

# Northwest Mining Association Presents

## Rocks to Riches...

*and meeting the challenges between*

117th Annual Meeting, Exposition & Short Courses

November 28 - December 2, 2011

John Ascuaga's Nugget Casino Resort

Sparks, Nevada

# Technical Session Abstract Book



Convention Chairmen

**Jeff Parshley**

*Principal Geologist*

*SRK Reno*

*Reno, NV*

**Neil Eurick**

*VP Business Development, Metals & Mining*

*Celerant Consulting, Inc.*

*Denver, CO*

2011 Abstract Book  
Table of Contents



**W**ednesday, November 30, 2011  
*Morning Sessions 8:00 - 11:30 am*

- Responsible Mining: Just what does that mean? ..... 2 - 4

*Afternoon Sessions 2:00 - 5:30 pm*

- Exploration, Development & Mining in British Columbia ..... 5 - 12
- USGS Mineral Resource Studies in the International Arena ..... 12 - 15
- What's Being Done to Improve the Health & Safety of Miners? ..... 15 - 17
- Challenges with CERCLA & Abandoned Mine Lands - Technical & Legal Challenges ..... 17 - 20

**T**hursday, December 1, 2011  
*Morning Sessions 8:00 - 11:30 am*

- Nevada Prospectors Forum - Part I ..... 21 - 25
- Alaska - Beginning to Show its True Mineral Potential ..... 25 - 30
- International Project Environmental and Social Performance ..... 31

*Afternoon Sessions 2:00 - 5:30*

- Traditional Large Left Lateral Leaps ..... 31 - 34
- Underground Operations - New or Novel Mining Methods to Improve Overall Mining ..... 35 - 37

**F**riday, December 2, 2011  
*Friday Sessions 8:00 - 11:30*

- Nevada Prospectors Forum - Part II ..... 37 - 41
- Power Session: Energy Opportunities in Mining ..... 41 - 42
- Open Pit Mining ..... 42 - 43
- Groundwater Issues in Mining ..... 44 - 47

**Note: Only sessions with abstracts have been printed in this booklet.  
For a complete listing of the sessions offered refer to the Final Program.**

Wednesday November 30, 2011

Morning Sessions - 8:00 - 11:30 am



**RESPONSIBLE MINING: Just what does that mean?**

**Chairs: Dr. Falma Moye Cullianane**, *Geologist, Hecla Mining Company, Coeur d'Alene, ID*

**Paul Glader**, *Environmental Manager, Hecla Mining Company, Coeur d'Alene ID*

**Sustainability Reporting – Where is the value?**, *Luis A Plancarte, Community Relations Manager, New Gold, Inc., El Centro, CA*

In today's ever more restrictive business environment, companies are faced with the realities of an overabundance of complex laws, codes, standards, and corporate guidance directives. Corporations are tasked with public disclosure and transparency, while responsibly guarding their rights, and pursuing equitable treatment of ALL stakeholders.

How can companies add value and bring rhyme and reason to this sometimes overwhelming challenge through sustainability reporting? What are the benefits and drawbacks of reporting?

New Gold, Inc. adheres to reporting guidelines set forth by the Global Reporting Initiative (GRI). GRI is a network-based organization that produces a comprehensive sustainability reporting framework, widely used around the world.

GRI's reporting framework provides disclosure guidelines for: management, increased comparability and reduced costs of sustainability, brand and reputation enhancement, differentiation in the marketplace, protection from brand erosion resulting from the actions of suppliers or competitors, networking and communications.

Sustainability Reporting can become a useful benchmarking and corporate governance tool plus an avenue for long term dialogue with other reporting organizations.

How can your company benefit from Sustainability Reporting? This talk will discuss the benefits, challenges, and some potential drawbacks to Sustainability Reporting as well as consider various levels of Reporting.

**RESPONSIBLE, GREEN AND SUSTAINABLE MINING PRACTICES -- RECENT DEVELOPMENTS**, *Jeffrey S. Conner, Esq., Conner & Associates, P.C., Reno, NV*

Many business, community and political leaders categorize a "responsible" mining company as one that strives to increase the positive results of its business (e.g., jobs) and reduce the negative ramifications of its activities (e.g., environmental impact). The concepts of Green building and sustainability have generally taken root in the American psyche and culture, but do these concepts apply to mining? More importantly, *can* they apply to mining?

In an article published in The Federal Corporate Ethics Monitor, the author poses the question “Is Mining Sustainable?” He goes on to state, “This is also an industry that consumes vast amounts of energy and produces massive quantities of waste.”

I do not believe that the mining industry is in effect a lost cause. In fact, there are many positive steps and best practices management strategies that owners can and are using to make mining increasingly green, sustainable and “responsible.”

In 2004, The Mining Association of Canada began implementing a program called “Towards Sustainable Mining,” a call to action for Canadian mining companies to act in a more socially and environmentally responsible manner.

In 2007, Colorado-based Newmont Mining Co. became the first gold mining company to be listed on the prestigious Dow Jones Sustainability Index, an index of companies with a commitment to environmental concerns and protection.

At the 2010 International Bar Association conference, the Model Mining Development Agreement (MMDA) was introduced. Its aim is to encourage sustainable development through a template agreement geared towards mining companies and host countries. The MMDA recognizes the fundamental role that such investment plays in the growth of many economies and, in turn, the improvement of living standards in local communities.

In 2011, a California company developed a biodegradable composition that can be applied onto soil or gravel surfaces to control dust, stabilize the top surface, and seal tailings. The emulsion does not cause its own toxic leaching nor adversely affect wildlife, and reportedly prevents the process of acid mine drainage.

Currently, mining industry leaders are focusing on five key themes of research regarding sustainable mining practices: footprint reduction; innovation in air, water and waste management; materials recovery; ecosystem risk management; and mine closure and rehabilitation (some scientists refer to this concept as “industrial ecology”).

This session will focus on recent developments and case studies in the application of responsible, green and sustainable business practices to mining activities. Do the concepts and goals of green and sustainability apply to the mining industry? For today’s many responsible mining owners, the answer is yes they can, and yes they do.

**Can Environmental Stewardship and Profitable Mining Co-exist?,** *Randy Brandt, P.G., Principal, Geosyntec Consultants, Oakland, CA*

The rising price of precious metals has breathed new life into the mining industry and as a result, new mines are emerging and idle or abandoned mines are being reactivated. The cost and effort of planning and incorporating environmental controls into mine operations can be a tough pill to swallow; however, if environmental controls are not effectively planned and implemented, the staggering cost for mitigating environmental damage can be a major blow to profits of even the most successful companies. This presentation promotes a different paradigm for mine operations planning that emphasizes the implementation of

*(continued on next page...)*

**RESPONSIBLE MINING: Just what does that mean?... (continued)**

*Can Environmental Stewardship and Profitable Mining Co-exist?*

state-of-the-practice and cost effective environmental controls and management practices at the early stages of mine planning and operations. These controls and practices, when focused on the goal of environmental stewardship, may require higher upfront costs for engineering and capital improvements but the return on investment comes in the form of lower back-end closure costs, reduced long-term environmental liability, and better public image. These benefits in turn result in lower closure/post closure financial assurance bonds, better corporate image with the public, more cooperative working relationships with environmental regulators, and higher profit margins, among other key benefits.

