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The Mineral Exploration Business: Innovation Required

David J. Hall (SEG 1999 F), GoldQuest Mining Corp., Suite 1500, 67 Yonge Street, Toronto, Ontario, M5E 1J8, Canada. E-mail: david@goldquestcorp.com, and **Stewart D. Redwood** (SEG 1992 F), Consulting Economic Geologist, P.O. Box 0832-1784, World Trade Center, Panama, Republic of Panama. E-mail: info@sredwood.com.

INTRODUCTION

In this paper we investigate the management of the mineral exploration business, focusing on precious and base metal exploration. We define exploration and discovery (E&D) as the research and development (R&D) of the mining industry, and draw comparisons from R&D in other industries. We stress the need for innovation and leadership among exploration geologists and exploration managers, who need to understand clearly that exploration is a business, competing for funds from the investment community and from the dwindling number of major mining houses.

The mining industry, which comprises the mineral exploration, extraction, and processing sectors, is a relatively small part of the global economy in financial terms, yet an essential one. However, the mining industry's overall record for the investment community has not been good. Despite record profits for many companies from high metals prices in the past two years, the industry failed to produce returns that met its cost of capital in the preceding quarter century (McDonald, 2000). So it is hardly surprising that the investment community is shy and ambivalent regarding mining investments.

Mineral exploration is, of course, intrinsically linked to the rest of the mining industry: no mine exists without the discovery and definition processes that make up the business of mineral exploration.

However, in an industry increasingly concerned with improving its rate of return to investors and attracting more investment in a competitive market for capital, the "exploration budget" is always a tempting item for cost-cutting. Exploration is too often considered an expense, rather than seen as an investment.

Moreover, this financial vulnerability is only one of the many ways in which exploration groups have always been something of a misfit in the mining industry. The focus of the mining industry is firmly on maximizing production and profits from mines, and its appeal to investors is all about steady growth and stability from well-managed production facilities. The management of production is completely different from that of exploration and is typified by methodical, safety-conscious staff who prefer to work regular hours and who, like the investors, seek steady growth rather than too much excitement from their lives.

At the other end of the spectrum are the truly speculative investor and that close relative of the old-time prospector, the exploration geoscientist. Management of exploration involves the management of creativity—of corporate mavericks, and of geologists who enjoy the ride maybe more than the reward. It is a distinctive business but one that has to be reviewed in light of its association with the extractive side.

THE STATE OF THE INDUSTRY

The mining industry is small relative to other sectors; however, its importance should not be understated. The global mining industry's market capitalization stood at US$461 billion as of December 2004. The industry is dominated by the four largest players—BHP Billiton, Rio Tinto, Anglo American, and CVRD. At US$43 billion, the market capitalization of Anglo American, for example, is small compared to BP in the oil sector at US$228 billion, and GlaxoSmithKline in the pharmaceuticals sector at US$152 billion. Another salutary comparison of scale is that the entire gold mining industry has a total market capitalization less than McDonald's (Dow, 2002). Since 2000, a spate of mergers and acquisitions has resulted in the disappearance of a large number of familiar mining company names, including Amax, Asarco,

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Battle Mountain, Cyprus, Homestake, Lac, Magma, MIM, Noranda, Normandy, North, Rio Algom, Santa Fe, and, most recently, Placer Dome. The number of new names is far fewer, Xstrata being the only significant one.

This consolidation began with the fall in exploration expenditures for nonferrous minerals exploration from 1997 to 2002, and somewhat surprisingly, has continued as exploration budgets have climbed back to their 1997 levels (Fig. 1; Metals Economics Group, 2005a, b). The so-called junior sector, an important generator and discoverer of new projects, suffered severely after the Bre-X scandal in 1997, the subsequent diversion of investment into the technology boom, and the profound depression of metals prices. The loss of exploration budgets as a result of mergers has been offset by a strong revival since 2003 in the junior sector.

