

Technical Program

Sunday, May 14, 2006

Wealth Creation: The Business of Exploration

Exploration – The Life Blood of the Mining Industry

Pierre Lassonde, President, Newmont Mining Corporation, Denver, CO USA

How Does Exploration Add Value?

Charles “Chip” Goodyear, Chief Executive Officer, BHP Billiton Ltd., Melbourne, Australia

Exploration – The Perspective of Wall Street

Geoff Stanley, Senior Analyst, BMO Nesbitt Burns, New York, NY USA

Wall Street provides the ultimate test of exploration success through market valuations. Industry has numerous valuation criteria and evaluation processes for use in making exploration investment and capital allocation decisions. More stringent SEC reviews increase the importance of definitive valuation of acquired properties. Discount rate considerations, the cost of capital, goodwill impact to balance sheets and evaluation concepts are discussed in relation to Wall Street's view of exploration and acquisitions, and their impact on company profitability.

Metals and Minerals: The Past 25 Years

Phillip Crowson, Honorary Professor, Center for Energy, Mineral & Petroleum Law and Policy, University of Dundee, Dundee, Scotland, United Kingdom

Review of trends in consumption and production of non-ferrous metals and precious minerals over the past 25 years, focuses on the main determinants of these trends including analysis of price movements, and has implications for corporate structures and profitability.

The Role of World-Class Deposits in Wealth Creation

Richard Schodde, Mineral Economist, and **Jon Hronsky**, Manager-Strategy and Generative Services, both of Mineral Exploration Team, BHP Billiton Ltd., Melbourne, Australia

“World-class” is widely applied to many discoveries and mines. However, through over-use its meaning is devalued. This paper reviews the current definitions of “world-class” and proposes using an NPV approach, as economic modelling found that much of the industry's wealth is captured in but a handful of mines. The impact of world-class mines on industry, and society, is examined.

The Exploration Philosophy of Rio Tinto – A Longer Term View of Value Creation

Tom Albanese, Chief Executive Officer, Copper and Exploration, Rio Tinto plc, London, United Kingdom

Creating sustainable competitive advantage and value is a core challenge for Rio Tinto businesses. The company's track record of discovery and development of world-class resources demonstrates that strongly focused exploration programs with clear priorities can ultimately deliver new high-margin businesses. Management focus should be on creating the conditions for sustainable, effective exploration.

Changing Industry Approaches to Sustainability

Ian Thompson, Principal, On Common Ground Consultants, Inc., Vancouver, BC, Canada

Susan Joyce, Principal, On Common Ground Consultants, Inc., San Isidro, Lima, Peru

The mining industry, and mineral exploration in particular, has evolved over the last decade in response to pressures to become a more integrated part of local society and economies – towards achieving sustainable development.

Sustainable Mining Development in Action: Rosia Montana, Romania, and Nui Phao, Vietnam

Jeremy P. Richards, Professor of Economic Geology, University of Alberta, Alberta, Edmonton, Canada

In the debate about sustainable development, many mining companies are leading as well as learning by doing. Enlightened explorers recognize incorporating sustainable development principles into their core activities is not merely a moral nicety, but may be essential if their activities are to continue.

Human Resource Strategies for the Minerals Industry – Careers, Competencies, and Compensation

Leigh Freeman, Downing Teal Inc., Denver, CO USA

Paul Bartos and **Maeve Boland**, Colorado School of Mines, Golden, CO USA

In the context of a profession undergoing significant change, more focus is being placed on economic geologists – specifically how to fully realize their human and commercial potential, both on individual and corporate levels. Social competencies are a key requirement for success within the minerals industry.

Changes in Mineral Exploration Practice: Consequences for Discovery

Richard H. Sillitoe, Consulting Economic Geologist, London, England, United Kingdom

John F.H. Thompson, Vice President Technology, Teck Cominco Ltd., Vancouver, BC, Canada

Exponential advances in data-processing technology rather than in the main exploration disciplines – geology, geochemistry, and geophysics – have facilitated many aspects of mineral exploration in recent years. Nevertheless, with the exception of covered terrain, discovery is dictated by tried-and-tested field methods, a situation unlikely to change in the foreseeable future.