This paper discusses some of the proactive operational practices and facilities that can be incorporated into mine planning and presents case histories that support environmental stewardship and result in substantial benefits, including life-cycle cost savings. Proactive environmental controls that will be discussed include:

- Properly designed containment facilities for tailing ponds, surface impoundments, heap leach pads, evaporation ponds, and waste rock piles.
- Appropriately designed groundwater and surface water monitoring systems around process, operations, and waste management areas.
- Surface water/stormwater controls incorporating best management practices.
- Forward planning strategies to manage and maximize water resource assets at mine sites.

Case studies will be presented that show the high cost of closure as a result of minimal environmental controls in contrast with cases that show Life-cycle cost savings as a result of proactive environmental controls.

**A Sustainable Mining Case Study: Molycorp**, *Scott Honan, Director Health, Environment, Safety and Sustainability, Molycorp Minerals, Greenwood Village, CO*

The Mountain Pass Mine has gone through a substantial evolution over the past 20 years, starting from a recognition of the importance of basic compliance, to the present day, where the operating philosophy is based on environmental superiority. There have been distinct benefits to this evolution in both environmental and regulatory terms. These benefits were seen clearly during recent permitting efforts, where a broad base of stakeholder support has made it possible for the company to move ahead with a rare earth open-pit mining and production facility in the state of California.

Wednesday November 30, 2011

Afternoon Sessions - 2:00 - 5:30 pm



## EXPLORATION, DEVELOPMENT AND MINING IN BRITISH COLUMBIA

**Chairs: Dean McDonald**, *Vice President Exploration, Hecla Mining Company, Vancouver, BC, Canada*

**Tom Schroeter**, *P.Eng/P.Geo., President & CEO, Fjordland Exploration Inc., Vancouver, BC, Canada*

**British Columbia's Growing Mining Industry: Exploration, Development and Mining Highlights**, *Bruce Madu, Director, BC Mineral Development Office, Vancouver, BC, Canada*

The economic value of mineral production in 2011 is estimated at over \$6 Billion. Coal and copper continue to contribute most of the value. Gold, silver, zinc, industrial minerals and aggregate are also significant. A number of new mines are anticipated and most major metal and coal mines are undergoing expansions in light of the province's mineral and coal wealth and elevated commodity prices. Major infrastructure improvements are underway in the province as well. The extension of the power grid into the north-west of the province will provide a significant benefit to several large mine projects under consideration for development. Port capacity is also being improved to handle the anticipate rise in bulk shipments of mine products.

Five mines in the southeast coalfields continued to produce the majority of the province's coal. The resurgence of activity in the northeast coalfields continues with the operation of four mines and robust exploration at several projects including a feasibility study of reopening of the former Quintette mine. Expansions and further openings are under consideration in these coalfields as well. The Quinsam underground thermal coal mine is the sole producer from Vancouver Island and is proposing new developments to sustain production.

The majority of BC's metal production is from large tonnage open pit operations. Major expansion and/or modernizations are underway at the Highland Valley copper-molybdenum, Gibraltar copper and the Endako molybdenum mines. New resources are being developed that will significantly extend mine lives at the Huckleberry copper and Mount Polley copper-gold mines. The Copper Mountain copper-gold mine opened in 2011 whilst construction continues at the New Afton and Mount Milligan copper-gold mine development projects. The Kemess South gold-copper mine has concluded its operations; however, underground development is being considered for the Kemess North deposit which could see renewed mining at the site. At the Myra Falls underground zinc-copper-gold-silver mine production continues as ongoing exploration successfully replaces reserves. Smaller mines include the re-opened Bralorne and QR underground gold mines.

There are a large number of metal and coal mining projects at various stages of applying for government permits and environmental certificates. Given continued

*(continued on next page...)*

## **EXPLORATION, DEVELOPMENT AND MINING IN BC... (continued)**

### *British Columbia's Growing Mining Industry... (continued)*

strong commodity prices, government has anticipated up to 8 new mine openings and 9 expansions may emerge prior to the end of 2015.

Exploration levels attained very high levels in the year putting strains on many service providers to the industry and permitting processes. Very large programs were undertaken at several porphyry base and precious metals projects this year such as at the Woodjam, Brucejack and Snowfield projects. Similarly, bulk-mineable near surface gold and silver projects such as Blackwater-Davidson, and Spanish Mountain have attracted a lot of exploration capital and attention in areas of the province that have been underexplored or where new deposit models are being tested. Heightened interest in rare metals has sparked activity along the length of the Rocky Mountain carbonatite belt.

The BC Geological Survey conducted significant field programs in the northwest including the Dease Lake, Kutcho Creek, and Iskut River areas, and along the North coast between Prince Rupert and Bella Coola. A province-wide study on rare metals continued into its second year in collaboration with the Geological Survey of Canada.

### **The Spanish Mountain Gold Project, British Columbia, Canada, Judy Stoeterau, VP Geology, Spanish Mountain Gold Ltd., Vancouver, BC, Canada**

The Spanish Mountain Gold Project is wholly owned by Spanish Mountain Gold Ltd (the "Company"), a Vancouver-based public company listed on the TSX Venture Exchange ("SPA"). The project is located in southern central British Columbia near the village of Likely and approximately 90 km northeast of the City of Williams Lake.

The project area has excellent road and air access, currently operating mines (Mt Polley and Gibraltar), communities and provincial government supportive of mining and cheap energy costs. The Company has been working with local First Nations and other communities for about 3 years. The project lies in the traditional territory of two First Nations groups - the Company has signed a Memorandum of Understanding with one of the bands and is working with the second band to enter into a comparable agreement.

Gold mineralization on the project is hosted within middle Triassic to early Jurassic age meta-sediments of the Quesnel Trough. Sediments are typically black mudstone argillites (often graphitic) and siltstone/greywacke sequences with minor tuff units and form a generally northwest trending package. Gold typically occurs as discrete grains (occasionally visible) within quartz veins and also as fine disseminations within the host rocks. Silver

occurs in very minor amounts and the principal gangue mineral is pyrite (up to 6%). Previous exploration by others had focused on tracing the higher grade quartz vein hosted gold with limited success. The recognition of larger intervals of lower grade, potentially bulk-mineable gold mineralization occurred in 2003.

Since 2003, the Company has completed approximately 120,000 metres of drilling.

An initial NI 43-101 compliant resource was completed in 2008 with an update in 2009. A Preliminary Economic Assessment (“PEA”) was completed in late 2010. The scope of the PEA included a 40,000 tonne per day milling operation (grind and float) to recover gold from a pit design based on a gold price assumption of US\$ 950/ oz of gold. An updated compliant resource estimate was completed as part of the PEA and approximately 2Moz of gold would be recoverable from the conceptual pit resulting in a base-case of ten years of mine life with annual production of about 200,000 oz of gold and cash costs of less than US\$600 per oz gold. Sensitivity analysis within the PEA report indicate that if a pit design based on US\$1100 per oz were used, recoverable gold ounces would increase to 2.8 Moz resulting in a mine life of at least 14 years.

