America and Australia. The general profile is approximately the reverse of the governments' position as shown in Figure 5.2.

Figure 5.4 Investors' NPV per change in gold price (or gold grade)

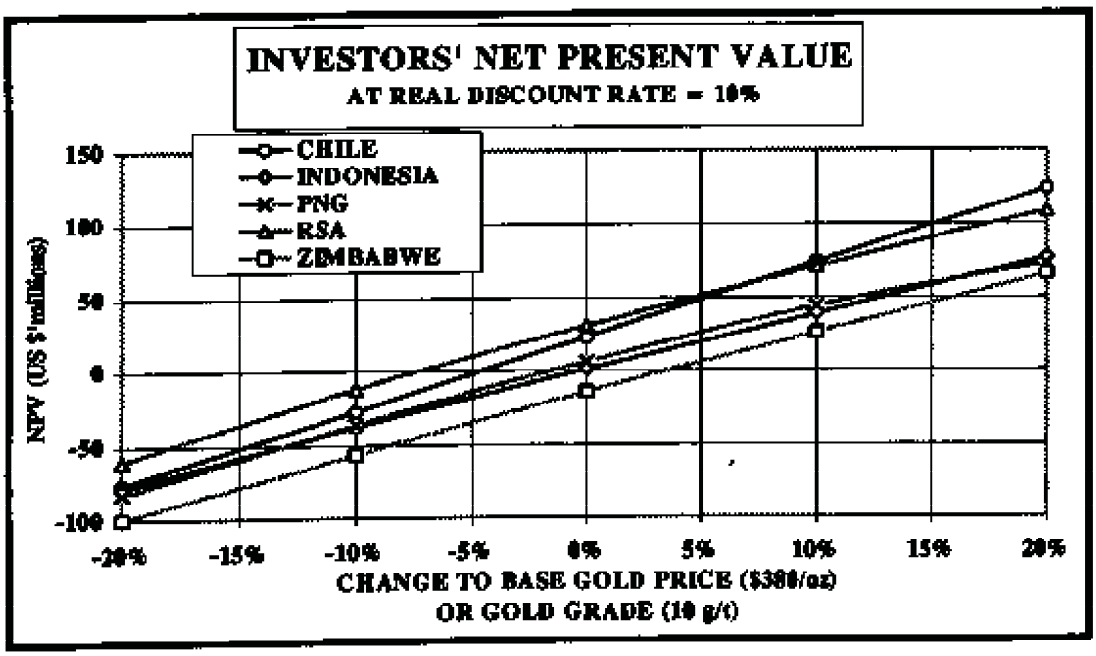


Figure 5.4 illustrates the concept mentioned previously which is the level of gold price (or gold grade) required by an investor to achieve the same NPV, at a 10 per cent real discount rate, in each country. For example, if the investor were to achieve a NPV of US$50 million in PNG the gold grade of the deposit would have to be approximately 10 - 15 per cent higher than in South Africa or Chile. The next series of investment decisions would have to focus on whether the geological setting in PNG provides the potential for such

projects, and then the relative degree of political and administrative risk would have to be considered.

By the same token the positions of the investor in Chile and South Africa, under the 'test' project parameters considered, are quite close. If consideration were to be extended to geological setting, an investor might start penalizing South Africa because the Witwatersrand gold basin has been explored and producing for over 100 years. Because of criteria such as ever-increasing depths of mining, the attendant capital required, the lead times to first production and the recent labour demands, investors might view Chile as a far better prospect than South Africa on a risk and return basis. Factoring in these 'costs' to the test project the investors' NPV curve for South Africa would be pushed much lower than that shown in Figure 5.4. Other observations from Figure 5.4:

* The impact of PNG's additional profits tax on the foreign investor is demonstrated at the higher gold prices (or grades) where the gradient of the curve diminishes relative to the other countries'.

* A similar effect is shown for South Africa where the gradient of the curve is less than the other countries (except PNG). This is due to the higher formula based tax 'take' per change in gold price (or grade).

* Chile appears to offer the investor the most benefit in NPV terms at the higher levels of profitability. The investor would be better off, however, in South Africa with the less profitable projects, all other things being equal.

The above examples demonstrate the broad application of the simulation model to international mining investment decisions.

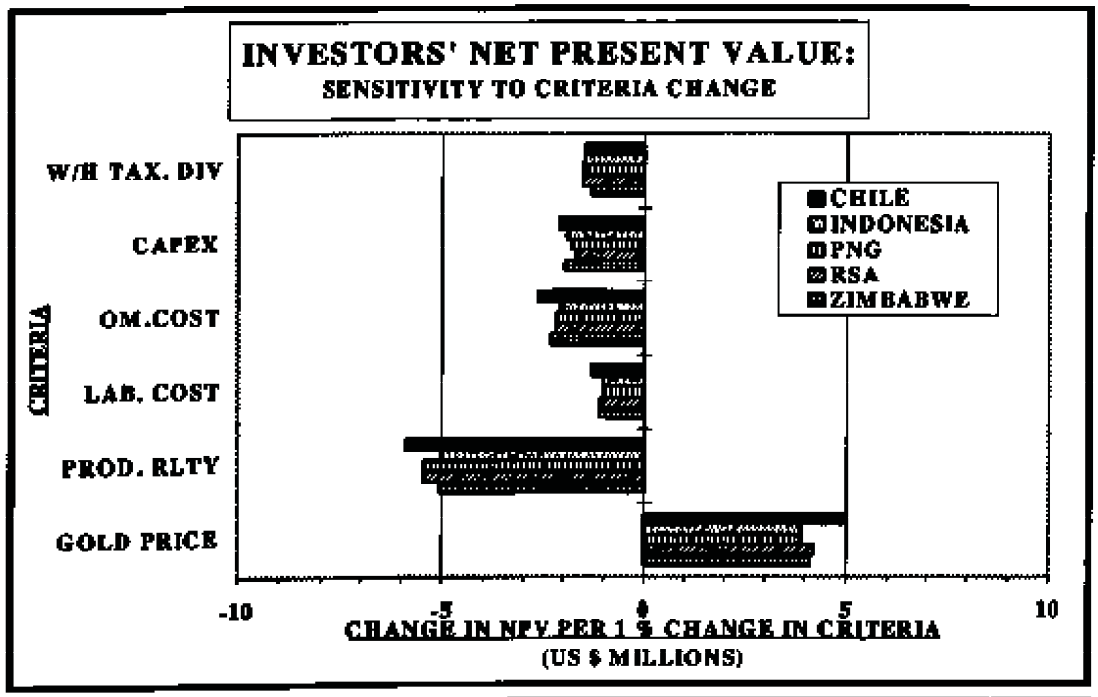
The same series of sensitivity analyses as those for the host governments have been carried out for the investors, as shown in Figure 5.5. Most of the observations applicable to the host governments' positions are relevant but a few specific issues are noted:

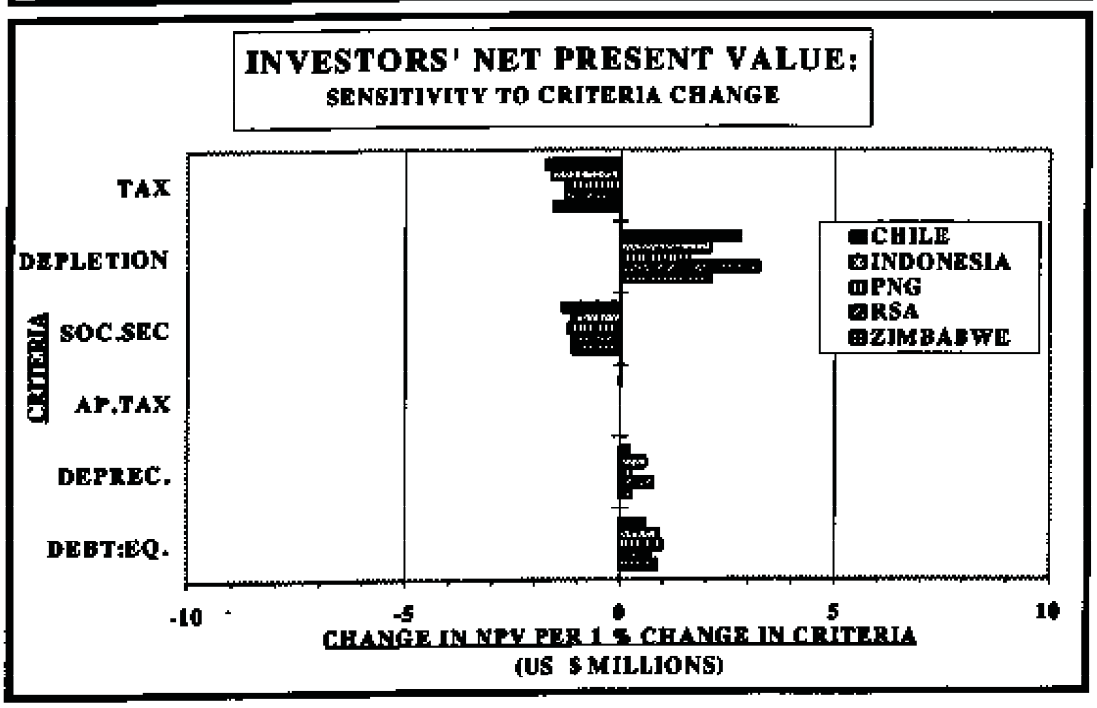
* The revenue-based royalties have the greater impact on investors' NPV than any other criteria analyzed. Of the five countries compared in this study, Indonesia and PNG apply this type of tax. It is not surprising that investors are very critical of this fiscal instrument (see section 3.4.1).

* The depletion allowance (essentially a percentage of revenue deducted from taxable income) can have a significant positive impact on investors' earnings, particularly if it were to be applied in South

Africa. The reason for this is that the tax rate is higher in S.A. than the other countries.

Figure 5.5 **Change in investors' NPV per change in selected criteria**





* The with-holding tax can have a significant impact on investors' earnings, approximating 50 per cent of the impact that would result from a change in the gold price (or gold grade). As mentioned previously, however, South Africa has recently removed this form of tax (15 per cent NRST) on non-resident investors' remittances and, on the basis of Figure 5.5, this has saved some US$30 million for the investor over the life of the 'test' project.

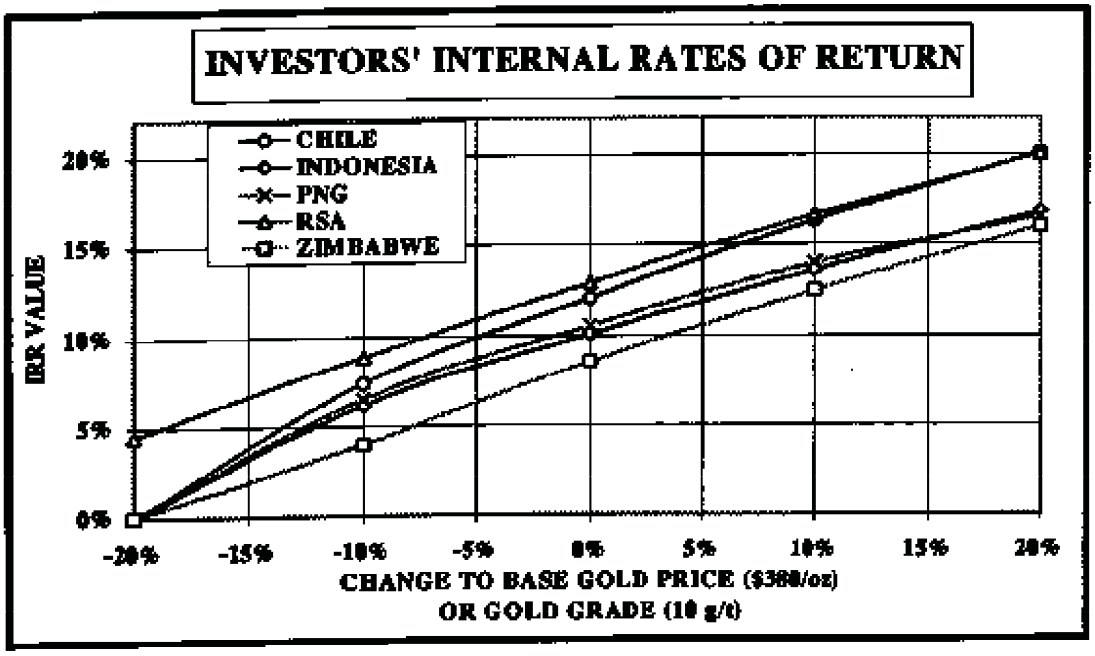
These are a few interpretations that can be made from the simulation framework. Another, which has been mentioned previously, is the equivalence approach where the impact of each criterion can be measured in terms of the impact of other criteria, such as gold price, ore grade or even tax rate.

5.2.3 Investors' internal rates of return (IRR)

The analyses thus far have focused on the relative accruals to the host government and investor, as measured by the PV and NPV respectively over the life of the project. Another common measure used in mining investment analysis is the internal rate of return (IRR), particularly as applied to the investor who has injected the initial risk capital. Figure 5.6 compares the IRR values for an investor in each country over a range of gold prices (or gold ore grades).

The curves show similar relative positions to those depicted in Figure 5.4, which should be the expected, but there are some adjustments because of time value of money effects. For example, South Africa offers better returns than Chile over the whole range analyzed which

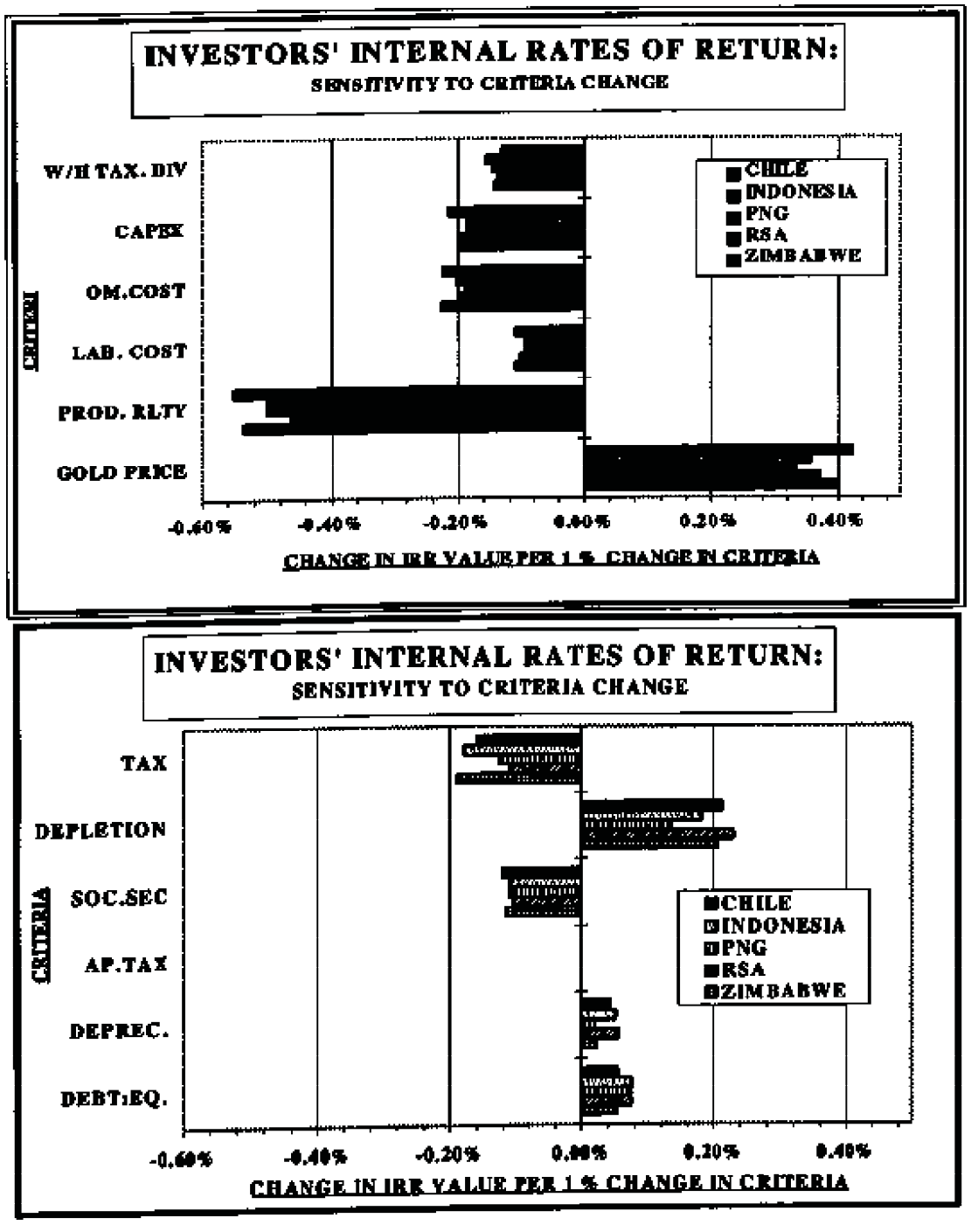
Figure 5.6 Investors' IRR per change in gold price (or gold grade)