Measuring Costs, Risks and Returns from Exploration – Improving the Success Rate

Michael Doggett, Professor, Queens University, Kingston, ON, Canada

Richard Leveille, President, Phelps Dodge Exploration Corporation, Mesa, AZ USA

Only 38 of 65 copper projects developed from 1992-2004 cover an 8% cost of capital; just 14 generate sufficient returns to offset their cost of discovery. Returns are inversely proportional to exploration duration – they decrease with exploration maturity. The case of Chile shows that exceptional deposits with positive returns to exploration are found early in the exploration play.

Making Better Decisions and Generating Greater Value in Mineral Exploration

Michael Etheridge, Oliver Kreuzer, Gillian Lucas, Maureen McMahon and Colin Wastell, Macquarie University, Sydney, Australia

Mineral exploration is a simple business: Money is invested in a number of trials (projects), and returns are generated from infrequent, but potentially high-value, discoveries. The main levers of the business are the expected (average) probability of success, the number of trials, the average investment, and the likely value per discovery. A probabilistic model of this business has implications for exploration decision making, and the use and abuse of science, technology and exploration methods.

Reserves, Resources and Reconciliation

Harry M. Parker, AMEC, Sparks, NV USA

Successful evaluation and developing of mineral deposits use geologic ore controls as part of the explorationist's deposit models, which are also used in grade (and density) interpolation. To be successful, resource estimation, reserve declaration and reconciliation must be cognizant of mining selectivity. Geological risk assessment is key to making sure sufficient data are in-hand to proceed. Geostatistics is not a replacement for geological understanding.



Bingham Canyon

Monday, May 15, 2006

Wealth Creation: Generating and Delivering Wealth

Wealth Creation through Joint Ventures

Norm Keevil, Chairman, Teck Cominco, Vancouver, BC, Canada

Exploration Business Strategies and Relationships within the Major Mining Company and Junior Exploration Sectors

William Mercer, Falconbridge, Toronto, ON, Canada

Robert Schafer, Hunter Dickenson, Vancouver, BC, Canada

At times of high prices, the number of junior exploration companies grows and their activity feeds into the work of the majors. Junior companies typically operate in high-risk geologic, geographic and political environments, while majors largely focus on growth, adding reserves at existing operations. The relationship between these groups changes as new exploration frontiers are pioneered.

Challenge and Prosper: The What, Why and How the Goldcorp Challenge Worked

Rob McEwen, Former Chairman, Goldcorp, Inc., Toronto, ON, Canada

The Goldcorp Challenge brought brainstorming to a global level, and the world of mining into the 21st century. Goldcorp posted its Red Lake

Mine geological database onto the Internet and asked the world "where will we find the next 6 million ounces of gold." Over 1,400 individuals worldwide downloaded the dataset and 41 submitted their conclusions. The winner came from Australia, without ever setting foot on the property!

New Initiatives in Geometallurgy

Karin O. Hoal, Colorado School of Mines, Golden, CO USA

Terry McNulty, T.P. McNulty and Assoc., Inc., Tucson, AZ USA

Roland Schmidt, Hazen Research, Golden, CO USA

In exploration programs and in existing operations, geometallurgical methods can reduce operating costs through the early identification of process attributes, a reduction of characterization steps, improved communications, and better information flow. New initiatives combine geological domain mapping, metallurgical core logging, and applying metallurgical advances to exploration target identification and strategy.

Mapping Metallurgical Responses: A Systematic Approach to Ore Typing for PT Freeport Indonesia's Grasberg-Ertsberg District Ore Bodies

George MacDonald, Vice President Exploration, Freeport-McMoRan Copper and Gold, Inc., New Orleans, LA USA

Thomas H. McCord, Senior Metallurgical Engineer, Crescent Technology, Inc., New Orleans, LA USA

Definition of metallurgical throughput and recovery characteristics are fundamental to the appropriate valuation of ores. PT Freeport Indonesia uses a comprehensive set of procedures to cost-effectively move from initial geologic observations to the application of "metal recovery expectations" into the resource model, and ultimately the mine plan.

Timing is Everything – Almost: The Optimization of Lac des Iles

Andre Douchane, President and Chief Executive Officer, North American Palladium, Inc., Toronto, ON, Canada

From discovery through to operating mine in July of 2001, Lac des Iles' timing was nearly perfect. Palladium prices were at historic highs of \$600; and the new 15,000 tpd mill was declared commercial. All seemed well timed – until the primary crusher failed in August of 2002. Operating costs began to rise sharply, and free cash was becoming a problem. So what happened?