The Company has announced the start of a pre-feasibility study to better establish the scope and size of the project and not to refine the assumptions contained within the PEA. Consideration will be given to: 1) using a gold price assumption of US\$1100 per oz and 2) starting with a smaller mill for the first years of mine life and then expanding to 40,000 tpd for the remaining mine life. The project has also formally entered the Environmental Assessment process. The Company expects that, contingent of positive Feasibility Study results and the granting of mining permits, the project could commence production in Q2, 2014.

**Discovery and Exploration of the Woodjam Copper-Gold Project, Tom Schroeter, President & CEO, Fjordland Exploration Inc., Vancouver, BC, Canada**

Consolidated Woodjam Copper Corp’s (initially owned by Fjordland and Cariboo Rose shareholders 60%/40%) 56,500-hectare Woodjam property is located 50 km east of Williams Lake in central British Columbia. Gold Fields Canada Exploration currently has two separate option agreements on the Property: Woodjam North (July 2009) and Woodjam South (May, 2010). Gold Fields may earn up to a 70% interest in both Woodjam properties by expending approximately \$35 million, as well as delivering a feasibility study for the Woodjam South Property. During 2011, exploration expenditures at Woodjam were estimated at \$6 million, including approximately 30,000 m of drilling. Since 2001, approximately \$18 million has been spent by Fjordland/Cariboo Rose and Gold Fields on exploration at Woodjam.

The project area is located within the prolific Quesnel Trough, a large regional depositional belt hosting both alkaline and calcalkaline porphyry copper+/-gold+/-molybdenum deposits, extending for 2000 km from the US border through central BC to the Stikine River.

To date, four zones of porphyry mineralization (Megabuck, Deerhorn, Takom and Southeast) have been identified by core drilling (> 80,000 m in over 280 holes) in an area approximately 5 km in diameter. The Southeast and Deerhorn zones were discovered in late 2007 and late 2008, respectively. Several other targets remain to be tested.

*(continued on next page...)*

## **EXPLORATION, DEVELOPMENT AND MINING IN BC... (continued)**

### *Discovery and Exploration of the Woodjam Copper-Gold Project... (continued)*

The Megabuck and Deerhorn zones appear similar in style, with gold-copper mineralization being hosted by alkaline to subalkaline monzodioritic intrusive rocks and Nicola Group volcanic and volcanoclastic rocks. Mineralization at the Southeast Zone is calcalkaline in character, hosted in quartz monzonitic phases of the Takomkane batholith. The age of mineralization for all zones appears to be tightly constrained at 197 to 198 Ma; slightly younger than at the nearby Mount Polley copper-gold mine (203-205 Ma).

During 2011, infill and expansion drilling of 42 holes totalling 17,200 m were completed on the Southeast Zone over a core area measuring 900 m by 800 m by 400 m. Several holes bottomed in mineralization; previously, the deepest mineralized hole drilled was > 700 m. To the end of 2011, all but one reconnaissance drill hole of the 78 holes completed have intersected mineralization from the bedrock to the bottoms of the holes. Hole WJ08-84 assayed 0.69% Cu, 0.27 g/t Au and 0.006% Mo over 359.1 m, including 1.01% Cu, 0.44 g/t Au and 0.002% Mo over 200.8 m. A 43-101 compliant inferred resource is anticipated by Q1, 2012.

Elsewhere during 2011, additional drilling was completed on the Deerhorn and Megabuck zones, as well as on the Megabuck East and Tisdall Lake targets. At Deerhorn, hole DH11-32 assayed 0.18% Cu and 1.0 g/t Au over 207.5 m, including 0.29% Cu and 1.9 g/t Au over 90 m. At Megabuck, hole WJ04-32 assayed 0.14% Cu and 1.03 g/t Au over 274.9 m. Previous drilling on the Takom Zone included hole TK10-12 which assayed 0.41% Cu and 0.82 g/t Au over 61.9 m.

The discovery and advancements at the Woodjam Property have precipitated several other regional exploration programs in the area; more discoveries are expected.

### **A Review of the Red Chris Copper-Gold Porphyry Deposit, Northern British Columbia: Exploration to Development, Kevin MacKenzie, Project Manager, Imperial Metals Corporation, Vancouver, B.C.**

Imperial Metals' Red Chris property hosts a porphyry copper-gold deposit located 80 kilometers south of Dease Lake in northern British Columbia. When Imperial acquired the property in 2007, previous exploration indicated that Red Chris was a mid-sized, low-grade alkalic porphyry, typical of those in accreted island arc terranes in the Canadian Cordillera. In 2007 the initial hole of a deep drilling campaign intersected mineralization over its entire length of 1,024.1 meters, grading 1.01% Cu and 1.26 g/t Au. Subsequent deep drilling over a five year period has extended the higher grade Cu/Au mineralization from the base of the 400m deep open pit, with a current reserve of 301 million tonnes, grading 0.359% Cu and 0.274 g/t Au, to depths of 1200m. This was highlighted by drill hole RC09-350 which intersected 647.5 meters of 1.50% Cu and 2.68 g/t Au, including a particularly high-grade zone below the pit design, of 152.5 meters grading 4.12% Cu and 8.83 g/t Au.

As Imperial continues to explore the system at depth, a better understanding of the geologic context is emerging. Of significance is re-classification of Red Chris from alkalic to a high-K calc-alkalic system, a class to which many of the world's largest and highest grade Cu-Mo-Au deposits belong. Detailed analysis is resolving the subtleties between the porphyry phases and it is now recognized that mineralization was emplaced by a quartz monzonite porphyry, with mineralization extending into pre-mineral diorite wall rocks. High grade Cu/Au mineralization is associated with multi-stage A-style veins and stockworks, carrying chalcopyrite and bornite. The system is capped by moderate to intense sericite-quartz-pyrite and argillic alteration that overprints earlier potassic alteration (K-feldspar-biotite-magnetite).

The project is currently at the development stage, with construction of the open pit mine underway at a capital cost of C\$450 million. Production at 30,000 tonnes/day is scheduled for early 2014 in conjunction with the completion of the 287kV Northwest Transmission Line which will bring grid power to the northwestern region of British Columbia for the first time. While Imperial prepares for the development of the upper part of the system, exploration will remain focused on delineation and expansion of the deeper resource.

**Geology and Exploration of the Blackwater Gold Project British Columbia, Canada,** *Mark A. Petersen, VP Exploration, New Gold Inc., Centennial, CO*

The Blackwater Gold Project is a recently discovered gold deposit located on the north flank of Mt. Davidson on the Nechako Plateau in central British Columbia. The deposit was discovered by Richfield Ventures in 2009 which was subsequently acquired by New Gold Inc. in June 2011. The Blackwater mineral resource is currently estimated to contain 165 million tonnes averaging 1.01 g/t and containing 5.4 million ounces of gold in the Indicated category plus another 39 million tonnes averaging 0.94 g/t containing 1.2 million ounces of gold in the Inferred category.