was not the case in Figure 5.4. This can be explained by the project's tax liability starting later in South Africa than the other countries (refer also to Appendix J - the equity earnings profile). The reasons for this are the 100 per cent capital write-off against taxable income in the year of expenditure and, while unredeemed capital expenditure is carried forward for a new mine, the 12 per cent capital allowance can be applied.

As with the previous formats, the impact of selected criteria on the IRR has been shown in Figure 5.7.

Figure 5.7 **Change in investors' IRR per change in selected criteria**



The sensitivity profiles of the selected criteria on the IRR are similar to those shown in Figure 5.5 for the investors' NPV sensitivities. The same principles for interpretation as discussed previously would apply, for example, the equivalence of the impact on the IRR of one criterion in terms of the impact of another.

Of particular relevance to the IRR analysis, however, was the magnitude of mining investment returns expected by the executives in the survey. To achieve returns of some 30 per cent in Zimbabwe, for example, the 'test' project (base IRR: 9 per cent as per Figure 5.6) would have to achieve a recovery grade some 50 per cent higher, or 15 g/t (as equated to the gold price sensitivities). This is not impossible but the scale of the project (12 tonnes gold per annum) may be difficult to achieve, considering Zimbabwe's greenstone geological setting. Other criteria such as lower labour costs would reduce the minimum investment grade required, however. For example, a 50 per cent improvement in productivity would add approximately 5 per cent to the IRR value, thereby reducing the minimum gold grade by some 12-15 per cent.

For the executives in the survey to consider a mining investment in Indonesia, on the other hand, the expected returns would be of the order of 20 per cent per annum (10 per cent higher than the test project IRR). The test project would have to achieve a recovery

grade some 30 per cent higher than the base 10 g/t, or 13 g/t. This could be lowered, however, if the lead times to first production were shorter than the base 3-4 year period assumed and the capital outlay reduced. The copper-gold deposits in Indonesia (Irian Jaya) do have the potential to achieve a larger scale than the 'test' project and do not have the depth risks of the Wits gold deposits.

An example would be Freeport McMoran's Ertsberg-Grasberg project which is planning to expand annual metal production to 500 000 tonnes copper and 1.5 million ounces (46.7 tonnes) gold by 1996 (Mining Magazine, 1994a: 113). To achieve this, mill throughput is to be increased from 66 000 to 115 000 tonnes per day at a total capital cost of US$685 million. Assuming a pro rata relationship to milled tonnage this equates to an incremental increase of approximately 200 000 tonnes copper and 600 000 ounces gold. These additional copper tonnes would produce revenues of US$600 million at a copper price of US$3000 per tonne, equivalent to 1.58 million ounces gold at a price of US$380 per ounce. So, for <u>three times</u> the capital assumed for the 'test' project, Grasberg is expanding production by 2.2 million ounces (equivalent) gold, or <u>six times</u> the 'test' project's gold production (386 000 ounces). The returns on this expansion should be well in excess of the 10 per cent real returns estimated for the 'test' project.

These examples demonstrate some of the philosophy behind the current trends in international mining investment. The executives in the survey all agreed that the returns required to attract investment into some regions in the 1990's were lower than those envisaged for the 1980's. By analogy the ore grade of a deposit need not be as high as was required in the 1980's. The probability of finding suitable projects must therefore be enhanced. Furthermore, the 'costs' of any combination of other criteria (government inefficiency, tax rates and other disincentives) may have reduced, which would be equivalent to lowering the investment cut-off grade. In other words, the risk premiums have been lowered and the flow of capital from the industrialized world to the developing countries can be motivated more convincingly.

5.2.4 Investors' payback period (PBP)

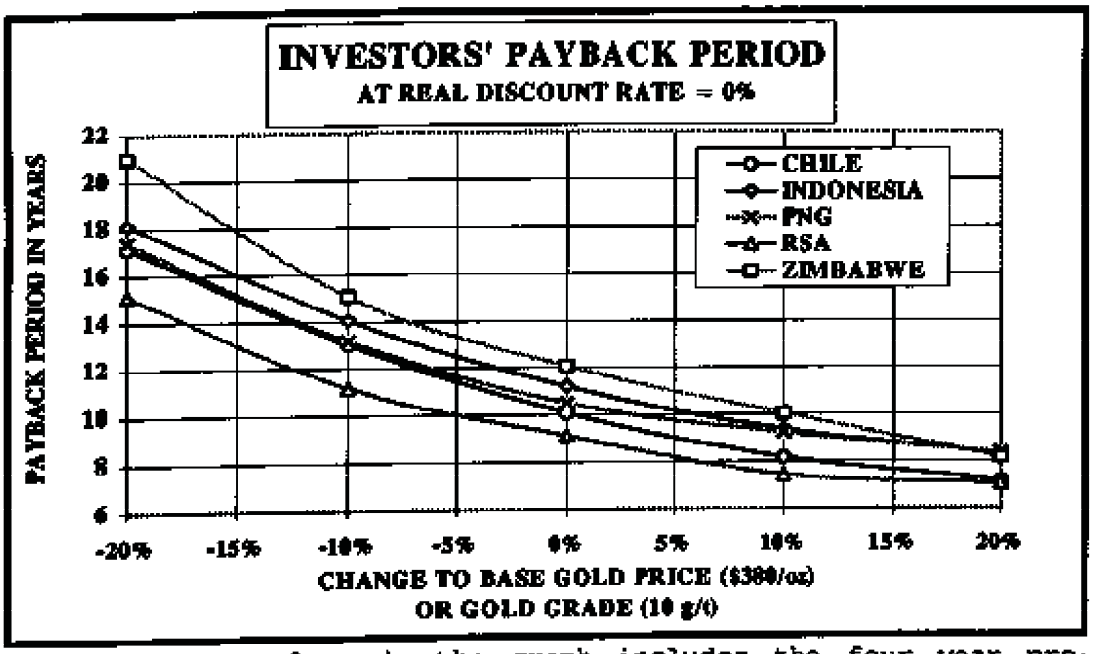
Executives in the survey placed considerable importance on the time period to recoup their initial capital outlay, or the so-called payback period. This measure has been applied to the 'test' project results and Figure 5.8 displays the PBP (assuming a zero real discount rate on earnings) in each country for a range of gold prices (or gold grades).

