Stop Screening — Start Drilling! Criteria Guiding Exploration at SOQUEM

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Abstract

Criteria used to select exploration programs have evolved somewhat since the beginning of SOQUEM. At the outset, our policy was quite conventional: to locate conductive sulphides in rhyolitic centers; to carry out geochemical surveys on metamorphic haloes in sediments, etc. However, almost simultaneously, we also started systematic prospecting of large areas by indirect but reliable methods, such as regional geochemical surveys or airborne scintillometer flights along all the roads of Quebec. More recently, the scale of our systematic surveys has decreased, as the Quebec Department of Natural Resources now carries out and publishes such studies. However, we continue to locate and drill all kinds of anomalies when we judge that their geological environment can correspond to exploitable mineral deposits somewhere in the world. Special attention is given to showings reported by prospectors or private promoters. We carefully avoid using too many decision criteria; for example, geochemical anomalies are drilled or examined by trenches without other preliminaries. Finally, project managers are required to assign 50 per cent of their annual budgets to the examination of favourable wildcat targets, either by drilling or blasting. In our opinion, this is the only way to compensate for the variability of anomalies caused by mineral deposits and for the variety of geological interferences.

Introduction

EXPLORATION CRITERIA have a value only if successful. Therefore, we will first recall a few of our discoveries in order to present our credentials, modest as they are. Then, we will try to express our criteria. However, as the reasons for selecting a project are often subjective, we will explain what we did rather than why, and use our discoveries as examples. From this, an exposé of SOQUEM'S selection criteria on the efficiency of exploration will follow. Finally, we will comment on a problem often evoked in publications; that is, how to select the "good" anomaly when all anomalies look alike. The author's term for this is "exploration decidophobia", and his solution is simple: drill them all!

Most discoveries were not evident at some point in time, and, quite often, the turning point was the first drill hole. Therefore, it is our opinion that more will be gained by systematically reserving half of one's exploration budget for checking the other half — by drilling the best "anomalies" rather than by drilling too little. If we look at the record of junior companies, it is evident that they did more drilling than the senior companies when they discovered ore in areas which the seniors had abandoned.

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SOQUEM's Discoveries

After eight years and twelve million dollars of exploration and development expenditures, SOQUEM so far has one operating mine — Louvem, in Val d'Or, Quebec. It started producing copper four years ago with reserves of half a million tons, or the equivalent of twenty months of production. It is still in operation today and will shortly become a rich medium-sized zinc mine with at least six more years of reserves.

SOQUEM'S columbium discovery at St-Honoré is being developed and will start production in 1976 Many years of reserves are shaping up in SOQUEM'S salt discovery on the Magdalen Islands, and the company has also optioned out a small nickel deposit (100, 000 tons of ore) which has been in operation for one year at La Tuque. Finally, we have several promising ventures under study, such as the Silverstack gold property.

From the above, SOQUEM can claim a moderate degree of success.

Selection of Projects

The rationale for localizing a project is usually a geological concept: a rhyolitic center such as Launey Guyenne in Abitibi; a metamorphic aureole around the Tabletop granite in Gaspé; or aeromagnetic anomalies suggesting ultrabasic intrusives. The ground is then covered with appropriate tools selected so as to be most effective under the conditions of the project.

To find conductors in volcanic belts, we will fly Input electromagnetic surveys in the deep clay belt, Dighem surveys in high-potential areas, and Otter or Emal fixed-wing EM surveys in low-potential areas covered by fairly shallow overburden. Suitable ground surveys follow. When stream geochemical surveys are done in Gaspé, they are followed by prospecting and soil geochemistry rather than by geophysical surveys. Fairly rapidly, it becomes a game of what was first — the chicken or the egg.

Except for straight ground prospecting, of which we would like to do more (and we have had some success in uranium discovery), the influence of the tool on the type of targets found becomes rapidly overwhelming. We will not attempt to explain in detail how we work, as it would not be really pertinent, but we will give a few examples of how we obtained our successes and our near hits, and this will in turn give a picture of what we are aiming at in planning exploration at SOQUEM.

Examples of Successful Projects

The Louvem mine started as an option on a 30-square-mile property in a favourable volcanic belt on strike with several massive sulphide and gold mines of the Val d'Or area — East Sullivan and Manitou Barvue being the main ones. As most of the property had never been covered by ground E.M., we decided to carry out a systematic Turam survey, hoping that previous airborne electromagnetic surveys flown by others had missed some deeper conductors because of the clay cover (Salamis & Gaucher, 1969) (Vallée, 1972). The Turam survey found one poor and several very poor anomalies. We drilled five of them, and the poor one turned out to be Louvem's copper orebody. Now, six years later, one of the adjacent, originally unnoticed, Turam anomalies was found to represent a zinc orebody, although this new discovery cannot be credited to the original Turam survey.