Bedrock exposures in the immediate area of the Blackwater mineral resource are very sparse due to extensive post-mineral glacial till cover ranging from a few to several tens of meters in thickness. Current understanding of deposit geology is therefore based entirely on observations from drill core and to a lesser extent on data from airborne magnetics and ground-based IP-Resistivity surveys. Gold mineralization at Blackwater occurs as low (intermediate?) sulfidation epithermal style disseminated and stockwork sulfide veining hosted within late Cretaceous age Kasalka Group subaerial volcanics of intermediate to felsic composition. Individual lithologies include andesite flows, tuffs and breccias, flow banded rhyolite and rhyolitic ash tuffs, a heterolithic breccia containing altered fragments of the former units, and intensely silicified hydrofractured multi-phase breccias. Alteration and mineralization are characterized by an assemblage of pervasive silica-sericite-illite alteration accompanied by disseminated and stockwork veined pyrite-pyrrhotite±sphalerite-galena-bismuthinite. Local Mn-rich garnet-bearing zones within the silicified volcanics are also common in the western portion of the deposit.

*(continued on next page...)*

## **EXPLORATION, DEVELOPMENT AND MINING IN BC... (continued)**

### *Geology and Exploration of the Blackwater Gold Project... (continued)*

The overall geometry and internal structural controls for the Blackwater deposit are still being defined through exploration drilling. The general trend of mineralization as it is currently delineated strikes WNW-ESE and dips moderately north over an area measuring approximately 1,500+ by 500+ meters and to depths ranging from 300 meters to more than 450 meters. Zones of higher grade multi-gram gold mineralization occur within several areas of the deposit and appear to be localized at the intersections of steeply dipping NW and N striking structures. A younger system of NE-striking post-mineral(?) faults exhibiting both sinistral and dextral offsets appears to cross-cut the deposit along its strike extent. The Blackwater deposit remains open in all directions and at depth.

New Gold is currently conducting an exploration drilling program to expand the Blackwater mineral resource and define the ultimate limits of the deposit. A preliminary economic scoping assessment is also in progress for completion by mid-2012. This will be followed by a feasibility study to be completed by the end of 2013.

### **The Iron Range Project – A New Polymetallic Discovery in a World-Class Mining District, Tim Termuende, President/CEO, Eagle Plains Resources Ltd, Cranbrook, B.C. CANADA**

The Iron Range deposits were originally staked in 1897 and were covered by Crown Grants held by Cominco Ltd. and the Canadian Pacific Railway. The grants covered a prominent regional fault structure with over 100km of strike length, which links many local mineral deposits and occurrences. In the area of Iron Range Mountain, the structure hosts significant iron resources over widths of up to 150m over a 5km strike length. Eagle Plains staked the current claims immediately after the Crown Grants reverted in 2000 and have been exploring the property since then, both to define an iron resource and to delineate significant gold, silver, copper, lead and zinc mineralization apparently associated with the structure. Exploration work to date includes geological mapping, geochemical surveys, diamond drilling and various airborne geophysical surveys. An additional 35,800 hectares of claims were added to the existing land package after encouraging drill results were obtained in late 2010, resulting in a total of 56,200 ha- an area approximately 11 km by 50 km. The land package now covers over 30 km of the Iron Range structure, most of it unexplored. The claims also overlie rocks of the Aldridge Formation, including the same stratigraphic time horizon which hosts the world-class Sullivan deposit located 70km to the northeast. Over its 100 year lifetime, Sullivan produced approximately 150,000,000 tonnes of ore including 300,000,000 ounces of silver, 8,000,000 tonnes of zinc and 8,000,000 tonnes of lead, collectively worth over \$45 billion at current metal prices.

The Iron Range project is 100 per cent owned by Eagle Plains and holds no underlying royalties or encumbrances. Providence Resources holds the option to earn a 60-per-cent interest in the property by spending \$3-million on exploration, making \$500,000 in cash payments and issuing one million shares to Eagle Plains over four years.

**Update on the Brucejack/Snowfield Gold-Silver Projects, Ken McNaughton, VP Exploration, Pretium Resources, Vancouver, BC, Canada**

The Brucejack property is underlain by Lower Jurassic rocks of western Stikine terrane, or Stikinia, an oceanic island arc which was accreted to the western margin of NA in latest Jurassic to mid-Cretaceous. In northwest B.C. rocks of the Stikine terrane were deformed in two major contractional events, both prior to and following deposition of the host rocks and mineralization at Brucejack.

The Brucejack property lies within the core of the McTagg anticlinorium, a major north-trending mid-Cretaceous structural culmination in western Skeena fold belt. Coincident with the core is a prominent mineralized trend which runs for at least 25 km, from Brucejack on the south to Treaty glacier on the north. Locally, there is a spatial association of alteration mineralization with the north trending Brucejack fault, a late-tectonic brittle structure which probably marks a reactivated older structure.

At least eight well-defined mineralized zones have been found to date on the Brucejack property. These lie within a 4 km-long north-trending altered belt of intensely sericitized, pyritized, and locally silicified country rocks. Individual zones typically lie transverse to the northerly alteration trend. They range in strike length up to 600 meters and have down-dip extents of similar or greater dimensions.

While there are many differences from zone-to-zone, including the Au:Ag ratio, most are within extensive Early Jurassic quartz-carbonate-adularia stockwork and vein systems hosted primarily by volcanoclastic and tuffaceous rocks and flows of the Lower Jurassic Hazelton Group. The stockwork occur in a number of lithologies and there is evidence that there was some control on emplacement by lithologic contacts, particularly those involving reworked volcanic rocks (immature conglomeratic rocks). The depth of emplacement has yet to be determined as there is conflicting evidence for both shallow and medium depths. Some of the gangue and vein mineralogy (e.g., adularia and acanthite) may suggest a low temperature and shallower level of emplacement, but the lack of colliform banding and general lack of open-space filling may suggest deeper levels of vein emplacement.

The property has a long exploration history dating back to the 1880's. From 1985 through 1994, Newhawk completed 458 surface drill holes across the property, 443 underground drill holes and over 5,000 m of underground ramp and level development on West Zone. In 1990, a feasibility study was completed for development of the West Zone which defined minable reserves of 616,200 tons grading 0.412 opt gold and 17.97 opt silver. The project was later fully permitted but not built due to declining metal prices.

Recent drilling in 2009 and 2010 totaled 51,500 m in 110 drill holes, which defined measured and indicated resources of 8.2 million ounces of gold and inferred resources of 12.6 million ounces. This equates to a rate of discovery of 402 ounces of gold per meter drilled at Brucejack, and represents an 8,000% increase in resources over the previous 1990 estimate.

*(continued on next page...)*

## **EXPLORATION, DEVELOPMENT AND MINING IN BC... (continued)**

*Update on the Brucejack/Snowfield Gold-Silver Projects... (continued)*

Pretivm Resources completed a Preliminary Economic Assessment in early 2011 which was focused on the development of only the underground high grade resources. Drilling in this year focused on definition of additional high grade resources, primarily in the Valley of the Kings Zone, and totaled 73,500 m of drilling in 178 drill holes. Drilling in Valley of the Kings confirmed the continuity of the mineralization within well-defined structural corridors and regularly produced bonanza grade intersections up to 18,600 grams per tonne gold. A resource update will be completed in the fourth quarter of 2011, and a revised Preliminary Economic Assessment in the first quarter of 2012.

Over the last 30 years, this project has been the focus of at least 3 major exploration campaigns. The recent work demonstrates that this camp still has good potential to not only expand, but also produce both world class high grade and bulk tonnage resources.