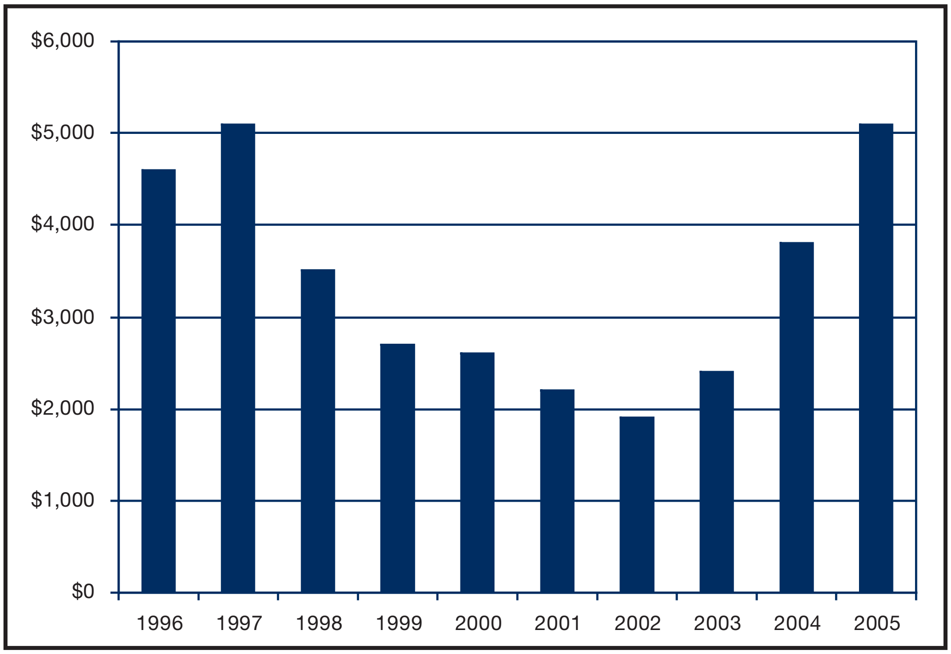

FIGURE 1. Global exploration budgets for nonferrous metals, estimated totals in US$ million (Metals Economics Group 2005a, b).

Although the substantial six-year decline in exploration spending does not appear to have had much effect on existing production, the decline in new discoveries moving up the pipeline will probably significantly reduce new mine development in the near future. The consensus of senior executives at the Reuters Mining Summit was that there is serious lack of good new projects of the kind that last for decades and make a company's fortune. Donald Lindsay, Chief Executive of Teck Cominco, expects "the scarcity of good exploration projects to become a serious issue in three to five years from now" (Industry Outlook, International Mining, September 2005, p. 29–30). It has been pointed out that there are large, unexploited gold resources available, if the gold price is right (Burton, 2003). However, the quality of these deposits in terms of grade, metallurgy, infrastructure, and legal-fiscal regimes is often suspect. Indeed, Barrick's gold discovery at Alto Chicama in Peru illustrates how a near-surface oxide gold deposit in a favorable mining country is preferable to lesser quality orebodies elsewhere despite their availability. In terms of copper exploration, the available resources around brown-field sites in the advent of better prices is vast, and thus the exploration for new copper deposits must take this into account: the question is, are there quality targets to compete? Zinc is very much in a similar position, although the view is that zinc oxide deposits (technology driven) are the way forward.

Clearly, there is always going to be a demand for new, quality projects, because the major mining houses must strike a balance between growth strategies of exploration versus acquisition—the product they deal in is finite and has to be replaced. This bodes well for companies involved in E&D, especially for successful ones capable of providing returns for investors on a par with, or even better than, the high-technology and dot.com sectors. Interestingly, despite phenomenal returns for investors in these sectors, the inability to be profitable drove them into a spectacular decline.

THE BUSINESS OF EXPLORATION: MEASURING SUCCESS

In order to determine whether or not exploration is profitable, exploration as a cost item must be compared with the return generated as a result of this expenditure (Doggett, 2000). This comparison is complicated by the long-term nature of exploration. In even the most favorable geological environments, it will take, on average, several years to discover and delineate an economic mineral deposit—the basis for calculating returns from exploration. In this respect, there is clearly a need to shorten the time frame of exploration to allow the returns to be seen by the relevant company and the investor.

The most direct evidence that exploration is profitable in the long term is provided by the survival and growth of individual companies (Doggett, 2000). From the perspective of the exploration industry, the market should provide an indication of actual and expected profits through valuation of exploration companies and availability and cost of funds required for exploration. The average cost of exploration should not exceed the average return from exploration. From a corporate perspective, this is the bottom line for survival. If the profits from the development and production of economic deposits do not outweigh the costs of finding (or acquiring) them, then economic ruin will be the long-term outcome.

Yet E&D companies that do not develop and produce cannot use revenue as a measure of success. Survival is about securing funding and beating the probability of failure—in other words, continual discovery.