The Silverstack gold discovery is situated in a proven gold and potential base metal belt, between Val d'Or and Rouyn. Our interest in the property originated some five years ago, during a systematic helicopter electromagnetic survey on this belt of gold properties. We followed up a number of EM conductors on the ground, then checked them by drilling, with no economic results. A few of the airborne conductors were on Silverstack ground. We did not manage to option them at the time, but, two years later, this company contacted us again and we signed a joint-venture agreement. In the meantime, the Department of Natural Resources flew and published an Input survey confirming these conductors and many others. We studied the geology resulting from previous drilling programs, conducted a limited number of EM and IP traverses, and drilled the best five of the available targets. One of them, a low-conductivity EM target, turned out to be a gold-bearing pyrite zone, which is now being outlined by drilling.

As for geochemistry, so far only encouraging mineralization or near hits have been found. The earliest oreshoot discovered resulted from a fairly large stream reconnaissance survey in Gaspé, where we localized a good copper anomaly. On the third visit to the anomaly, our prospecting geologist first localized mineralized boulders and then a mineralized outcrop. Drilling outlined a small oreshoot of copper ore. Had we not found the outcrop, we could have found the mineralization from the soil geochemistry map, although it showed two anomalies in the neighbourhood, one of which did not correspond to mineralization. As for geophysics, later IP surveys did indeed outline two major anomalies, both believed to be due to graphitic schists. Neither has anything to do with the mineralization, although the copper ore occurs near a graphitic horizon.

Our salt dome discovery resulted from a joint venture on the Magdalen Islands with a "junior" company and a private entrepreneur. When brought to our attention, this concept of salt domes was supported by a limited gravity survey that had outlined two gravity lows. The concept was somewhat second-hand, as two 500-foot diamond drill holes had been put down previously on the property, with negative results. We agreed to try again with a much more powerful drill, using all suitable precautions, and we hit salt on the first try for a continuous length of 1500 feet. Before drilling, the author toyed with the idea of suggesting a seismic survey to check on the best location of the drill hole. He dropped the idea, luckily, because, for some obscure reason, later seismic surveys did not contribute to the understanding of the structure. Had we performed them, we would have reduced our chances to hit salt by half, as our initial budget ($100,000) allowed only either two deep diamond drill holes or the seismic survey and a single diamond drill hole, and as one of the two initial drilling sites on gravity lows turned out to be barren.

Our 100,000-ton copper-nickel orebody at La Tuque originated from mineralized samples brought to us by a prospector. The prospect was visited immediately, on a Sunday.

The last example we will cite involves a columbium discovery resulting from airborne radiometric surveys. First, we thought of running a panel truck with a scintillometer along roads to find anomalies. Then, we decided that a small plane carrying a scintillometer would be more efficient. We still followed the roads, as it is more economical to check anomalies along them. We found a radiometric high over a small window (200 feet in diameter) of the Trenton flat-lying limestones, in the Lake St. John area. Carbonatite was recognized in the window and, after outlining the limits of the carbonatite complex by gravity and magnetic surveys (Vallée & Dubuc, 1970), it was explored by drilling. Thus, the St-Honoré columbium deposit was discovered under the Trenton limestone by drilling a secondary magnetic anomaly, one mile away from the original radiometric anomaly. The deposit is now being developed, and it is scheduled for production in 1976.

Summary of SOQUEM's Exploration Criteria

From the above-mentioned examples, the exploration criteria of SOQUEM can be summarized as follows.

1. Select a favourable geological environment. This may mean a favourable, slightly mineralized rhyolitic horizon or, as a minimum, in the broadest sense of the word, it should mean that orebodies have been found somewhere in the world in the types of rocks to be explored.

2. Select an appropriate tool likely to locate targets which can correspond to the expected orebodies, under the physiographic conditions of the area to be explored.

3. Drill the resulting targets and, most important, persist in drilling or trenching them, even if the results are discouraging at the beginning, until the sum of money spent on drilling the targets equals the amount spent on finding and selecting them. If a few drill holes can give enough geology to presume the quality of the targets of the remaining areas, they should be drilled early in the game, before investing heavily on preliminary surveys. To use a common example of the third criterion, one may have one hundred or more barren graphite and/or sulphide conductors for each mineralized economic intersection, even when the geology is favourable, and, in our opinion, it would be a waste of money to walk away from an area without having tested at least enough anomalies to reach this 50% budgetary objective.