It is emphasized that the pre-production period of approximately 4 years has been included in Figure 5.8 because it was felt that the risk period should

commence when the first tranche of capital had been committed to the project. The executive survey results, however, reflected the period commencing when self-financing was achieved. Therefore to compare the executive survey with this analysis, the initial period of 4 years should be deducted from the figures shown in Figure 5.8.

Attention is drawn to the investors' position in South Africa where the shortest PBP of 5 years (9 less 4 years pre-production period) would be achieved, assuming the base scenario conditions. The longest PBP

Figure 5.8 **Investors' PBP per change in gold price (or gold grade)**



NOTE: The PBP values in the graph includes the four year pre-production period assumed in the 'test' project.

would be found in Indonesia and Zimbabwe, i.e. 7-8 years (11-12 less 4 years). The principal reason for this, as mentioned in the discussion on IRR comparisons, is the more generous capital write-off tax regime in South Africa; this delays tax payments and enhances earnings for the investor. Another factor adding to the PBP in Indonesia is the production royalty levied.

The PBP analysis would comprise only a step in the decision making process. An investor would have to assess the probability of achieving the parameters of the 'test' project in each country. Expanding on a previous example, there would be a slim chance of discovering a stand-alone, Wits gold mine with a lead time to first production of under 4 years, together with a 50 per cent profit margin (refer back to Figure 2.3 in section 2.5). Furthermore it would be unlikely that the self-financing stage could be reached for capital costs less than US$300 million (R1100 million). The FM (1993: 25) discusses these harsh realities in the context of new business opportunities for the S.A. mining houses.

A practical example would be Anglo American's new Moab project (Eastvaal, 1993), contiguous with Vaal Reefs' south lease area. Development costs have been estimated at some R1977 million (in escalated money terms or approximately R1800 million in 1995 money terms). This amount would approximate US$500 million in 1995 money

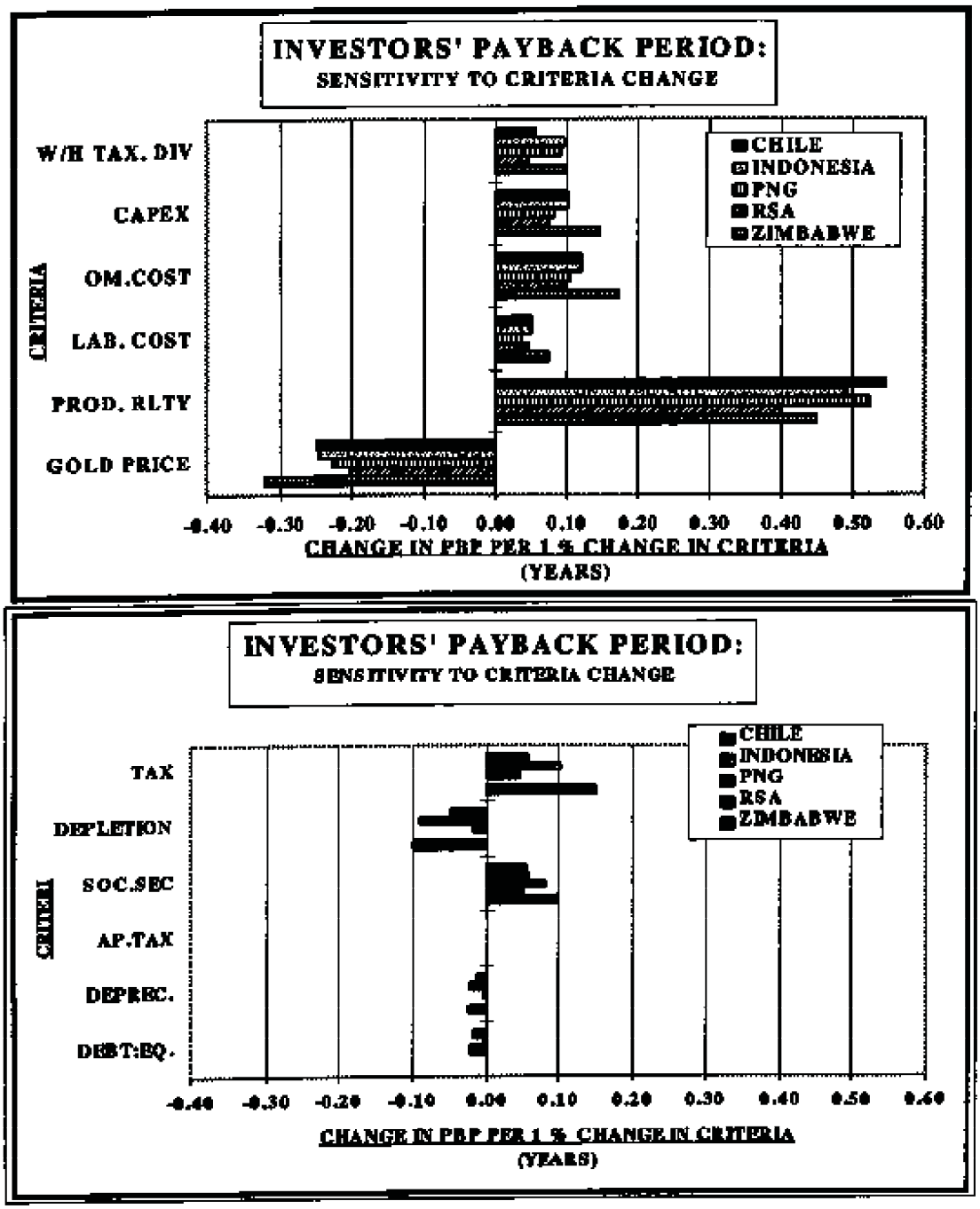
terms and has been planned to be spent over the period 1992 to the self financing stage in 2000. Moab is expected to produce 12-13 tonnes gold per annum from 1,14 million tonnes of ore milled, to be extracted from depths ranging between 2200 - 3700 metres below surface.

Fortuitously, costs of production are forecast to be in the region of US$190 per ounce gold produced, equating to a profit margin of 50 per cent at a long term gold price of US$380 per ounce. However, as a stand alone project competitive returns of 10 per cent or more would be impossible to achieve because the capital cost alone would be around twice that assumed for the 'test' project which was some US$270 million to self-financing.

Nevertheless the Moab project has been allowed to proceed. The reasons for this are firstly, Vaal Reefs facilities have been used for underground pre-development, thereby shortening the lead time to production and secondly, Moab's capital expenditure can be written-off against Vaal Reefs' taxable income - the so-called tax shield. This allowance reduces the capital funding that investors would have to inject to approximately R750 million (escalated) or approximately US$210 million. These positive factors would move the project back into more competitive terms vis-à-vis the 'test' project.

Similar to previous analyses, Figure 5.9 displays the sensitivity of the investors' payback period to selected criteria in each country.

Figure 5.9 **Change in investors' PBP per change in selected criteria**



Note that the results should be read in relative terms because the sensitivities over a range of criteria are not linear, as shown in Figure 5.8.

Other than similar applications and interpretations to those discussed previously, two effects specific to the PBP sensitivity analyses are noted:

* There is no impact on the PBP in any country by levying an additional profits tax (note that PNG already has this tax). The reason is that the tax would become payable later on in the life of the project, or only when the stipulated 12 per cent premium (to U.S. prime) return has been achieved.

