Strategic Mine Planning, an Exploration Tool?

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Abstract

Modelling and optimization are often thought of as late stage refinements in project development. This paper argues that use of these strategic planning tools during exploration can reduce the cost of discovery and maximize returns on the drilling investment. Ranking of exploration projects with regard to likely commercial success allows the prudent explorationist to concentrate funds, on a logical basis, where there is the greatest chance of return. Expensive over-drilling of a prospect can be avoided releasing funds for the testing of other concepts.

Introduction

In today's economic climate we need to improve the discovery costs of mineable reserves. An explorationist needs to know some fundamental mining parameters, which should be applied at the prospect level, to prevent wasting money by over-drilling. Discovery of metal in the ground is of little value if the deposit is not economic. The savvy exploration manager will rank prospects by some quantitative measure. Optimization software provides a tool. At an operating mine site, management needs to appreciate where they lie in the mine life cycle. There is no point in starting exploring when the pit is mining the last bench. How often have we seen a mill expansion followed a few months later by the operations closure?

In this paper I will attempt to show how the use of optimization software may assist in answering some of these questions. The ideas I shall present are not based on any rigorous scientific evaluation but rely on my own observations and experience of thirty years in the mining and exploration industry.

The Exploration Problem

From the discovery drill hole there is pressure to quantify the size and grade of the resource. While the discovery of a resource is an important objective of the explorationist, the main driving force must be the conversion of resources to reserves. There is no commercial advantage in expending precious exploration capital in quantifying a resource that, under prevailing economic conditions, will not yield an economic reserve. This reality is often overlooked in the excitement of a new discovery. A technical success may provide a warm fuzzy glow but it does not put money in the bank.

The example shown is of a small gold deposit drilled out at 20-metre spacing. Optimizing the model shows small pockets, or craters, of potentially economic mineralization. However, after allowing for the cost of establishing a ramp, it is unlikely that the project will return a profit. Drilling totals 25,000 metres with resultant 43,000 assays. By my estimate this work would have cost between $750,000 and $1,000,000. It has added 68,000 ounces to the resource inventory but nothing to reserves.

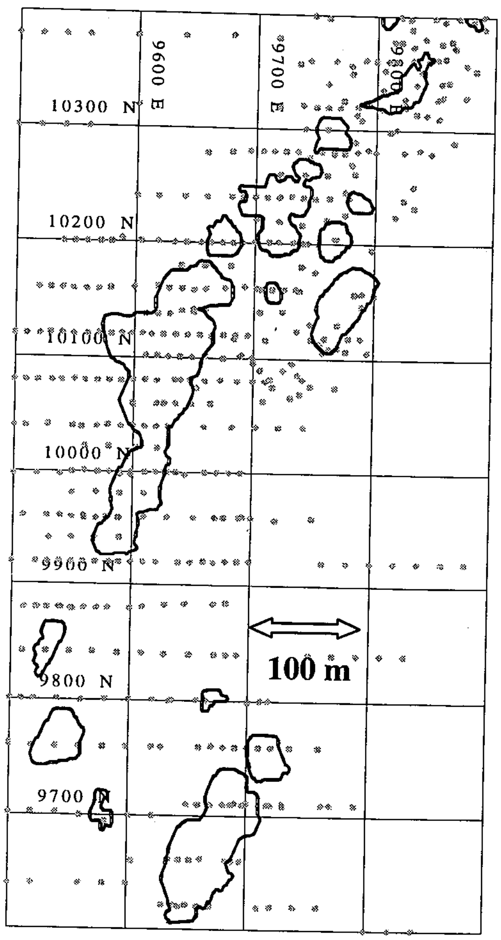

Figure 1: Heavily Drilled Small Deposit

It is my view that exploration results must be scrutinised for economic viability at an early stage. Using limited data, projections of mineralization grades and widths can be made using assumptions based on the geological model. The resultant economic model can then be tested using optimization software assuming some industry standard range of mining and processing costs. This approach was used in the example below, where drill results on 100 metre line spaces were modelled to justify the next round of drilling.

Note the significantly greater strike length covered by this drilling compared to the previous example. Approximately the same number of metres has been drilled, but the potential resource is now in the order of 400,000 ounces. Of course more drilling will be needed to test continuity, refine interpretations, and bring the project to a reserve status. However modelling has indicated the project to be economic for a likely set of mining scenarios. This additional work can now be undertaken with a high degree of confidence. Furthermore, the shells can be used to determine the areas of economic significance. These become the targets of follow-up drilling. Similarly hole depths can be designed on the basis of testing the likely economic shell. This may save many thousands of dollars by cutting out unnecessary or unwarranted holes. It must be stated that these studies are for internal company use and do not represent a statement of reserves that could be made public. By running optimizations at the completion of each phase of drilling the project can be kept on track toward final exploitation.