## **USGS MINERAL RESOURCE STUDIES IN THE INTERNATIONAL ARENA**

**Chair: David G. Frank**, *Facility Manager-Spokane Office, Outreach Coordinator, Western Mineral & Environmental Science Center, Spokane, WA*

### **USGS Global Mineral Resource Assessment Project - Results of the assessment of undiscovered copper resources associated with porphyry copper deposits,** Jane M. Hammarstrom, USGS, Reston, VA 20192 ([jhammars@usgs.gov](mailto:jhammars@usgs.gov))

The U.S. Geological Survey (USGS) led a probabilistic mineral resource assessment of undiscovered porphyry copper deposits as part of a global mineral resource assessment. The purpose of the study was to (1) delineate permissive areas (tracts) for undiscovered porphyry copper deposits at a scale of 1:1,000,000; (2) compile a database of known porphyry copper deposits and significant prospects; (3) estimate numbers of undiscovered deposits within those permissive tracts, where data permit; and (4) provide probabilistic estimates of the amounts of copper (Cu), molybdenum (Mo), gold (Au), and silver (Ag) that could be contained in those undiscovered deposits. The assessment was done using a three-part form of mineral resource assessment based on mineral deposit models. The fundamental geologic feature used for delineation of permissive tracts was a subduction-related magmatic arc or a post-subduction or post-collisional magmatic belt of a given age, based on geologic map distributions of volcanic and intrusive rocks related to a particular tectonic setting. Approximately 150 permissive tracts were delineated throughout the world, exclusive of the U.S. and Precambrian Shield areas, in the following study areas: Andes region of South America, Mexico, Central America-Caribbean region, Europe, Southeast Asia, Central Asia, Western and Southern

Asia, Tibet, Northeastern Eurasia (China-Mongolia-Russia), Australia, and the Western Pacific (Philippines-South Korea-Taiwan-Japan). Permissive tract areas range from ~1,000 to >500,000 km<sup>2</sup>. Approximately 40 percent of the tracts lack identified porphyry copper deposits; about 30 percent contain 3 or more known deposits. Probabilistic estimates of numbers of undiscovered porphyry copper deposits were made for ~85 percent of the delineated tracts. Within ~70 percent of the tracts that were assessed quantitatively, the mean expected numbers of undiscovered deposits exceed the numbers of known deposits. Reports include an overview and summary of the region assessed; a GIS compilation of the tracts, deposits, significant prospects, and assessment results; appendices documenting the rationale for tract delineations and estimates; and references. Reports are available online at: <http://minerals.usgs.gov/east/global/products.html>.

**SGS Global Assessment of Sediment-hosted Stratabound Copper Deposits: Development and Application of Deposit Models, Michael L. Zientek, U.S. Geological Survey, Spokane, WA**

Deposit models are the intellectual construct that underpins the USGS assessment methodology for undiscovered mineral resources. They define the geologic properties of deposits, the geologic setting in which they occur, and their grade and tonnage characteristics. In the process of conducting a USGS global assessment, we had the opportunity to revise the deposit model for sediment-hosted stratabound copper deposits, investigate the information requirements needed for assessing an area for this style of mineralization, and conduct assessments for several areas.

Our review of the model indicates that three subtypes of these deposits can be distinguished based on lithology and the nature of the reductant that localized the deposition of copper: (1) a reduced facies subtype that occurs in fine-grained siliciclastic or carbonate rocks that contain in-situ organic material; (2) a sandstone facies subtype that occurs in siliciclastic reservoir facies rocks in which the redundant was mobile hydrocarbon; and (3) a red bed siliciclastic rock subtype in which the organic material is coarse detrital plant debris. The first two subtypes were evaluated in our assessment.

In reviewing the grade and tonnage characteristics of these deposits, we found that reduced facies and sandstone facies subtype sediment-hosted stratabound copper deposits in the Katanga Basin in central Africa have significantly higher copper grades. The deposits in the Katanga Basin also have lower silver than deposits elsewhere, however, the Katangan reduced facies subtypes have higher cobalt contents. We developed regional grade and tonnage models to use when estimating mineral endowment in order to minimize bias.

When assessing an area for its sediment hosted copper potential, we used concepts similar to the total petroleum system models used for evaluating hydrocarbons. We need to consider the source of copper, the source and movement of metal-bearing brines, and the traps that would fix copper in deposits. These ore-system components determined the information needed for the assessment – the  
(continued on next page...)

## **USGS MINERAL RESOURCE STUDIES... (continued)**

*SGS Global Assessment of Sediment-hosted Stratabound Copper Deposits... (cont'd.)*

direction of fluid movement and the traps were critical to our studies. Because our assessments are depth limited, we also needed to understand the 3-dimensional subsurface geometry of the rocks.

The application of these models to assessments for the Chu-Sarysu, Kodar-Udokan, Kupferschiefer, and Katangan basins will be discussed.

## **US Geological Survey Iraq Minerals Project, Greg Fernetto, USGS Denver, CO**

In 2009 and 2010 the USGS carried out a mineral resources focused technical assistance project in Iraq. The project was funded by the Task Force for Business and Stabilization Operations (TFBSO) of the Department of Defense and the work was carried out in cooperation with the Iraqi State Company for Geological Survey and Mining (Geosurv).

The project consisted of four parts: laboratory, geophysics, mineral resources and training. In the laboratory component USGS completed a laboratory audit with recommendations for training and equipment upgrades to the Geosurv laboratories. In the geophysics task a large amount of airborne geophysical data was recovered from tapes archived from surveys completed in 1975. The mineral resources component included map production and GIS, an investigation of the lead-zinc potential and geochemical survey of western Iraq, and investigations of the mineral potential of the Zagros fold-thrust belt in northern Iraq. Training of Iraqi personnel, both in Iraq and in the US, covered a variety of subjects including geochemical sampling, mineral exploration, grade-tonnage estimation, laboratory information management and GIS.

A brief review of the geology and mineral resources of Iraq will also be presented.

## **USGS Science Used to Identify Mineral Investment Opportunities in Afghanistan, Steve Peters – USGS, Reston, Virginia**

The U.S. Geological Survey (USGS) of the Department of the Interior and the Task Force for Stability Operations (TFBSO) of the Department of Defense entered into agreements to study and assess the fuel and nonfuel mineral resources of Afghanistan from October 2009 to September 2011 so that these resources could be economically extracted to expand the economy of the country. A new report summarizes results of joint studies on 24 important Areas of Interest (AOIs) of nonfuel mineral resources that were identified for mineral investment and production opportunities in Afghanistan. USGS-TFBSO activities for oil and gas resources are reported separately. This report is supported by digital data and archival and non-USGS reports on each AOI, and these data are available for viewing and download on the USGS public Website (<http://afghanistan.cr.usgs.gov/>) A beta version map view of the data can be found at <http://mapdss2.er.usgs.gov>.