* The investors' PBP in South Africa has not been affected by varying the 'non-cash criteria such as depreciation and depletion. As tax only becomes payable later than the other countries, due to the 100 per cent capital write-off and 'new mine' allowance, the initial capital is paid back before these criteria impact on PBP.

6.0 SUMMARY AND CONCLUSIONS

There were four phases to researching the criteria which have been influencing trends in international mining investment:

* keeping abreast of current events in the global mining industry;

* carrying out a survey (by personal interview) of the opinions of selected senior mining finance executives in the USA and South Africa;

* comparing the mining investment codes of five countries; namely, Chile, Indonesia, Papua New Guinea, South Africa and Zimbabwe; and

* developing a simulation framework to evaluate the impact of various criteria on mining investment performance, with particular reference to the five countries' mining investment codes.

In the light of the expansive and ever-changing nature of the investment environment there had to be limits set as to the level of detail many issues were researched. Although a broader approach had to be adopted most issues were placed into perspective and some very clear messages were presented:

6.1 Executive Survey

6.1.1 Global events and situations

The most significant event impacting on the global political and economic landscape over the past 5 - 10 years has been the demise of the former USSR. This heralded the collapse of support for sympathetic ideologies around the world. Accordingly, many countries have had to adjust to the new status quo by creating more 'friendly' political, economic and legislative structures.

Not surprisingly the trend has been particularly prevalent throughout the developing or 'emerging' nations where much attention has been placed on attracting investment capital, primarily from the wealthier, industrialized countries. In essence, the emerging nations have had to introduce laws and incentives to alter the risk and return balance for international investors. A manifestation of these efforts has been the trend towards privatization of state-owned assets and a more committed acknowledgement of free-market principles.

6.1.2 Important criteria for mining investment

In the context of the above mega-trends, it was established that there were numerous criteria which

investors and financiers give priority when making investment decisions.

Without doubt the stability and transparency of political, legislative and administrative structures were the most important issues. Underlying factors cited as being particularly important were security of tenure, the ability to repatriate capital and income, the overall level of taxation and other duties. It would be impossible to instil confidence in the latter criteria without stable structures to support their implementation and management.

Interestingly, participants in the executive survey and another survey did not see criteria such as climate, availability of skills and infrastructure as major deterrents. These criteria did not seem to instil as great a sense of wariness as did the socio-political structures.

The more technical criteria such as ore deposit grade and size, operating costs and development capital expenditure to self-financing were not explicitly surveyed. These factors were considered obvious and a pre-requisite to the successful development of a mining project. Nevertheless, their importance was kept in perspective and within the context of the objectives of the research effort.

An appropriate analogy for the two groups of criteria would be the 'horse (political and legislative structure) and carriage (technical criteria)'. It would be difficult to move forward competitively if one or the other was unserviceable. On balance, however, political stability appeared to be the most important component; after all the horse can move forward without the carriage but the carriage cannot move anywhere if the horse is lame!

The importance of these socio-political structures can be demonstrated by citing examples of several large known mineral deposits which have yet to be developed in hitherto unstable countries, for example, Zaire, Angola and the former USSR.

6.1.3 Mining investment trends

In the context of the mining industry the most noticeable manifestation of these underlying trends has been an increasing flow of exploration dollars into Latin America, particularly by North American firms. The attraction to the developing regions has been enhanced by modifications to their investment codes and by the more hostile climate for mining in the industrialized world, e.g. stringent environmental laws and permitting procedures. The degree to which the developing regions have been under-explored relative to their developed counterparts has also been a factor.

As of 1993-1994 the mining investors' regional order of interest appeared to be Latin America, the Pacific Rim, then Africa. There may well have been an element of bias because the North Americans naturally might view the regions closer to them in a more positive light; familiarity was found to play an important role. Although mining development activity in Africa was virtually non-existent until about five years ago, momentum has been gathering pace more recently as countries (and governments) across the continent have been joining the world competition for investment capital. Although regional comparisons have been made, they should be taken in context; specific countries within Africa may be more attractive than some countries in Latin America. Ghana and its surging gold mining industry would be a case in point.

The former USSR and China have also been attracting renewed attention because of their vast geographic extent and potential for mineral development. Nevertheless, investors appear to be somewhat cautious, pending the transition to sustainable political and economic structures.

6.1.4 Rates of return (IRR) and payback periods

The (internal) rates of return and payback periods required by mining investors varied considerably between countries. The real returns required in the riskier regions, such as Africa and the CIS, were of

the order of 30-40 per cent with payback periods of 1-2 years. In the developed or less risky areas, such as North America and Australia, the equivalent figures were 10-15 per cent and 5-7 years respectively. There appeared to be some broad agreement with other published commentary on the issue, however. Notwithstanding the enhanced returns from new financing structures the higher these expected returns the less chance of mineral development. The logical conclusion would be that the regions are made less risky !

6.1.5 General observations

Several corollaries were drawn from the executive survey:

* The "winds of change" have opened up countries and regions to skills, technologies and financing structures which previously were restricted to the Western or free-market economies. Assuming success by mining firms in the discovery and development of new mineral occurrences, a very different global production "landscape" could be in prospect within 20 years or so. The impact on commodity markets and prices might be significant because of implied changes to cost and risk profiles, let alone the emergence of a new global cost curve for various mineral industries.

* The involvement of the multi-lateral funding agencies, such as the World Bank, IFC and MIGA, has been cited as one of the principal means of stabilizing the operating environment in developing countries. Their participation tends to offer private investment capital (and management) some protection against ad hoc policy changes and nationalization of assets by host(ile) governments. One executive observed that it was the colonial powers previously that maintained the enabling environment for risky, long term businesses such as mining. In the 1990's it appears to be the co-ordinated effort of the industrialized nations through the multi-lateral agencies that has taken over this role.

* The environmental protection issue continues to play an important role in the mining development process. Nevertheless, it was concluded that, over time, standards are likely to be applied uniformly on a global basis. It is likely to be extremely difficult for mining developers to raise funds from institutional sources unless international environmental impact standards have been met.

* Perceptions of the risks and returns attached to a mining investment seem to differ quite markedly depending on the executive's or company's familiar operating base. The relevant examples here would be the U.S. based firms' affinity towards Latin America compared with South African (or even European) firms'

more positive view of the African arena. An extension to this would be that managing geographic diversification of mining businesses will be an important issue on the agenda of many corporations. For example, some of the decisions revolve around whether to joint venture with local partners, or transfer in-house expertise to unfamiliar operating environments, or a combination of the two.

6.2 Simulation of Mining Investment Environments

Following the findings from the executive survey, and other published surveys, it was decided to review the actual constituents of various countries' mining investment codes. There was also the question of the relative impact of various criteria on the investment performance of a mining project.

To provide a realistic base for the review, five countries were selected as reference cases; Chile, Indonesia, Papua New Guinea, South Africa and Zimbabwe. It was clear that the codes included, or alluded to, many of the criteria mentioned in the surveys. Although there were differences in detail between countries, there were broadly similar headings; company structure (subsidiary or branch office), level of foreign ownership, debt:equity limitations, repatriation of capital and earnings, social security responsibilities and fiscal regime.

Considering that many of the criteria were quantifiable, a calculating framework was developed to simulate the cash flow performance of a 'test' gold mining project in the different countries. The framework also provided the means to think through several mineral economic and philosophical principles.

It was important to acknowledge, however, that the simulation framework would only reflect the criteria which had been explicitly quantified. For example, if there were extreme climatic conditions, or low labour productivity, then these would have to be factored into the framework, with the result that a very different set of conclusions could be drawn. However, by starting from a structured calculating base it was easier add on the 'building blocks' and to place the more qualitative criteria into perspective.

6.2.1 Distribution of project value

At various stages during the life of a mining project, debate and negotiation take place as to the distribution of the expected monetary benefits. One of the most striking features of the simulation results was the amount of (foreign) capital invested and the net earnings or returns relative to the amounts accruing to the host country (and government).