Value Creation in Near-Mine Development Programs at Newmont's Nevada Gold Operations

Leroy Schutz, Director, Minesite Exploration, Newmont Mining Corp., Denver, CO USA

The investment of technical research into reconciliation investigations at Newmont Gold led to new concepts and practices which highlighted opportunities for large increases in both revenue and gold reserves. During 2002 alone, over \$65 million in incremental revenue was added to the Gold Quarry "south layback" mine plan through such studies. At Lone Tree, Kriged polygons and controlled blast heave captured millions of dollars through improved mining efficiencies.

Exploring the Data – Adding Value with Non-Traditional Geologic Initiatives on Minnesota's Mesabi Range

Michael Orobona, Senior Geologist, Hibbing Taconite Co., Hibbing, MN USA

A mine geologist's opportunity for wealth generation is often limited to incremental reserve additions. The mine geologist, therefore, risks becoming task oriented rather than value driven. However, commonly large amounts of geologic data are collected but not evaluated. Optimizing mine-to-mill efficiency through the Total Ore Processing Integration and Management System aims to reduce costs and provides continuous optimization of the mining process by feedback from downstream mill performance.

Bones of Contention – Current Controversies in Assay Quality Control Practices

Scott D. Long, Chief Geochemist, AMEC, Phoenix, AZ USA

Within the mining industry, interest in Quality Control issues spiked after the Bre-X scandal. Now, there are “quality ounces,” and press releases support the validity of assay data by use of “qualified persons,” and the report being “TSE 43-101 compliant.” Beyond this increased awareness there are many points of disagreement about what constitutes “best practice” and “acceptable practice.” Quality control is about limiting and quantifying uncertainty (risk).

Turquoise Ridge and Cortez Hills – A Comparison of Economic Outcomes

G. A. Handley, Executive Vice President-Strategic Development, Placer Dome Inc., Vancouver, BC, Canada

Placer Dome acquired Turquoise Ridge through a corporate takeover in 1999 and discovered Cortez Hills through grass-roots exploration in 2003 following a strategy of owning high-potential exploration ground around existing ore-treatment infrastructure. Each deposit contains around 6 Moz gold (Placer share) in reserves and resources. Although the present values of cash flows from each mine to Placer today are similar, the Cortez Hills exploration discovery has a higher return on investment as well as creating significant additional market value for the company.

Discovery of the Yandal Gold Province: Integration of Empirical and Predictive Geoscience with Intense Exploration Activity

G. Neil Phillips, Former Head of CSIRO Exploration and Mining, Melbourne, Australia

Despite being only 50 km from the million-ounce Wiluna gold mine, the Yandal belt, Western Australia, was overlooked for nearly a century. During the 1990s, exploration activity involving university and industry geoscientists resulted in the greenstone belt being recognized as a substantial gold province, which now holds discoveries aggregating over 15 Moz of gold.

Creating Wealth by Innovation: SX-EW and the Technology Cycle

Paul J. Bartos, Colorado School of Mines, Golden, CO USA

Solvent Extraction Electrowinning (SX-EW) processing of copper ore is an example of identifying, adopting and modifying technologies developed outside a discipline and creating wealth through application elsewhere. Using organic solvents in SX-EW transformed the US copper mining industry, helping producers re-attain and maintain competitiveness for more than a decade before the process was widely adopted by Chilean competitors.

The Merensky and UG2 Reefs at Winnaarshoek, Eastern Bushveld – Review of Exploration and Feasibility Programs

Roger N. Scoon, Former Director, Exploration Manager, Platexco, Inc., South Africa and **Andrew A. Mitchell**

An intensive exploration program at Winnaarshoek during 1997-2000 delineated economically mineralized Merensky reef and UG2 chromitite layer. A bankable feasibility study reported 80 M tonnes of ore resources containing some 17 Moz 3PGE+Au, with average grades of 6.14 g/t and 7.05 g/t 3PGE+Au, for Merensky and UG2, respectively. Platexco was purchased by Implats, which during 2002 commissioned this as the “Marula” mine.