Because the report focuses on the 24 AOIs within Afghanistan, the potential for

early economic mining in each area is discussed for a number of different mineral, commodity, and deposit types. These AOIs were selected and identified in 2007 by the USGS as areas where known deposits and resources had been identified by earlier Soviet and Afghanistan geologists. Mineral deposits and occurrences in the AOIs were studied, sampled, and documented by the Soviet and Afghanistan geologists, which means that the economic geology in these areas is well documented by archival reports and maps. These AOIs commonly contain known measured mineral reserves or resources that were generated from previous sampling in trenches, drill holes, and (or) underground workings. Road access also is common in most of the AOIs. Therefore, these AOIs contain a number of assets that should reduce investment risk, so they are the most likely places to be mined early, considering the vast number of mineralized areas in the country. A number of the AOIs were field checked by USGS and TFBSO geologists between 2009 and 2011 and the previous geologic interpretations and concepts were confirmed.

The USGS-compiled digital data for each of the 24 AOIs, and an additional 33 subareas within these AOIs, include both previously published USGS data and newly generated data from the joint USGS-TFBSO project. All the data generated by the USGS is published, available, and is. The sum of these data within each AOI comprises a **Data Package**. These digital data packages have been combined with other existing reports and data generated by the USGS. Data and reports in each AOI are interpreted and summarized in individual chapters and combined with the archival reports and other information to form **Information Packages** for each AOI. The information packages are intended to be used to assemble **Bidding Packages** that would be constructed by the Ministry of Mines of Afghanistan and distributed to potential bidders, as specified by the Afghanistan Mining Law. The bidding packages provide legal and formal access to the mineral resources, according to the Mining Law of Afghanistan, and allow investors and mining firms in Afghanistan to develop the mineral wealth of the country.

## WHAT'S BEING DONE TO IMPROVE THE HEALTH & SAFETY OF MINERS

**Chair: FredFox, The Trapper Consulting, Salt Lake City, UT**

**NOISH's Health and Safety Research for Metal and Industrial Mineral Mining,**  
*F. Michael Jenkins, Senior Scientist, NIOSH – Office of Mine Safety and Health Research, Spokane, WA*

This presentation will focus on the current NIOSH research in safety and health in the metal and industrial mineral mining industry. NIOSH's Office of Mine Safety and Health Research (OMSHR) major programs deal with respirable dust control; hearing loss prevention; fires and explosions, prevention and response; prevention of machine and electrical hazards; prevention of musculoskeletal disease; and ground control. The presentation will highlight current efforts in

*(continued on next page...)*

## **WHAT'S BEING DONE TO IMPROVE THE HEALTH & SAFETY OF MINERS...** *(continued)*

*NOISH's Health & Safety Research for Metal & Industrial Mineral Mining... (cont'd.)*

these areas that focus on the metal and industrial mineral mining. Additionally, the newly drafted National Mining Agenda for occupational safety and health research and practice in the U.S. mining sector will also be introduced. Guided by the NIOSH-NORA process, a task force of mining experts from industry, labor, academia, and government has produced a draft strategic plan for research needed to improve the occupational safety and health of miners.

### **Biomonitoring Namibian Copper Smelter Workers for Arsenic Exposures,**

*Karen Hagelstein, Ph.D., CIH and Terry Mudder, Ph.D. - TIMES Limited, Sheridan, WY USA*

Namibia Custom Smelter (NCS) operations located in Tsumeb, Namibia will be discussed with respect to biomonitoring smelter workers for short and long term arsenic trioxide dust exposures. Arsenic metabolism, toxicity, urinary analysis, reference values, and recommendations for laboratory analysis of toxicologically significant arsenic compounds will be presented. Hair analysis for chronic exposures to metals and minerals is detailed. The NCS management programs with respect to health & safety, medical surveillance, environmental monitoring, and community outreach are outlined.

### **Thompson Creek Mining Company's Safety Performance Process,** *Eric Tilman, QEP Safety Manager - Thompson Creek Mine*

The Thompson Creek Mining Company's (TCMC) Safety Performance Process is designed to develop a culture of leadership, employee involvement, problem solving, and continuous improvement. This process has integral components that interact and overlap each other with Safety being the foundation from which each component is built around. Each of these components is discussed in this presentation. While each element or component is independently important, long-term success requires integration and alignment of all components. The vision of this Comprehensive Business Performance Process is for safety to become a part of the organizational fabric, rather than a stand-alone activity. The purpose of the process is to develop and promote a site wide safety commitment to safety and not a safety process that must rely only on compliance. The end result is TCMC being an industry "Leader in Safety" and this means that safety performance excellence "leads" the organization to all other aspects of business performance excellence. A Safety Culture and Safety Leaders are developed and continually improved.

**Mine Safety and Health Law Regulatory Update**, Tim Olsen – Attorney at Law, TRO-LAW

This presentation will address a number of topical issues in mine safety and health law, including: (1) MSHA's regulatory agenda; (2) important new MSHA policy statements; and (3) key recent court decisions concerning mine safety and health law.

**Overview of MSHA and the Western District**, Wyatt S Andrews – District Manager, Western District Metal/Nonmetal, Vacaville, California

This presentation will cover an overview of the MSHA Western District and the District's perspective on current and upcoming legislative and regulatory events for MSHA's Metal/Nonmetal mining sector.

**CHALLENGES WITH CERCLA AND ABANDONED MINE LANDS: A DISCUSSION ON TECHNICAL AND LEGAL CHALLENGES, AND CASE STUDIES**

**Chair: Dustin Wasley**, PE, Principal, Cascade Earth Sciences, Spokane, WA

**Mining the Mother Lode: From Reclamation to Litigation**, William E. Motzer, Ph.D., PG, CHG, Senior Geochemist ([bmotzer@toddenengineers.com](mailto:bmotzer@toddenengineers.com)), Raymond K. Will, PE, Principal Engineer ([rwill@toddenengineers.com](mailto:rwill@toddenengineers.com))

The California Mother Lode (ML) contains thousands of abandoned mines dating from the mid 1800s to present. Arsenic, often associated with ML-type gold ore deposits, generally occurs as arsenian pyrite and arsenopyrite, which often contains small amounts of gold. To maximize profits, many ML mines attempted additional gold recovery by processing ore using chlorination or cyanide leaching of sulfides. In the late 1800s and early 1900s, processed tailings containing considerable amounts of arsenic were discharged to streams and rivers. Flooding of Central Valley agriculture by such tailings disposal caused farmers in 1912-1913 to lobby the legislature for relief. Subsequent agreements between farmers and mine owners resulted in many mines impounding tailings either on or adjacent to their mine sites. By the mid to late 1950s most ML mines had ceased operations. Some mining properties have been reclaimed; many others have not with some retaining impounded tailings. Recent commercial development and improper reclamation has resulted in litigation by state and federal agencies, suing under CERCLA and other statutes. Litigation settlement and subsequent remediation/reclamation of arsenic-impacted areas has been expensive.

Beginning in the early 1980s commercial development began on a property adjacent to the Central Eureka Mine in Sutter Creek, California. This development mostly consisted of single-family homes constructed on old tailings. Subsequent soil testing revealed arsenic in overlying soils. The U.S. EPA became involved under CERCLA's Emergency Response provisions by instituting soil remediation

*(continued on next page...)*

## CHALLENGES WITH CERCLA AND ABANDONED MINE LANDS...

*(continued)*

*Mining the Mother Lode: From Reclamation to Litigation... (continued)*

including excavation, removal, and replacement, prevention of future exposure by installation of an engineered lining, erosion controls, and concrete-lined drainage ditches. They also began cost recovery proceedings against one of the building developers. The defendants negotiated by filing an answer and also instituting third-party complaint proceedings including an allocation of cost recovery study against 37 other parties. Subsequent settlement was made with the EPA and the third parties.