Given the importance of R&D in other business sectors and its high cost, many companies struggle to

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determine how well they are doing (Loch and Tapper, 2001). This can also be said for E&D. It is interesting to note that Loch and Tapper (2001, p. 459) state that "evaluating results by financial criteria has not provided an answer. In fact, companies using ONLY financial measures in R&D funding decisions perform worse than those using qualitative criteria." This finding can be related to the fact that in E&D the effort is not directly observable, and there is great uncertainty about discovery: at what point is it certain that you have discovered an orebody? The incentive to invest in what mining company management perceive as risky is low, especially if management cannot "own" the benefits. For example, in large corporations, a discovery may not be credited back to the management that discovered it.

The best means of measuring success in R&D/E&D for any company is by using the notion of benchmarking, which implies that being at least as good as the market leader is a prerequisite for being competitive. The first step is to keep careful track of one's own and the competitors´ performance, looking especially for unexpected success or for unexpected poor performance, particularly in areas where one should have done well. The successes demonstrate what the market values and will pay for (Drucker, 1999)—they indicate where the business enjoys a leadership advantage. The failures should be viewed as the first indication that either the market is changing or the company's competencies are weakening.

The market for the exploration business is the major mining houses. Nonsuccess in terms of lack of discovery or product will ultimately cause an E&D company to die because it will not be able to secure funding, either from the market or major mining houses. Yet in major company exploration departments this urgency rarely exists. If an E&D company is successful in discovery but the market does not want the product on the basis of size, location, or whatever, then the company might consider the option of developing the product on its own. However, this choice will likely be decided by the resource banking sector: does it consider the deposit worthy of funding? Of course, as soon as a company goes from E&D to mining, it immediately faces the same questions as a major mining company with regards to exploration and the role of this activity within the company. What level of profits does one put back into exploration to balance risk versus opportunity versus growth?

The message is therefore "perform or die." Exploration companies must innovate if they are to compete and be successful. Innovation is the specific instrument of entrepreneurship. It is the act that endows resources with a new capacity to create wealth (Drucker, 1985). All survivors in this new business era, whether individuals or corporations, must adopt an entrepreneurial mind-set (Snow and Juhas, 2002, p. 14). Entrepreneurial entities thrive on innovation; however, most of the innovation is not in high technology, but rather incremental improvements in product quality, more flexible management approaches, better marketing concepts, and better service to customers (Drucker, 1985). What can exploration companies do to embrace innovation? It is appropriate at this point to examine how R&D is viewed in other business sectors.

THE BUSINESS OF EXPLORATION: COMPARISON WITH R&D

We have compared the R&D process as defined by Nellore (2001) with the process of E&D in Table 1: the similarities are clear. The R&D process within the pharmaceutical industry provides a good comparison of risk and opportunity with that of the exploration and mining business.

The stages, timing, and risks involved in the drug development process (Table 2) are remarkably similar to the mineral exploration process. As described by one of the major pharmaceutical companies, GlaxoSmithKline, "It is getting more difficult and taking longer—currently an average of 12 years—to develop new medicines. Despite a substantial increase in global R&D expenditure, fewer novel medicines were launched in 2003 than at any time during the last 20 years." (Glaxo SmithKline, 2005, p. ii). They continue, "It takes well over £500 million [US$900 million] and between 10 and 12 years to develop a new drug. For every million compounds screened, approximately 250 make it to pre-clinical testing, 10 advance to clinical trials and just one is approved for patient use." (GlaxoSmithKline, 2005, p. 6). This sounds very similar to the mineral extraction industry, and is something that needs to be explained to the investment market. Another comparison of risk is shown in Figure 2, from a study by the Industrial Research Institute of Washington, D.C. (1999), which looks at the ideas that succeed in all industries. A success rate of 1 in 3,000 to 5,000 compares well with that often quoted for exploration projects (1 in 1,000). The point to make here is that while exploration is a high-risk

TABLE 1. The Similarity of the Research and Development (R&D) Process of Industries in General (Nellore, 2001) with the Exploration and Discovery (E&D) Process of the Mining Industry

The R&D Process	The E&D Process
Long-Range Research General scientific/technology research unrelated to any specific product	**Grass-roots exploration** General exploration of country or region; target generation exploration
Advanced Product Engineering Research and development ***focusing*** on product lines	**Advanced Exploration** Exploration and discovery ***focusing*** on quality economic orebodies incorporating geology, mine engineering, metallurgy and economics focusing on the product
Product Engineering Adapting the product concepts for use in products	**Mine Engineering, Mineral processing and Geological Modelling** Preparing the product – reserves for mining and the market