Tuesday, May 16, 2006

Wealth Creation: Case Histories

Wealth Creation Through Sustained, Successful Mineral Exploration – The WMC Experience

Barton J. Suchomel, Principal, Western Mining Services, LLC, Englewood, CO USA

During a 55-year period (1950-2005), WMC Resources Ltd. created significant wealth and economic development throughout Australia by discovering 149 separate deposits, over 60% of which became mines. WMC’s management understood the risk-reward of mineral exploration, and through a multi-disciplinary team approach were transformed from a small regional gold miner to a major diversified company worth over A\$ 9 billion in mid-2005.

The Vagaries of Wealth Creation through Acquisition & Exploration: The Hope Bay Project

Stephen P. Quin, Executive Vice President, Miramar Mining Corp., Vancouver, BC, Canada

The Hope Bay Project is the largest undeveloped high-grade gold deposit in Canada. This paper reviews the costs of acquisition and a sustained exploration program, illustrating the tremendous leverage exploration can provide in creating wealth “in the ground,” and contrasts this to the stock market’s response to that success, showing how other factors can overshadow simple exploration success.

Wealth Creation through Exploration: The Codelco Experience 1990-2005

Francisco Camus, Codelco, Santiago, Chile

Sergio L. Rivera, Exploraciones Mineras Andinas SA, Santiago, Chile

After the exploration successes of 1976-1990, Codelco decided to focus on creating a centralized corporate unit focused on adding value by way of incremental additions to the mineral resource base. As a result, during the period 1991-2004, US\$287 million was invested generating 6 discoveries with an expected NPV exceeding US\$1,100 million.

Uranium Market Fundamentals and Exploration Success: Cameco's Strategy

Colin Macdonald, Vice President Exploration, Cameco Corporation, Saskatoon, SK, Canada

The uranium price rise of the past two years has resulted in a remarkable shift in industry thinking on the health of uranium supply. Many have moved from believing supply was vigorous, to thinking near-panic that the commodity is analogous to an endangered species. Reality is that new investment is stimulated by higher prices. This paper examines “Are higher prices helping supply?”

Aber Diamond Corporation: Exploration Success to Holistic Diamond Company

Robert Gannicott, Chairman and Chief Executive Officer, Aber Diamond Corp., Toronto, ON, Canada

Aber was built on the dream of finding and mining diamonds in the Canadian North. That goal has been realized, and today Aber markets diamonds from one or the world’s premier diamond mines, the Diavik Project, NWT. Diavik will produce 6 – 8 M carats annually, approximately 7% of world supply.

SEG SPECIAL PUBLICATION No. 12

“Wealth Creation in the Minerals Industry” will be on sale for the first time at this conference!

Technical Program (continued)

History of Exploration and Development of the Aruntani District, Southern Peru – Efficiency Leads to Profitability

Guido del Castillo, Chief Executive Officer, Aruntani SAC, Lima, Peru

The Aruntani district, Peru, lies at approximately 5000 m elevation and was assessed by several majors during the 1990s. Despite extensive alteration, the region was thought unprospective due to hosting the “wrong” volcanic sequence, and being outside any known metallogenic belt. Work by Aruntani SAC discovered two gold mines now in development, both within 44 months time.

Creating Value with Royalties

Steve Aaker, Group Executive-Royalties, Newmont Capital Ltd., Denver, CO USA

The history of royalty companies, the types of royalties used and the concept of royalty creation as a financing alternative are reviewed. Royalties repay project investment out of production revenues with no restrictive covenants. Royalties can add credibility to a project with minimal project or shareholder dilution.

Case History of Wealth Creation Measured by the Metric of Share Price

Ross Beaty, Chief Executive Officer, Lumina Copper, Vancouver, BC, Canada

Lumina Copper Corp. presents a classic case history of wealth creation through market cycle acquisition timing (buying assets when copper prices were low), world-class resource discovery and financial engineering to optimize market valuation.

The Discovery of the Ekati Diamond Deposit

Oliver Warin, Consulting Geologist, San Anselmo, CA USA and former Vice President Exploration, BHP Billiton (retired)

The key components of an exploration success story are: a geologist (of great tenacity); a good idea (and a strategy based on that idea); and a good money supply (and someone to ensure that). In Hugo Dummett, BHP found a born discoverer who introduced BHP to Diamet’s Canadian diamond

project – an exploration program Dummett had initiated while with Superior Minerals many years before. Success relied on keeping the project alive (and funded!) within BHP.