**Azurite Mine – CERCLA Removal Action**, *Dustin G. Wasley, PE, Principal Engineer, Cascade Earth Sciences, Spokane, WA and Rodney T. Lentz, LHG, Regional OSC Region 6 - USDA Forest Service, Okanogan, WA*

The Azurite Mine is an abandoned gold mine in a remote area in the North Cascades. The Site consists of five adits with a total of 11,500 feet of workings. Surface wastes include metals impacted millsite soil, 50,000 cubic yards of pyritic tailings, and 25,000 cubic yards of waste rock with high ARD potential. Mill Creek, an alpine stream, bisects the Site. The mine is located in a remote high altitude valley that is only accessible 3 months of the year. On behalf of the Forest Service, CES completed a CERCLA Site Inspection (SI) and Removal Action design. Samples were collected as part of the SI and data gap assessment from tailings, waste rock, soil, and surface water, pore water, and sediment from Mill and Canyon Creeks to assess the impacts of the mine. Based on the SI, CES recommended performing an Engineering Evaluation/Cost Analysis (EE/CA) because unacceptable risks were identified for human and ecological receptors. The EE/CA was subsequently prepared by the PRP, ASARCO. Following the completion of the EE/CA, CES was retained to prepare the Removal Action Design. The design included onsite containment of the tailings and waste rock in a lined impoundment, reclamation of disturbed areas, reconstruction of the existing access road, and physical hazard mitigation of several mine openings.

The Removal Action project began in July 2011 under a design-build contract structure with CES, and is scheduled to be completed in September 2011. There will also be ongoing semi-annual inspections to monitor the constructed repository, revegetation, and to collect aquatic samples to assess the success of the Removal Action. The presentation would focus on a brief overview of the pre-Removal Action investigations and would focus mainly on the Removal Action activities documenting the before and after conditions at the Site.

**Holden Mine Cleanup Project Update**, Norman F. Day, Holden Mine Remedial Project Manager, Okanogan-Wenatchee National Forest, USDA - Forest Service, Wenatchee, WA

Holden Mine is an inactive underground mine located along Railroad Creek in the Okanogan-Wenatchee N.F. about 50 miles north of the town of Chelan and 10 miles west of Lake Chelan. Between 1938 and 1957, the Howe Sound Mining Company mined copper, zinc, gold and silver from the Holden Mine. The mining operations left more than 300,000 cubic yards of waste rock and about 8.5 million tons of mine tailings covering about 90 acres at the site. Since mining operations ceased, the mine partially filled with water. This water becomes contaminated as acid mine drainage that drains through the mine's main opening into Railroad Creek. Hazardous substances in groundwater, surface water seeps and the mine opening drainage are released into Railroad Creek at concentrations that are toxic to aquatic life. The mine abruptly closed in 1957 when the profitability of copper mining declined.

The USDA Forest Service, in cooperation with the United States Environmental Protection Agency and the Washington State Department of Ecology (collectively "the Agencies") are providing cleanup oversight under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and state's Model Toxics Control Act (MTCA) for cleanup of the Holden Mine located on the Okanogan-Wenatchee National Forest. The Agencies have identified the Potentially Responsible Party (PRP) as Intalco, an aluminum manufacturer that is a successor to Howe Sound Mining Company. In 1998, the three Agencies reached an agreement with Intalco and directed it to perform a detailed cleanup study of the site under CERCLA and MTCA authority. The agreement is known as an Administrative Order on Consent.

The Holden Mine is the largest and most complex mine cleanup project being conducted under CERCLA within the National Forest System. The Forest Service is the lead agency directing the performance of the cleanup study. It is also the lead Natural Resource Trustee and, therefore, is directing Natural Resource Damage Assessment activities at the site under CERCLA. Other Natural Resource Trustees include the U.S. Fish and Wildlife Service, State of Washington, Yakama Indian Nation and possibly the Colville Confederated Tribes.

The former mining town, Holden Village, is located adjacent to the mine and now occupied as an interdenominational religious retreat. The retreat is operated by a not-for-profit corporation, Holden Village Inc. under a Special Use Permit with the Forest Service. Holden Village is home to about 60 year-round residents and hosts about 5,000 visitors a year. Residents at Holden Village are concerned a major construction period longer than two years could have a negative impact on its future financial viability and existence. The Agencies and Intalco intend to work closely with Holden Village residents to assure them that remedy construction will not unduly interfere with their operations or financial viability.

On June 23, 2010, the Agencies released to the public its preferred alternative

*(continued on next page...)*

## **CHALLENGES WITH CERCLA AND ABANDONED MINE LANDS... (cont'd.)**

### *Holden Mine Cleanup Project Update... (continued)*

(Alternative 14) as the Proposed Plan for cleaning up the Holden Mine.

Alternative 14 can be constructed in two phases thus keeping major construction periods to no more than two years each and would cost about \$107 Million. The public comment period ended on September 22, 2010, with more than 900 specific comments received. The Record of Decision (ROD) is on track to be signed before the end of 2011 with Consent Decree negotiations beginning immediately after issuance of the ROD.

To facilitate a 2-year period of major construction for the first phase of the cleanup remedy that would begin in 2013, the PRP is doing substantial infrastructure development and early works during the 2011 and 2012 field seasons. The PRP's contractor is planning to install in-mine hydraulic bulkheads and complete site preparation work that includes bypass road, bridge, barge landing and dock improvements; rock and borrow source investigations, construction of staging areas; relocation of Holden Village utilities and maintenance buildings; and remedial design investigations – all during the 2011 field season.

### **Effective Mined Land Revegetation Techniques, Leonard Ballek , Senior Ecologist, Herrera Environmental Consultants, Missoula, MT**

Revegetation of reclaimed mined land (active or abandoned) is an important issue for meeting agency requirements and assuring the public of the mining industry's commitment to good land stewardship. There are many challenges to successful revegetation of these lands including: poor or impacted soils, harsh climatic conditions, and altered hydrology and landform. This paper will discuss techniques that have been developed by mined land revegetation experts that are both cost effective and successful. These techniques will focus on: 1) facilitating natural revegetation, and 2) handling and amending damaged soils. Both focus areas will discuss planning, execution, and cost effectiveness.

On many sites, reintroduction of native grasses and forbs will be the primary goal of revegetation. The problems and merits of various seeding techniques will be examined along with an in depth discussion of developing cost effective seed mixes. Replanting strategies of trees and shrubs will be presented. Types of woody plant material and installation techniques will be considered including plant salvage and use of cuttings and nursery grown trees and shrubs. Large and small scale wetland restoration will be presented including soils preparation, wetland vegetation selection, and planting techniques. Examples of pilot plots for project adjustments will be presented. Finally, monitoring program set-up and metrics will be discussed.