TABLE 2. The Drug Development Process: What Happens and When, Compared with the Exploration and Discovery Process (Source: Pharmaceutical Research & Manufacturing Association)

			CLINICAL TRIALS				
	Early Research/ Preclinical Testing	Phase I	Phase II	Phase III	FDA Review Process/ Approval	On Market	Phase IV
Years	6.5	1.5	2	3.5	1.5	Took 15 years to get HERE	
Test Population	Test Tube and animal studies	20-80 healthy volunteers	100-300 patients	1000-3000 patients			Patients
Purpose	Look for safety, desired activity	Determine safety and dosage for next phase	Evaluate effectiveness, look for potential toxic side effects	Confirm effectiveness, look for side effects from long term use			Post marketing surveillance of the patients to look for potential problems
SUCCESS RATE	5000 Evaluated	5 compounds enter clinical trials			1 COMPOUND APPROVED		
MINING	EXPLORATION	PRE-FEASIBILITY			POSITIVE FEASIBILITY		ECONOMIC MINE

business, it is no more so than other industries. Therefore, it is worth considering what innovative approaches other R&D sectors have used to increase their chances of success.

The first-generation biotechnology firms revolutionized how drugs were made and also created a new kind of company environment. The focus was on productivity, not established corporate behavior. Scientists were supported by management and touted as the key ingredient for success. The biotechnology industry showed itself to be extremely adept at creating new ways to support the front end of the process—discovery. The industry became so successful that the large pharmaceutical companies now devote a hefty share of their R&D budget to supporting research within these smaller biotechnology companies (Robbins-Roth, 2000). It has long been recognized that managing R&D at a corporate scale often does not produce results proportional to the expenditure—you can't just throw money at it—and that smaller R&D companies are far more successful in this regard because they are motivated and focused. However, the same caveat applies, that exploration success will not necessarily be proportional to the large increase in spending in the junior sector (Metals Economics Group, 2005a).

In addition to investing in the biotechnology sector, the major pharmaceutical companies have tried to emulate their success by copying their structure and splitting their R&D into smaller, competitive divisions. Pfizer, the largest pharmaceutical company in the world with a £4.3 billion ($7.7 billion) R&D

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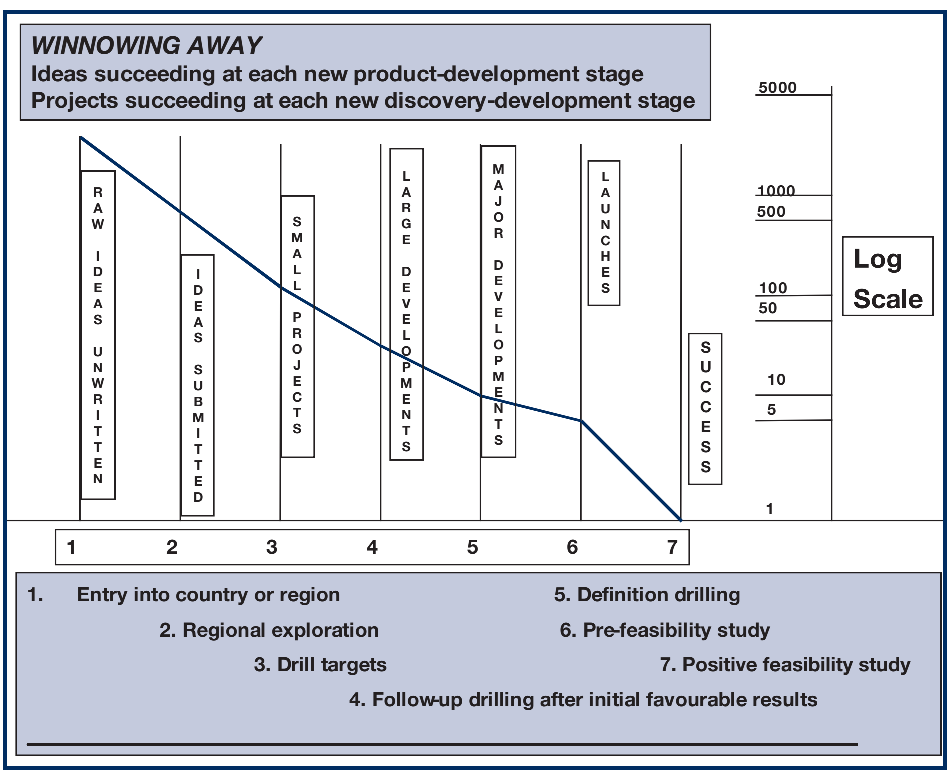

FIGURE 2. Winnowing away. Risk in all industries compared with risk in exploration and discovery in the mining industry. Adapted from Industrial Research Institute, 1999.