As a proportion of the total revenues generated (100 per cent) an average 14 per cent accrued to the host government and 13 per cent to investors (both equity and loans) net of initial capital injected. Most of the remainder went to employees, 25 per cent (before personal taxes deducted), and provision of goods and services, 45 per cent. A total of over 80 per cent would accrue to the country. These figures have been classified rather broadly because some investors may be local (as opposed to foreign) and some goods and services would be imported. If one assumes 50 per cent of goods and services were imported then some 60 per cent of the total revenues generated would still accrue to the country.

The point that needs to be made is that a relatively small change in the benefits accruing to the country (or government) may have a far greater impact on the investors' returns, thereby enhancing the chances of attracting development funds. The basic choices are for the country to give away a little to gain much and for the investor to gain much from a little. It need not only be the result of a tax reduction for example, it may be an improvement in the efficiency of government administration so that overall costs are reduced.

The key to success seems to be a clear demonstration to all participants as to the distribution of the benefits accruing from mineral development. By the same token it also needs to be demonstrated the disadvantages

attached to lack of development. Bearing in mind the poverty in many parts of the world, the age-old conflict between the host country and the providers of capital (and skills) is inappropriate and cannot be afforded.

6.2.2 The impact of various criteria

Although several participants were identified, usually the host government and the investors have to agree on whether a mining project is developed or not. Extending the distribution analysis, the monetary benefits accruing to these two parties were simulated over a range of changes to various criteria, i.e. sensitivity analyses.

Bearing in mind the level to which criteria could be quantified in the simulation, the net accruals to each of the two participants was different in each country (as detailed in section 5.0). Although the differences were certainly noticeable in cash flow terms, and provide a base for analysis, it was debatable that the extent of the differences warranted an investment decision being made solely on those quantifiable elements. It would be a matter of judgement as to the relative magnitude or impact of other criteria, such as prohibitive environmental laws, infrastructure deficiencies and inefficient administration. The impact of these factors could push an investment decision away from a particular project in a certain country to

another, although the quantifiable elements would indicate otherwise.

There were several other issues highlighted in the simulation results and sensitivity analyses:

* Comparing some criteria without due consideration of the time dimension can lead to incorrect interpretations about their relative impact. An example of this was the case of South Africa where, for a new mining project, tax becomes payable later than the other four countries, all other things being equal. This was due to the 100 per cent write-off of capital expenditure to taxable income and the additional capital allowances on the unredeemed balances carried forward. However, when tax became payable the tax rate was higher over most ranges of profitability in South Africa than in the other four countries. Participants need to be cautious about the trade-off in instances such as this.

* It has been commented previously that the cash flow benefits accruing to the host government and investors would be different in each country. Hypothetically, for the participants to receive the same investment value in each country, some criterion would have to be adjusted from the current base situation, e.g. a tax rate, an incentive allowance or even labour productivity. Most importantly, this could also be achieved if the grade of the mineral

deposit were different, as much as 10-15 per cent in the countries tested. This concept can have major ramifications for exploration strategies because the probability of the geological terrain hosting a certain 'class' or size of mineral deposit has to be assessed.

* Sensitivity analyses of the impact of selected criteria on participants' positions showed a range of effects. Not only did the impact of each criterion differ considerably within the same country but also the impact of the same criteria in different countries. In terms of a broad impact ranking the revenue or production-based royalty levied by some countries had the most significant impact on both the host governments' (increase) and investors' (decrease) positions. Other criteria having a considerable impact were, in order after the production royalty, gold price (or gold grade), depletion allowances, corporate tax rates and withholding taxes.

* An extension to the sensitivity analyses was interpreting the impact of a change in one criterion in terms of the impact of changing another. For example, the impact of a change in production royalty could be as much as 50 per cent higher than the impact of a change in the gold price (or ore grade).

The range of results appeared to support the findings of the surveys (and literature) where the critical issues in any mining investment decision relate to political, legislative and administrative stability. The quantitative criteria certainly have to be evaluated but the credibility of the results would be entirely dependent on the support of the political and legislative structures. Based on this premise, an investor may even decide to develop a mining project in a country where the investment codes are relatively onerous but their stability in the long term is assured.

6.3 The Costs of Political Structures: Some Philosophy

The research process raised some philosophical issues attached to the mineral development business, both from the host country's and the investor's perspective.

The simulation results showed the costs and benefits of changing certain criteria in terms of ore deposit grade. For example, if a tax rate was increased, and investors wished to achieve a minimum rate of return, a higher grade for the deposit would be required - all other things being equal. Using the same argument; if investors were confronted with administrative inefficiency and political uncertainty this could add substantial costs because of wasted time, effort and frustration. These 'costs and risks' might reach such a

level that the required grade for the deposit precluded its likely existence in that locality. A global mining investor would then have to focus on other countries where those problems were reduced in relative terms.

The philosophical point is that man-made social structures can highly distort the development process from the natural order that resources would be extracted if only the physical conditions prevailed. The existence of the former USSR was a case in point where its policies and influence in other parts of the world distorted the allocation of resources according to free market or natural principles.

In the light of the changes that have taken place to the world's political structures, and the modifications being made by countries to their investment policies, geographic borders appear to be becoming more diffuse. The entire process is being given further impetus by the communications networks that transmit information from one side of the world to the other in a matter of seconds. In other words, any political and economic system which is too far 'out of line' (in the negative sense) will be identified very quickly. It would be penalized by the outflow of investment capital, which eventually leads to the emigration of technical and managerial skills.

These conclusions may seem very general but they have been based on the opinions of senior mining executives,

published commentary and a series of quantitative simulations. In essence, the simulation model has enabled the main criteria influencing any mining investment anywhere in the world to be placed in perspective. In fact, the principles could be applied to any industry.

As a final consideration, the lessons of the past, recent changes to global political structures, revisions to investment codes and current information technologies may well herald an era of renewed growth and prosperity. The key to realising this potential will be in the hands of host governments, labour, management and providers of capital and skills. Their individual abilities to identify and implement the necessary structures for wealth creation will be paramount.

6.4 Pointers for Africa

Many of the issues and philosophies discussed in the research report may seem obvious to some people, but then why is Africa still so under-developed? Whatever the reasons being cited from various quarters, such as damage caused by the colonial era, disease etc., there is a problem that has to be solved. If the most important issues, in the opinion of the author, were to be isolated from the study, and in the context of Africa, they would be the following:

* Create stable political, legal and administrative structures; the latter preferably being independent of 'politics'; under this heading would be the elimination of corruption and self-interest.

* Monitor critically the policies and investment environments in other regions; they are Africa's competition for investment capital. It appears that even countries have to be run as businesses in today's world of rapid (information) technological advance.

* Education and training of Africa's populus are an integral part of the process towards the implementation of the above enabling environments.

Needless to say, it is all easier said than done but there are encouraging signs that continent's leaders are beginning to tackle the enormous obstacles that have built up over the decades. It is better late than never.

Time will tell .....

7.0 RECOMMENDATIONS FOR FURTHER RESEARCH

In the light of the scope of the subject matter it was not surprising that new dimensions and further areas of interest emerged. Brief suggestions for additional research have been presented below with the hope that other researchers may be inspired to expand on the foundations provided.

7.1 Country Risk Analyses

As many as possible of the quantifiable investment criteria impacting on a mining project were incorporated into a calculating framework. The more qualitative aspects, such as politics, legislative and administrative structures were handled intuitively by using the quantitative framework as a base reference point. However, a different approach to measuring risk and return in country investment environments may be contained in the global debt markets. A comparison of the interest rates prevailing on such instruments underwritten by different countries should give an indication of the market's confidence in the structures supporting the investment. Nevertheless, analyses would still need to be carried out as to the reasons for any trends shown so that better predictive bases can be developed.