4. At all times, keep in mind the limitations in the possibilities of developing the resulting discovery — for example, transportation facilities, future markets, ground acquisition costs, etc.

Exploration Decidophobia

I would like to describe the psychic "decidophobia" that often hits geologists and management alike, especially when one has overspent the initial budget for finding targets and the time has come to "waste" money on drilling. This decidophobia can express itself in several ways; for example, by refusing to select targets, recommending additional surveys on the neighbouring area, etc. The rationales for the decidophobia are as diverse as there are disciplines. Let us cite a few examples.

Geological Decidophobia

Those conductors, or those remaining conductors, are no good because this is a barren sulphide area; just watch until something is found, and all the maps will colour themselves, chameleonlike, with a beautifully favourable rhyolite yellow; or this area has chloritic alteration, but not quite enough of it, and it is too widespread.

Geophysical Decidophobia

This EM target is no good, because it is a non-magnetic conductor (Texasgulf), too long (5 miles at Thompson), too small (Cupra, Marbridge) or not conductive enough (Louvem).

Geochemical Decidophobia

Without too much direct experience in the field, I still witnessed a group of geochemical anomalies due to drainage, depression, high manganese, etc., which were suddenly resurrected when mineralization was intersected by a drill hole selected by qualified geochemists who were prodded to act by the rule of spending half of the budget on exploratory drilling.

Overdrilling Decidophobia

We do insist on exploratory drilling definition. It is all too easy to select a single target and overdrill it by spending the total initial drilling budget, while neglecting other targets which may turn out to be more worthwhile. In our opinion, drill holes beyond the first or second one on a given target should be based on a separate budget, and the decision to postpone checking other targets in favour of following a submarginal intersection in a so-called "favourable environment" can be dictated as much by decidophobia as was the case in the other examples given above.

Another possible example is shown by concentrating all the money on one deep drill hole rather than checking several targets localized near the surface by previous surveys.

Radiometric Decidophobia

This decidophobia may soon reappear, as interest in uranium prospecting is increasing. One of the common reasons given for refusing to drill is the lack of uranium in surface radioactive samples, even if one knows that uranium is easy to leach out. Another reason could be an unfavourable uranium-to-thorium ratio in the radioactivity spectrum. Again, the best insurance for success, according to the author, lies in the budgetary control of expenditures on exploratory drilling by the 50% ratio.

Exploration by Junior Companies

Flanagan (1974) and Freyman (1974), after D. Derry and P. H. Kavanagh, have reminded us of the remarkable rate of new discoveries by the junior exploration companies. The reason for their apparent success is obscure; certainly, technically, both junior and senior groups are comparable. As a discovery is often something new and unexpected, a major company may be at a disadvantage because it is more inclined to think along rules, policies and regulations, whereas a junior might be more inclined to take the risk. Senior companies have well-defined policies as to when to drill, and a geologist with a major company may not feel free enough to follow his hunches. For example, to find a mine in the Noranda area one has to look for something different than a classical textbook anomaly of a mine, because these textbook anomalies have already been drilled (even if not always from the right side). If one is not ready to probe poorer targets than his predecessor, then one should stay away from the mining camp, because the evident targets have been drilled and the budget is likely to be used up in preliminary survey expenditures.

In the author's opinion, the reason for the apparently higher rate of discovery by the junior companies is the poor performance of most of the major ones, due to their reluctance to drill — and the resulting, sometimes unbelievably small, percentage of the total exploration budget spent on exploratory drilling. It may sound unbelievable that no money is available in the major companies' exploration budgets for exploratory drilling, but an honest compilation of the expenditures on such drilling by most exploration companies might surprise exploration managers when they relate it to the total expenditures spent on geosurveys to find sites to probe.

Conclusion

In resumé, we feel at SOQUEM that we should select favourable geological environments, perform high-quality appropriate surveys for the minerals sought and the physiography of the area and, finally, follow up our work by drilling or trenching the anomalies without dogmatic criteria about what a mine anomaly should look like, but rather selecting the best anomalies until we at least meet a minimum budgetary criterion for the project, based on a given percentage to be spent on exploratory drilling. This is the best way, in our opinion, to reduce the entropy of fragmental information in exploration. We also hope that luck will stay with us for a while.

The substance of the presentation represents a picture of SOQUEM'S exploration criteria, but it is not intended to be interpreted as SOQUEM'S official policy.

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