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budget in 2004, created eight separate "Discovery Sites" and a Central Development Site in 2000 with a view to maintaining the excitement of a small discovery unit (http://pfizer.com/pfizer/main.jsp). GlaxoSmithKline, the second pharmaceutical company with a 2004 R&D budget of £2.8 billion ($5.0 billion), also restructured their R&D in 2001 into six "international biotechnology companies" which would compete for resources and operate autonomously. These are called "Centres of Excellence for Drug Discovery" (CEDDs). The units are divided along therapeutic or disease lines (equivalent to commodities). Their job is to deliver drugs with "proof of concept" to GSK's drug development organization—in other words, their role is discovery. They describe the idea as being to maintain agility, entrepreneurial spirit, and individual accountability. The parent company will then carry out the high cost development (clinical trials, equivalent to reserve definition and feasibility study in the mining sector) in their Development Organization. At that time, GSK had a "less-than-ideal late-stage pipeline"—i.e., a lack of new discoveries—with 50 drugs at the trial stage. In a mining company, this equates to depletion of reserves and lack of new projects. By 2004 they were able to claim substantial R&D growth from 118 to 140 projects in clinical development between 2001 and 2004, including an 80% increase in "New Chemical Entities" in their pipeline. Building on the success of the CEDDs, they introduced six Medicine Development Centres (MDCs) in 2004 to integrate R&D with manufacturing and marketing in order to speed up the delivery of new products to the market (i.e., patients; GlaxoSmithKline, 2005).

However, in spite of high spending and innovative management of R&D, many of the big pharmaceutical companies are failing to deliver significant new products (Wood Mackenzie, 2005a), leading some analysts to question the current R&D focus on blockbuster drugs (those with sales of over $1 billion per year—read, world-class mines).

Yet there is a strong "junior" sector, well-funded biotech companies developing new ideas. Why should biotechnology companies share their ideas and potential development with companies that could be seen as competitors? It comes down basically to survival, and also that a major corporate partner provides credibility to that biotechnology firm's research.

Typical biotechnology/big pharmaceutical company deals include the following (Robbins-Roth, 2000):

- An up-front licensing fee that gives the big pharmaceutical partner rights to use the technology;
- R&D funding for the life of the agreement (typically 3 to 5 years, initially), which covers the people and supplies used by the biotechnology partner to carry out the work;
- Milestone payments that give the biotechnology partner rewards for moving the project forward and reaching benchmarks that are significant for product commercialization (for example, filing for FDA permission to start clinical testing, starting Phase I / II / III trials, filing for marketing permission, product launch);
- A purchase of equity in the biotechnology partner by the big pharmaceutical partner.

The last point is not always included. Robbins-Roth (2000) points out that the big pharmaceutical companies do not always see stock as useful commodity, and usually buy shares only because the biotechnology firm wants them to.

The amount of money a biotechnology company can command for each of these points is very dependent on the perceived quality of the company and its technology; i.e., whether the technology is seen as "cutting edge" or the third runner-up in an area, how crucial the technology is to the big pharmaceutical's internal strategy, and how hungry the big pharmaceutical partner is for new product candidates to fill its pipeline.

Although associations between major mining companies and exploration companies are becoming more common, there is a need for innovative financing models that require less capital to get to discovery, which means that we need management teams that can do more with less.