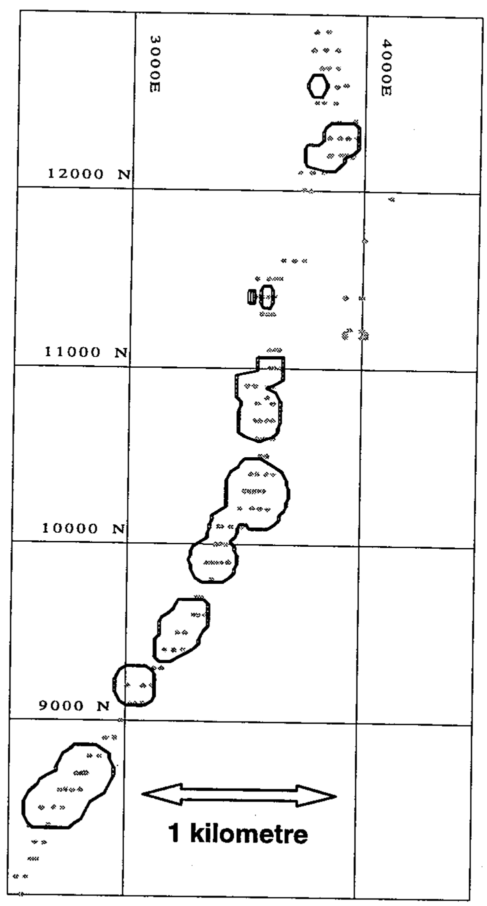

Figure 2: Sparsely Drilled Deposit

The Project Selection Problem

The exploration manager is frequently faced with funding competing projects from limited resources. The project geologists may argue for each project in compelling terms. A review of the potential economic returns by the use of optimization software provides an independent and logical measure by which to rank prospects. Using the two examples examined previously, funding would be rejected in the first instance but likely approved in the second. I would advise any project geo to become familiar with optimization theory and use this in support of their budget application.

The Operating Mine Problem

The dilemma faced by every mining operation is to maximize profit but remain in business. Frequently these two aims work against each other. Maximum profit is often achieved by rapid production, which adversely impacts on mine life. The solution to the problem is to find more ore. This requires the expenditure of funds in exploration activity. The need for this expenditure is often not recognized until the mine is unable to support the additional impost. The heady days of mine start-up are not seen as the time to expend further funds on exploration. Rather this is seen as a time to recoup the discovery cost and start-up capital. A look at a typical optimization curve will show why this strategy is doomed to failure.

In the early stages, after any pre-strip has been accounted for, the project makes money rapidly. This flattens as the maximum, or optimum, is reached. If exploration is delayed until this shoulder, then it is unlikely that the project will be able to sustain the extra cost burden. Indeed the additional cost will lower the optimum position and thus hasten the demise of the operation. Exploration conducted during the early stages will have less impact and can be factored in to the financial model. This strategy will give the best chance for additional discoveries and extension of the project life.

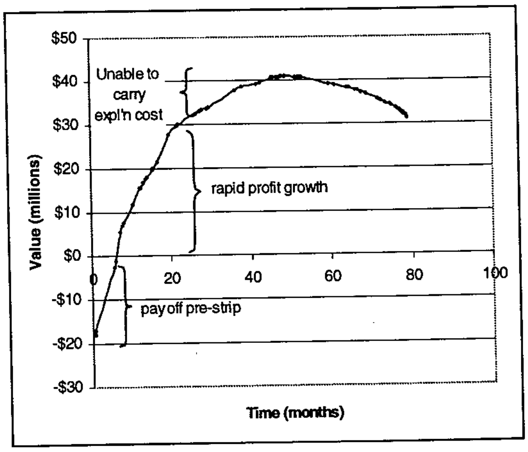

Figure 3: Typical Time Value Curve

Conclusion

The use of strategic planning software throughout the exploration stages of a project enables assessment of the project viability at the earliest opportunity. This protects against the expenditure of exploration funds on non-viable projects, thereby reducing risk and increasing returns on the exploration dollars expended.

Ranking of projects can be achieved by comparing the potential economic return of one with another. This may provide some quantitative input to the decision-making process.

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