7.2 Skills Availability in Developing Countries

Considering the flow of mining investment capital to new countries and regions, companies are likely to re-assess their strategies and skills' requirements. The problem that arises is the availability of local skills, the amount of training needed and whether the transfer of expatriate skills is warranted, or even allowed by the authorities in various countries. A complication would be that the host governments may stipulate certain labour and training codes, thereby introducing unrealistic constraints which would impact on longer term investment attractiveness.

Research in this area would be extremely valuable in identifying the degree of the problem, designing programmes to alleviate the backlog and, in particular, minimizing the impact of the mixing of cultures.

7.3 Structure of Mining Finance Companies

An extension to the skills availability issue would be the appropriate structures in the mining finance and management companies. The degree to which change will be required would depend on current structures and the extent to which they are geared to a globally diversified mining business profile, e.g. Rio Tinto Zinc (RTZ). An interesting research angle would be the most effective plan to 'globalize' the South African mining houses, with the exception possibly of the Anglo American - De Beers - Minorco triad. Other issues would be the amelioration of past political baggage and the

constraints to the movement of foreign exchange so as to participate competitively in new opportunities.

7.4 Expected Returns on Investment

The executive survey indicated that certain returns on investment would be required before venturing into different countries. There were some very high figures suggested, 30-40 per cent, which places the probability of finding such prospects into the realms of impossibility, assuming a 100 per cent equity-based financing structure. Connected to this was the concept of payback period where 1-2 years was proposed for some regions. In the context of the current global political and economic climate, there is considerable scope to re-think the applicability of these measures in mining project evaluation.

APPENDIX A

NAMES OF EXECUTIVES PARTICIPATING IN THE SURVEY
October - November 1993

U.S. based
Messrs.:

PAUL HANSEN, *Manager Corporate Development, Echo Bay* Mines, Denver.
Interviewed: *4th October*

DENNIS ARROURT, *Chief Financial Officer, Minorco (USA)* Inc., Denver.
Interviewed: 5th October

TOM LOUCKS, Vice-President, Denver Mining Finance Co. Denver.
Interviewed: 5th October

WILLIAM PINCUS, Executive Vice President, Pincock Allen and Holt Inc., International Mineral Resource Consultants, Denver.
Interviewed: 6th October

TIM HADDON, Chief Executive Officer and President, Amax Gold, Denver.
Interviewed: 7th October

DOUGLAS SILVER, Senior Partner, Balfour Holdings, Denver.
Interviewed: 7th October

NAMES OF EXECUTIVES PARTICIPATING IN THE SURVEY

October - November 1993 (U.S. based continued)

Messrs.:

PETER PHILIP, President and Chief Executive Officer, and;

WAYNE MURDY, Chief Financial Officer, Newmont Mining Corporation, Denver.

Interviewed: 8th October (both executives)

PETER STEEN, President and Chief Operating Officer, Homestake Mining Company, San Francisco.

Interviewed: 11th October

OLIVER WARIN, Vice President and Manager Exploration, BHP Minerals, San Francisco.

Interviewed: 12th October (Completed questionnaire later)

(Some views were provided by Dr. Cory Williams, Manager, Exploration, Admin. and Services, who is a colleague of Mr. Warin)

CLIVE ARMSTRONG, Economist, International Finance Corporation (World Bank), Washington DC.

Interviewed: 19th October (Completed questionnaire later)

WILLIAM SMART, (pp. Dr. Pat Ryan) Manager - Exploration, Phelps Dodge Mining Corporation, Phoenix, Arizona.

NOTE: Due to prior commitments and the short notice given by PSA, PD partially completed the questionnaire and this was received by mail in February 1994.

NAMES OF EXECUTIVES PARTICIPATING IN THE SURVEY
October - November 1993 (continued)

South African based(Johannesburg):

Messrs.:

JOHN HOPWOOD,	Executive Director, Gold Fields of S.A. Limited.
Interviewed:	28 October
B. VAN ROOYEN,	Executive Director (retired), Gold Fields of S.A. Limited.
Interviewed:	1 November
ROB TAYLOR,	Director of Exploration - Africa Division, Rio Tinto Zinc (RTZ).
Interviewed:	4 November
OSKAR STEFFEN, (Dr.)	Senior Partner, Steffen Robertson and Kirsten Inc.
Interviewed:	5 November

Senior executives in three other S.A. mining and related companies were approached to participate but were unable to do so because of work, time and travel pressures. It was decided not to pursue the interview process any further because a consistent base of opinion had been achieved.

APPENDIX B

EXECUTIVE SURVEY: DISTRIBUTION OF CODED RESPONSES

Question topic 2: Global events and situations

Distribution of responses for Table 2.1

Codes	3	2	1	0	Totals
Question:					
2a	9	3	0	1	13
2b	1	7	4	1	13
2c	9	3	1	0	13
2d	0	4	8	0	12
2e	0	5	6	1	12
2f	11	2	1	0	14
2g	6	6	1	0	13
2h	1	2	10	0	13

Question topic 3: Country risk factors

FOR THE EXPLORATION PHASE:

Distribution of responses for Table 2.2

Codes	3	2	1	0	Totals
Question:					
3a	1	2	7	0	10
3b	0	1	8	2	11
3c	0	0	7	4	11
3d	2	3	4	2	11
3e	4	1	2	2	9
3f	1	5	3	1	10
3g	11	3	0	0	14
3h	10	3	0	0	13
3i	12	1	0	0	13
3j	11	2	0	0	13
3k	9	2	2	0	13
3l	10	2	1	0	13
3m	12	1	0	0	13
3n	12	0	0	0	12
3o	9	2	1	0	12
3p	3	4	5	0	12
3q	3	3	4	0	10
3r	3	2	6	1	12
3s	4	2	4	2	12
3t	0	2	7	3	12

NOTE: The questionnaire differentiated between exploration and production phases but several executives viewed the two in the same light. This is the reason the number of counts for the production phase (overleaf) were lower.

Question topic 3: Country risk factors (continued)

FOR THE PRODUCTION PHASE:

Distribution of responses for Table 2.2 (continued)

Codes	3	2	1	0	Totals
Question:					
3a	3	3	0	0	6
3b	0	2	4	1	7
3c	0	4	2	1	7
3d	0	0	4	3	7
3e	2	0	2	2	6
3f	1	4	2	0	7
3g	6	1	0	0	7
3h	5	2	0	0	7
3i	5	2	0	0	7
3j	6	1	0	0	7
3k	4	2	1	0	7
3l	5	2	0	0	7
3m	6	1	0	0	7
3n	5	1	0	0	6
3o	3	3	0	0	6
3p	2	2	3	0	7
3q	2	2	2	0	6
3r	3	1	3	0	7
3s	5	0	1	1	7
3t	0	1	5	1	7

PROJECT EVALUATION METHODS

Codes	3	2	1	0	Totals
Question:					
3u	4	5	1	0	10
3v	2	6	2	0	10
3w	8	4	1	0	13
3x	6	3	3	0	12
3y	5	4	1	0	10

Question topic 4: Exploration attractiveness

FOR THE 1990's:

Distribution of responses for Table 2.4

Codes	3	2	1	0	Total
Africa	1	5	4	2	12
Angola	0	0	3	7	10
Ghana	4	2	2	2	10
RSA	2	3	3	2	10
Zaire	0	0	3	7	10
Zambia	1	3	3	3	10
Zimbabwe	1	3	4	2	10
Lat. America	11	1	0	0	12
Argentina	6	2	0	0	8
Brazil	0	3	3	2	8
Chile	9	0	0	0	9
Mexico	6	2	0	0	8
Peru	2	4	2	0	8
Pacific Rim	3	6	1	0	10
Indonesia	4	2	1	0	7
Malaysia	3	1	2	1	7
Papua N.G.	0	2	5	1	8
Philippines	0	2	3	2	7
Vietnam	1	3	1	1	6
Others:					
Australia	3	5	3	0	11
Canada	0	7	4	0	11
China	2	3	3	3	11
CIS	4	5	1	1	11
USA	2	8	1	0	11
WORLD INDEX	50	60	47	34	191

NOTE: Some executives preferred to give responses for regions only which explains the number of counts being higher than those given for the individual countries.