The oil business is in a similar situation to mining, with a decline in reserves considered to be partly responsible for the oil price reaching over $70 per barrel recently. Oil companies are no longer replacing reserves through new discoveries (Wood Mackenzie, 2005b). Exploration spending is at two-thirds of the 1998 level, resulting in a 50% decline in reserve replacement. The reduction in exploration spending has been caused by growing technical risks and uncertain oil prices, and while this has resulted in good returns for the companies, it has been at the cost of reserve depletion. This is due to the philosophy of "capital discipline" which has been in vogue since at least 1998 when the oil price last crashed (Brethour, 2004). This is a conservative strategy of risk-avoidance which focuses on the short-term returns of quarterly results at the expense of building reserves. As a result, exploration spending is 73% of six years ago in the top 10 listed oil companies, down from $11 billion in 1998 to $8 billion in 2003. In relative terms, the fall has been even greater, with the average annual exploration expenditure per unit of production falling from US$1.70/barrel of oil equivalent (boe) to US$1.00/boe between 1998 and 2003. This is at a much lower level than the mid-cap peer group where relative spends have fallen from US$2.80 to US$2.50/boe (Wood Mackenzie, 2004).

THE BUSINESS OF EXPLORATION: MANAGING FOR SUCCESS

Many articles have been written on the ingredients required for success in exploration (e.g., Miller, 1976; Bailly, 1979; Frost, 1980; Eggert, 1993; Sillitoe, 1995; Stevens, 1996). Sillitoe (1995), in analyzing the case histories of the 54 most important discoveries made in the Circum-Pacific region from 1970 to 1995, concluded that the most important elements were the following: long-term exploration, systematic and well-planned, scientifically grounded programs, quality of the geological team; competitive remuneration to attract and retain the right people, and rock contact time of those quality people. Yet from our experience, many companies pay only lip service to these ingredients.

The importance of people is a recurring theme in analysis of exploration success. Stevens (1996, p. 37) wrote that "... best people, in my experience are the only competitive exploration advantage." The best people are a company's distinctive capability. For the purposes of strategy, the key distinction is between distinctive capabilities and reproducible capabilities (Kay, 2000). Distinctive capabilities are those characteristics of a company that cannot be replicated by competitors, or can only be replicated with great difficulty, even after competitors realize the benefits they yield for the originating company. In terms of exploration management, one must identify the distinctive capability of the company, i.e., quality people, and seek to surround them with a collection of reproducible capabilities or complementary assets that enable the company to sell its distinctive capabilities in the market in which it operates; e.g., exploration focused in a certain region or deposit type.

If people are such a key component for success, one would consider that the major companies are in the best position to attract such people by offering lucrative remuneration packages. However, this is no guarantee. Due to the structure in such established firms, innovation is often difficult. Firms may employ the most capable people, but then set them to work within processes and business models that doom them to failure, a problem not unique to the mining industry (Christensen and Overdorf, 2000), which is being addressed in the big pharmaceutical industry, as discussed above.

The other factor to consider is that, with the market upturn, the mining industry is now short of skilled people. Many experienced geologists left the industry during the past decade, either released by the major companies in mergers and cost-cutting, or forced to seek alternative employment by the lack of financing during the severe downturn in the junior sector. In addition, universities have cut back on geology and related degree programs, so there are fewer new graduates coming into the business.

On the understanding that the quality of the geological team is vital for success, how can management of this critical element further enhance a company's competitive advantage? Economic geologists fit a category of employee defined as the *knowledge worker* (Drucker, 1999). They own their "means of production," which is their knowledge. An increasing number of people who are full-time employees, such as knowledge workers, have to be managed as if they were volunteers (Drucker, 1999). Volunteers have to get more satisfaction from their work than paid employees, precisely because they do not get a paycheck. Knowledge workers are paid, of course, but they have mobility. They can leave. Money alone does not motivate people to perform, although dissatisfaction with the money earned grossly demotivates. Knowledge workers need, above all, challenge. They need to know the company's mission and to believe in it. They need continuous training. They need to see results. Drucker (1999) believes that the productivity of the knowledge worker is likely to become the focus for the management of people. But in terms of exploration groups, as in R&D, one does not "manage" people so much as lead them, and the goal is to make productive the specific strengths and knowledge of each individual. It is in this context that the big corporations, even if they maintain exploration teams, are less likely to be successful.

However, assembling a quality team of geologists is not enough. As pointed out by Sillitoe (1995), their value is enhanced by maximizing the rock contact time of the exploration team. It is often stated that the high cost of exploration is one of the main disincentives for exploration. However, if people—the geological team—are one of the critical factors in exploration success, this is actually a relatively low-cost investment. Essentially, the systematic testing of ideas is what enables E&D companies to discover and define resources. What is critical in E&D is that unpromising properties are eliminated at the earliest possible time before expenditure becomes too high, instead of becoming an expensive mistake. This equates to Dow's (2002) conclusion that if exploration geologists are to play a leading role they have to understand the real business difference between ore and mineralization.

