MINERAL POTENTIAL PROJECT - OVERVIEW

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INTRODUCTION

The Mineral Potential project was initiated in 1992 to meet the need for current regional mineral potential information in regional and sub-regional land-use planning. These planning processes have the responsibility of making recommendations on protected areas, as described in the provincial Protected Areas Strategy (PAS). The goal of PAS, created in 1992, is to protect representative examples of the province's natural, recreational and cultural heritage features. A provincial target of 12% protection has been established; when PAS was announced, 6% of BC was considered protected. Mineral exploration and mining are not allowed in protected areas, hence decisions on which areas to protect need to fully account for mineral values.

Part of the mandate of the Commission on Resources and Environment (CORE) is to run regional land-use planning processes and to make recommendations to Government on these findings. Initially, three regions, Vancouver Island, Cariboo-Chilcotin and the Kootenays, were selected for evaluation and land-use planning (Figure 1).Recommending protected areas is one of the more controversial issues in the CORE processes.

To provide readily useable mineral resource information to this process, the land within each region was ranked with respect to its mineral potential using quantitative analysis. The CORE process necessitated the upgrading of all resource and cultural inventories in the province to facilitate informed land-use planning. This project is one of more than twenty inventory projects undertaken by seven ministries. The project is operated by the Geological Survey Branch of the British Columbia Ministry of Energy, Mines and Petroleum Resources and was designed to meet CORE's timetable. The project will complete the mineral potential assessment of the province within a four-year time frame and will meet the information needs of other land-use processes in addition to CORE's.

This paper provides an overview of the methodology used to assess the mineral potential and report on the progress of the project.

PHASE 1 ANALYSIS

Phase 1 analysis is the prediction of the relative future value of the land base by analysis of historical information. Four parameters were used in this analysis; value of past exploration, value of known resources, value of past production and number of discovered mineral occurrences. To date, only the six major metallic commodities; gold, silver, copper, molybdenum, lead and zinc have been used in this analysis. In the future, all metallic and industrial mineral commodities will be included in the phase 1 analysis.

Within each tract, the value of each of the four parameters was calculated. These parameter values were normalized by dividing them by the areas of the tracts. Tracts were then ranked by each normalized parameter and given an ordinal value related to the ranking. The ordinal values for each parameter range from 1, for the lowest ranking tract, to n, the number of tracts in the region, for the highest ranking tract. Each tract then had four ranking values, one for each of the parameters. These rankings were then multiplied by a weighting factor proportional to their perceived importance in predicting future value, and summed for a final ranking value.

The weighting factors used were; 25 for known resources, 10 for exploration expenditures and 5 for each of past production value and number of mineral occurrences. It was felt that discovered commodities in the ground was the most important indicator of future economic activity. To a lesser extent, the amount of exploration performed in a tract indicated where the exploration community, during the past 40 years, has felt the best ground is located. Value of past production and the number of mineral occurrences were given the least weighting but both are important as indicators of favourable geology.

The final ranking was used to order all tracts within a region from most to least potential. This type of analysis makes some very large assumptions and must be used with these assumptions in mind. To a large extent it assumes that new resources will be discovered near previously discovered resources. This assumption neglects the possibility that new types of deposits, completely unrelated to known deposits, may exist or that the importance (value) of commodities may change over time. The rankings are based on the market value of commodities. Market value may not be the best indicator of the value of a commodity to the province's socio-economic well being. In the future, mine-head value of commodities rather than the market will be used to get closer to the true value to the province of the commodities it produces. This is also how the provincial mineral statistics have traditionally been quoted.

PHASE 2 ANALYSIS

Phase 2 analysis evaluates both known resources and predicted future resources. The value of known resources is compiled from the literature and, as described above, was added to the MINFILE database. The amount of resources to be discovered in the future was obtained by soliciting probabilistic estimates from individuals with expertise in the area to be assessed or in the deposit types believed to exist in the area. The methodology used for the

se predictions is similar to the three-part
methodology of the United States Geological Survey (Singer, 1993).

In our methodology, tracts are based on geology rather than the possibility of a specific deposit type occurring, as in the
three-part methodology. For each combination of tract and possible deposit type, probabilistic estimates of the number of
deposits to be discovered or proved in the future are made. These estimates are made individually by several experts for
each combination of tract and deposit. No attempt to reach consensus between est imators is made as the range of thinking
within the geological community is important.

The estimators were instructed to use the median deposit size and grade as the b asis of their estimate. Grade and tonnage
distribution curves, together with descriptive characteristics for each deposit type, were supplied to them. Where possible
these curves were from British Columbia deposits, but in many cases there are in sufficient deposits reported in the province
to develop a meaningful curve and data from around the world were used. These wo rld deposit grade and tonnage
distributions were generously supplied by the United States Geological Survey (G runsky, 1995; Cox and Singer, 1986). It is
most important when using data from outside province, to assure that the relativ e economic importance of the deposit types
remains true to the British Columbia situation. For this project a deposit is de fined as a mineral occurrence which contains
the same or more of a commodity than the smallest deposit reported in the associ ated grade and tonnage distributions. To
make a probabilistic estimate for a particular deposit type in a tract, the esti mator actually makes several estimates at
different probability levels. The value reported for each of these estimates is the probability of at least a specified number
of deposits being discovered or proved in the future. The first question estimat ors asks themselves when making an estimate
is: "What is the chance of at least one more deposit of this type being discover ed or proved in this tract?". This value is then
recorded on a linear scale from 1 to 100% probability, with a "1" indicating at least one deposit. Estimators then ask the
same question with respect to increasing numbers of deposits until they reach a number beyond which they feel there is no
chance of that number of deposits being found in that tract in the future.

Each of the estimates are then run through the Mark 3 Monte Carlo Simulator to d etermine the amount of mineral commodity
predicted by the estimate. The Mark 3 simulation program was developed by the US GS (Root et al., 1992) and was
generously provided to this project. Simply, the simulator combines the probabil ity distribution of deposit discoveries
provided by the estimators with the grade and tonnage probability distributions compiled from known deposits. The output
from the simulator is the probability distribution of volume of the commodities associated with the deposit type. As
mentioned above, each estimate is put through the simulator individually. The re sults from multiple estimates of the same
deposit type in the same tract are then combined and recorded. For each combinat ion of deposit type and tract, the results at
three probability levels are retained. The mean, maximum and minimum estimates f rom individual estimators at the 90, 50
and 10% probability levels are stored for each commodity included in the estimat es for a given deposit type. Once all the
deposit types for a tract had been simulated and the relevant values saved, the

predicted amounts of each commodity are
combined and given a dollar value. Finally the total dollar value of all the com
modities with potential in the tract were
combined to give nine values, the mean, maximum and minimum, at three probabilit
y levels (Figure 4).

Figure 4. Graphic used to display the known and estimated resource value for eac
h tract. The height of the bars is in
dollars.

These estimated values of future discoveries, together with the value of the kno
wn resources in each tract, were used to rank
the tracts within each region. The value used to rank the tracts was the value o
f the known resources plus the value of the
mean of the estimates to the 50% probability level. Graphically displaying these
 values for all the tracts in a region allows
easy visual comparison of the relative importance of each tract in a form useabl
e by third parties (Figure 5).