Discovery of Oyu Tolgoi Cu-Au Deposit, South Gobi, Mongolia

Douglas J. Kirwin, Executive Vice President Exploration, Ivanhoe Mines Ltd., Bangkok, Thailand

Outcropping oxide copper was found at Oyu Tolgoi during the Bronze age, and in 1996 Magma Copper recognized the porphyry style mineralization with leached cap at Central Oyu. After a partial drill test during a 2-year program, Ivanhoe Mines acquired the property and through additional drilling identified the gold-rich porphyry system at Southwest Oyu. Further drilling based on IP chargeability anomalies discovered the blind, high-grade hypogene copper-gold Hugo Dummett deposit.

Sustainable Development at Oyu Tolgoi

R. Edward Flood, Deputy Chairman, Ivanhoe Mines Ltd., Vancouver, BC, Canada

Oyu Tolgoi will have an important impact on the Mongolian economy and the fiscal position of government. Planned expenditures total in-excess of US\$5.6 billion over the period 2002 to 2043, representing a substantial increase in capital expenditures for the economy. More than 10 thousand person years of construction employment and 38 thousand person years of export-related employment are created over the life of the project, both dominated by Mongolians. GDP is estimated to increase on-average almost 35 percent, and national employment by just over 10 percent. The development of local firms to supply Oyu Tolgoi with many of its production inputs (such as electric power) would also increase the sustainable impact of the project on the economy. Overall, estimates show the project leads to a sharp increase in domestic economic activity, and productivity.

Conference Wrap-up

Stephen Enders, Newmont Mining Corporation, Denver, CO USA
Stephen Kesler, University of Michigan, Ann Arbor, MI USA
John Thompson, Teck Cominco, Vancouver, BC, Canada

Poster Presenters

| | |
|------------------------------|---|
| C.H. Ash | Gold-quartz veins and placers of the Klondike gold fields, Yukon |
| S.B. Bartrop & P. Guj | Capitalizing on market valuation methodology changes |
| R.M. Baumgartner et al. | Fluid inclusion and isotope studies at Cerro de Pasco, Peru |
| A.B. Christie | Mineral potential of Maori land: Wealth creation for the indigenous people of New Zealand |
| J.H. Dilles et al. | Lessons from Butte, Montana: Research applied to exploration and mining |
| R.L. Gordon | An economic look at the impact of new technology applied to exploration and discovery |
| D.J. Hall | Risk in exploration: Managing for success |
| R.J. Herrington et al. | Metallogeny of the Altai: New terranes for world-class orebodies |
| E.L. Hoffman & D. Sutherland | Soil-gas hydrocarbons applied to gold and kimberlite exploration |
| S. Hyseni et al. | Estimated geological resources of the Artana lead and zinc mine |
| S.M. Jovic et al. | Exploration potential for sulfide-rich vein deposits in Patagonia of Argentina |
| K.J. Maiden | The Lady Annie-Mount Kelly copper deposits, northwest Queensland |
| V.T. McLemore & J.M. Barker | Sustainable development and social license for mining operations in New Mexico |
| P. Moreira et al. | Epithermal gold-silver vein exploration, La Josefina project, Argentina |
| P. Redmond | Ten years of mineral exploration in Mongolia: A case study |
| S.D. Redwood et al. | Gold discoveries by geochemical exploration in the Dominican Republic |
| G. Rivera V. & J. Martin M. | Economic impact of a mining company in Antioquia Province, Colombia |
| A. Rozendaal & C. Philander | Recovery of sterilized heavy mineral resources at the Namakwa, South Africa |
| B.G. Rusk et al. | Sulfide minerals in porphyry copper and epithermal ores of Butte, Montana |
| T. Shimizu & M. Aoki | Japan's largest polymetallic deposit: Toyoha mine, southwest Hokkaido |
| D.J. Szumigala et al. | Wealth creation begins with geological information in Alaska |
| P.I. Warren et al. | Whole-rock geochemistry applied to exploration for epithermal gold-silver deposits |
| A.Yaghubpur & M. Motallebi | Talkheh epithermal copper deposit, Central Iran |
| A.Yaghubpur & M. Motallebi | Evaporite minerals in Khur and Biabanak Playa, Central Iran |

Poster Topics

General poster session will include 50+ posters from the student conference!