In terms of managing for success, comparison with R&D is critical. Management publications need to be continually reviewed for ideas. An example is a recent article by Thomke (2001) which has some very enlightening pointers for the E&D sector. Briefly stated, the writer points out that innovation requires the right R&D (E&D) systems for performing experiments (fieldwork) that will generate the information needed to develop and refine products (resources, reserves) quickly. The challenges are managerial as well as technical:

1. Organize for rapid experimentation: for E&D, organize for rapid exploration;
2. Fail early and often, but avoid mistakes;
3. Anticipate and exploit early information;
4. Combine new and traditional technologies.

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Under the first point, the main objectives are to examine and if necessary revamp entrenched routines, organizational boundaries, and incentives to encourage rapid exploration.

The second point emphasizes the necessity to embrace failures that occur early in the development process (exploration program) and advance knowledge significantly. A critical yet difficult concept for management to understand, and even more so for investors, is that failures should not be confused with mistakes. Thomke (2001) points out that mistakes produce little new or useful information and are therefore without value. A poorly planned or badly conducted experiment (exploration), for instance, might result in ambiguous data, forcing researchers (explorationists) to repeat the experiment (drill again). Another mistake for example, is repeating a prior failure or being unable to learn from that experience. Unfortunately, even the best organizations often lack the management systems necessary to distinguish carefully between failures and mistakes.

The third point is probably the most significant. Thomke (2001) uses IDEO, a leading design firm in Palo Alto, California, as an example of following the principle of the three Rs: Rough, Rapid, and Right. The final R recognizes that early prototypes may be incomplete but can still get specific aspects of the product right. In terms of E&D, this could be re-phrased as "recognizes that early exploration models may be incomplete but can still get specific aspects of the style of mineralization, the important controls on that mineralization, and the spatial scale right." Establishing such a process generates important information when it is most valuable: at the early stages of exploration. For the investor, the importance of adding value (i.e., to the asset of the company) or a property is good news. In addition to saving time and money, exploiting early information helps product developers (explorationists) to keep up with customers' (major mining houses) preferences that might evolve over the course of a project.

Thomke (2001) introduces the benefits of "front-loaded development"—i.e., solving problems early. In terms of an exploration project, this requires the input of mining engineers, metallurgists, legal-fiscal back-up, as well as geology to determine if a specific property (product) will make it to the market (major mining houses). The solving of problems early equates to shortening the time frame of exploration.

Lastly, Thomke (2001) notes that the increased automation of routine experiments will not remove the need for the human element in innovation. However, he points out that automation will allow people to focus on areas where their value is greatest, i.e., in generating novel ideas and concepts, learning from experimentation, and ultimately making decisions that require judgment.

In E&D terms, advances in database management and better geochemical and geophysical data do not remove the human element in exploration. However, they do allow geologists to focus on interpreting their data better, learning from on the ground exploration, and ultimately making decisions on the economic potential of a prospect or area. The value of the geologist as a knowledge worker actually increases, because he is, firstly, in a position to use his knowledge to decide if the data are of value, especially if the data are from an area he is familiar with. Secondly, they can focus on target areas with potential, rather than doing routine fieldwork to define targets. Finally, the geologist knowledge worker is in a position to turn over prospects rapidly in order to define quality targets, thus focusing on shortening the time from exploration to discovery.

CONCLUSIONS

Mineral exploration, although intimately linked with the mineral extraction and processing industry, is a distinctive business sector. E&D is the R&D sector of the mining industry, and can be defined as the generation and application of scientific knowledge to the discovery of new orebodies, either by grassroots exploration or in the vicinity of existing mines.

There is a shortage of new precious and base metal exploration, development, and production projects in the pipeline. This shortage could significantly reduce new mine development in the near future. This follows a six-year decline in exploration activity, and even though exploration expenditures have recovered in the past two years, the decline is compounded by the loss of senior geologists from the industry and the shortage of new graduates.

The exploration business needs to attract investment, and if exploration geologists are going to play a leading role in this business, they must innovate. The business must get better in terms of shortening the time frame to discovery, and being as cost effective as possible without wasting vital funds. It must also find better financial models and must learn to manage people better. People, i.e., the quality of the geological team, are the only competitive advantage an exploration company has over its rivals. The ability to motivate these people is a part of the innovative capacity that management must develop.

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