will be represented on the board of investee companies. Bioventures can invest between R1-million and R12-million in any one company.

The biotechnology industry

No simple description of the biotechnology exists. Bioventures uses the Deloitte & Touche definition of biotechnology: 'The application of science and engineering in the direct use of living organism, or part or products of living organisms, in their natural or modified forms for commercial purposes'.

Based on this Bioventures has divided the biotech sector into six divisions:

- *Genomics*—including drug discovery based on genomic information, bioinformatics, toolmakers and service providers to the genomics industry
- *Pharmaceuticals and fine chemicals*—based on the use of natural plant, animal, fungal or microbiological products
- *Healthcare technologies*—including vaccine development, medical devices, diagnostics (particularly genetic disorder diagnostics) thate are innovative in terms of their technologies
- *Agriculture, floriculture and mariculture*—where innovative technology is used to improve current agricultural practices. Individual farming activities will NOT be invested in
- *Nutraceuticals*—production of enhanced, beneficial foodstuffs often using natural plant products
- *Biomaterials and bioprocessing*—including industrial biotechnology for the production of proteins, waste biomediation, development of bio-fuels amongst others.

Bioventures is interested in investing in all these divisions if suitable companies are found ◆

---

* *Issued by: Penelope Gracie Investor Relations, on behalf of Gensec Bank Limited, Tel: +27 (11) 447-3301, Mobile 083-55-77-444*