Question topic 4: Exploration Attractiveness (cont.)

FOR THE 1980's:

Distribution of responses for Table 2.4 (continued)

Codes	3	2	1	0	Total
Africa	0	2	5	5	12
Angola	0	0	1	9	10
Ghana	0	1	5	4	10
RSA	1	3	3	3	10
Zaire	0	0	4	6	10
Zambia	0	0	2	8	10
Zimbabwe	0	3	2	5	10
Lat. America	0	4	8	0	12
Argentina	0	0	2	6	8
Brazil	1	2	3	2	8
Chile	3	3	1	2	9
Mexico	1	2	3	2	8
Peru	0	0	2	6	8
Pacific Rim	2	3	4	1	10
Indonesia	4	0	1	2	7
Malaysia	2	1	3	1	7
Papua N.G.	3	4	0	1	8
Philippines	0	2	4	1	7
Vietnam	0	0	1	5	6
Others					
Australia	5	4	1	0	10
Canada	5	4	1	0	10
China	0	0	1	9	10
CIS	0	0	1	9	10
USA	8	2	0	0	10
WORLD INDEX	33	31	41	81	186

Question topic 5: Rates of return and payback period

For the 1990's and 1980's: Number of responses given for IRR and PBP in selected countries:

	IRR	PBP
Africa	7	6
Angola	6	5
Ghana	6	5
RSA	6	5
Zaire	6	5
Zambia	6	5
Zimbabwe	6	5
Lat. America	7	7
Argentina	5	5
Brazil	5	5
Chile	5	5
Mexico	5	5
Peru	5	5
Pacific Rim	6	6
Indonesia	4	4
Malaysia	4	4
Papua N.G.	4	4
Philippines	4	4
Vietnam	4	4
Others		
Australia	7	7
Canada	8	7
China	5	5
CIS	6	6
USA	8	7

NOTE: Although not all executives gave their expectations of IRR and PBP, most of the others indicated that their estimates would reflect the same trends as those given for question topic 4.

APPENDIX C

EXECUTIVE SURVEY: DETAILS OF THE COMMENTS AND OPINIONS

The following pages provide more detail on the opinions given by the executives during the interviews. The write-up has been laid out to simulate the chronology of the interviews. This approach may allow interpretations to be made by the reader which could well be different to those of the author.

Specific comment(s) or opinion(s) made by a particular executive is (are) highlighted with a pointer sign (>) and the subscribing executive(s) identified with numbers, e.g. Executive 1,2 or 3 etc. It was decided not to identify each executive by name purely to protect any confidential views, as mutually agreed at the time of the interviews.

Different respondents did make similar comments and these may border on repetition in the following notes. Where possible the identification numbers of the executives have been attached to the common opinion.

Question topic 1: Setting the scene

The following comment has been drawn from Anglo-American Corporation's 1993 annual review: "The changes taking place in (South Africa and) much of the world beyond us have widened the Corporation's horizons, offering the prospect

of a challenging and dynamic period of renewed growth". Doyou agree that this comment could apply to your company?

Executives' comments and opinions

Executive 1:

> The world is a very different place now with advances being made in various technologies and the developed economies being less materially (copper, zinc etc.) intensive. However, the search for the "elephants" or world class mineral deposits is likely to intensify and ways will be found to develop these, subject of course to political stability or war situations.

Executive 2:

> There is currently a "push-pull" scenario influencing the strategies of U.S. based firms. The "push" comes from pending changes to the U.S. Mining Law of 1872 which potentially means additional royalties on minerals extraction and increased costs or provisions for environmental protection. The "pull" stems from the reformation of Latin American investment codes which have enhanced the potential returns on foreign capital and makes the region far more attractive to investors.

Executive 3:

> The end of the West vs. East "Cold War" has resulted in socialism and nationalism losing their historic support base. This has allowed "free market"

ideologies to take hold and enables an intense drive to find and develop more capital efficient and lower cost resources. The environment has also raised questions about the efficiency of state owned enterprises, with the trend towards privatization becoming a natural extension.

PSA comment: These ideological issues were repeated by numerous executives throughout the discussions.

> Latin America, particularly Peru, is a good example of this trend with various other countries having sold, or are in the process of selling off, their mining assets to private capital and management expertise which are considered to be more efficient.

Executive 4:

> The current process of change is translating into a transfer of wealth from the developed to the developing nations.

> Colonialism was a major factor in the early to mid part of this century because the influence and control of an economic power block maintained a stable operating environment, e.g. Britain, France, and Germany. Now the companies themselves are having to play a more pronounced role in this regard, which essentially is the management of the risks associated with unfamiliar and volatile environments. Part of the process is for companies to ingratiate themselves with host governments. The formation of the multi-

lateral agencies, such as the World Bank/IFC, has also assisted in this regard.

Executive 5:

> Approximately another 50 per cent of the world has opened up under this new status quo of rejuvenation and privatization. This realization began setting in around 1986-1987 when many countries started changing their investment and tax codes to maintain competitiveness in the global business environment.

Executives 6, 12, 14 and 15:

> "Privatization" is believed to be the greatest driving force in mineral development to-day, i.e. after the collapse of the former USSR and the repercussions from this across the globe.

Executive 7:

> Changes have taken place, both pro and con, in mining investment laws and environmental legislation worldwide.

Executive 8:

> Considerable more preparation and exploration work has to be carried out before the growth phase can be realized.

(PSA comment: This was the reason for the only "no" response given for question topic 1.).

Executive 9:

> The financial capacity of companies to realize these opportunities is going to be a major factor. (Ex. 9)

Executive 11:

> In the context of U.S. consulting work, 10-20 per cent was offshore based between 3 - 5 years ago and currently it is more like 50 per cent.

Question topic 2: Global events and situations

The following situations appear to be influencing trends in international mining investment. What is your view of the degree of impact each has had, or is likely to have, on these trends? Enter codes for major (3), moderate (2), minor (1), or no impact (0).

Executives' comments and opinions

Executive 2:

> Elimination of dictatorships or centrally controlled ideologies appears to be an international objective and to a large extent has been successful.

> There is an appreciation in business circles of the influence wielded by the World Bank, IFC and OPIC organizations so that sound economic and business principles are adhered to in the developing world.

Executive 3:

> The pending changes to the U.S. Mining Law of 1872 creates an atmosphere of uncertainty in the mineral development process.

> The business climate is very different now (compared to the recent past) and strategies for mineral investment and development need to be modified accordingly.

> "Native rights" seems to be an emerging factor which mining finance firms should be cautious about, e.g. Mabo title case in Australia and the analogous North American Indian.

> The privatization trend has been the natural extension to the major events mentioned above, i.e. the demise of the former USSR etc., and is arguably the most important "ideology" to have emerged in recent history.

> The changes in South Africa are of major significance to local S.A. mining companies, and probably to Africa at large, but it is not likely to affect non-South African firms that much.

> The mining industry's image appears to have been tarnished in the industrialized countries. This differs from the developing countries where perceptions of the mining industry are far more positive. An issue which is not often appreciated is that this also affects the quality of individual attracted to the industry as an employer.

> MIGA (Multi-lateral Investment Guarantee Agency), the World Bank and IFC have contributed to the globalization of the mining industry through