Thursday December 1, 2011

Morning Sessions - 8:00 - 11:30 pm



## NEVADA PROSPECTORS FORUM - PART I

**Chairs:** Eric Struhsacker, *VP Exploration, Renaissance Gold, Inc., Reno, NV*  
Mark Abrams, *MSc, PG, RG, VP Exploration (USA) Golden Predator Corp., Reno, NV*

### **Bravada's Quito Exploration Gold Project, Lander County, Nevada, J.R. Pierson**

*& J.A. Kizis, Jr., Bravada Gold Corporation, Reno, NV*

Bravada's Quito Project is a Carlin-style gold exploration project located in the Toiyabe Range, 45km northwest of Newmont's multimillion ounce Northumberland Gold deposit. The deposit was discovered by FMC in 1980 and then joint-ventured in 1984 with Inspiration Mines, forming the Austin Gold Venture. The original published reserve was 1.7 million short tons at a 6.34g/t average gold grade. From 1986 to 1988 ore mined and milled from two open-pits and underground developments recovered 176,445 ounces of gold.

Bravada acquired the project from Meridian Gold late in 2010 believing that the property remains highly prospective for high-grade, underground-mineable mineralization. Bravada initiated extensive compilation of the reams of available historic drill data into digital format in order to create a 3-D model to evaluate structural and stratigraphic controls of mineralization.

Cambrian to lower Devonian sedimentary rocks at Quito include Lower Plate carbonates, siltstones, and shales, well-known host-rocks for Carlin-style gold deposits. The assemblage includes the Ordovician Nine Mile and Lower Antelope Valley Formations and the Silurian Roberts Mountains Formation. Mineralization discovered and mined to date occurred primarily in rocks identified as the Nine Mile and Lower Antelope Valley Formations. High-angle and low-angle faults acted as conduits for mineralizing fluids. High-grade gold mineralization, in places over 10pt, is structurally controlled and occurs within veinlets of quartz and calcite containing minor amounts of pyrite and other sulfides. Alteration is very limited in the enclosing rocks; however, local jasperoid bodies occur along some structures and were the focus of early exploration efforts. Tertiary(?) dikes are widespread at Quito and are often poorly exposed due to argillic alteration. These dikes contain anomalous Au, As, and Sb values.

### **Geology and Exploration Updates on the Carlin and Jake Creek Projects, Ne-**

**vada.** *Steven R. Koehler, Senior Geologist, Evolving Gold Corp, Elko, NV.*

Evolving Gold's Carlin project is located on the underexplored southern third of the Carlin Trend – a prolific belt of sediment hosted gold deposits with a gold endowment exceeding 150 million ounces. In 2009 Evolving Gold targeted a gravity embayment two miles south of the town of Carlin, Nevada. Drill hole CAR-002 intersected favorable lower plate carbonate rocks and confirmed vertically-exten-

*(continued on next page...)*

## NEVADA PROSPECTORS FORUM - PART I... (continued)

### *Geology and Exploration Updates on the Carlin and Jake Creek Projects... (cont'd.)*

sive Carlin-style alteration with gold mineralization up to 0.347 oz/t. This blind discovery occurs beneath tuffaceous conglomerate and a +2,200 foot-thick package of fine to coarse grained siliciclastic rocks.

Since the completion of CAR-002, eight additional RC precollar/core tail holes have been completed into favorable lower plate carbonate rocks. Select drill results to date include: 33 feet of 0.324 oz/t Au from 2925 -2958 feet, 30 feet of 0.290 oz/t Au 2902-2932 feet, 15 feet of 0.905 oz/t Au 3089-3104 feet, and 4.6 feet of 1.113 oz/t Au 3067-3071.6 feet. The nine holes outline a 2,800 by 1,000 foot Carlin-style alteration zone (decalcification, carbon, clay, sooty pyrite,  $\pm$ silica,  $\pm$ realgar,  $\pm$ orpiment), that locally contains sulfidized dikes and multi-lithic breccia horizons.

Jake Creek is an epithermal gold project located in north-central Nevada, approximately six miles east of Newmont Mining Corporation's Twin Creek mine. In late 2010 two reverse-circulation drill holes were completed to test gravity and geochemical anomalies along the western margin of the Northern Nevada Rift. Drill hole JC-005 intersected 95 feet of 0.039 oz/t gold in bleached, clay-altered, and variably silicified volcanic rocks, beneath +300 feet of post mineral cover. Within this gold-bearing interval, one five foot sample returned 0.330 oz/t gold from a quartz-sooty pyrite cemented breccia.

### **Navaho Gold Ltd., Mark Dugmore**

Navaho Gold is an Australian-based exploration company focused on the discovery of world-class gold deposits in Nevada, USA and Queensland, Australia. Navaho Gold is clearly focussed on Carlin-style gold mineralisation and has assembled six (6) projects under exploration earn-in agreements in Nevada with four (4) companies within the areas associated with the Carlin and Battle Mountain - Eureka Trends. Navaho Gold has identified three (3) main project areas in Queensland.

The Company's exploration portfolio ranges from reconnaissance projects where no previous exploration has been carried out through to drill-ready projects where prior exploration has identified high tenor geochemical and geophysical anomalies or returned significant gold anomalous drill intersections which remain open and require further assessment.

Several of these properties in Nevada are within a few kilometres of very large producing gold mines held by major gold- companies including Barrick Gold Corporation and Newmont Mining Corporation. An aggressive drill program, including a number of deep (~1,000m) drill holes, is currently underway by the Company to test targets on the projects.

In Queensland, the Company holds a 100% interest in its extensive tenement position covering some 8,000km<sup>2</sup> providing investors with full exposure to any future gold discoveries which may result on these properties.

The Company listed on the Australian Stock Exchange in April 2011 and is a new entrant into the exploration scene in Nevada. This talk will give an overview of

Navaho Gold's exploration approach and activities on the key projects in Nevada.

### **About Navaho Gold**

#### **Carlin Style Mineralisation**

Navaho Gold is clearly focused on the exploration for and ultimate development of "Carlin Style" gold mineralisation.

#### **Projects in Nevada and Queensland**

Navaho Gold has various agreements to earn majority interests in, or acquire, at Navaho Gold's election, six projects in Nevada, four of which are located on or adjacent to the Carlin and Battle Mountain Trends, and holds exploration licences over three potential new "Carlin" style regions in Queensland.

Importantly, Navaho Gold's Carlin East project in Nevada lies approximately 5km east of Barrick Gold Corporation's 40Moz gold Post-Betze deposit, the Utah Clipper project in Nevada is located immediately along trend from Barrick's Cortez and Pipeline-Gold Acres deposits which contain more than 30Moz gold<sup>3</sup> and the Rose Mine and Stevens Basin projects are located 10km SW of Barrick's Archimedes/Ruby Hill mine.

#### **Kinsley Mountain Project, Northeast Nevada, Bryan J. MacFarlane, Geologist, Metal Resource Development, Tempe, AZ**

Gold mineralization in the Kinsley mining district in eastern Elko County NV is hosted in Cambrian to Ordovician aged shallow marine carbonate and clastic rocks. The objective of this study was to understand the structural setting of the range, as well as gaining insight into chemical associations to gold mineralization. The structural evolution of the range began with two episodes of compressional deformation, a bedding-parallel faulting event followed by top-to-the-west folding. Extensional faulting occurred in several generations, beginning with north-south low-angle and transitioning into high-angle east-west, northwest, and north-south structures. Past production of ~135,000 ounces of gold was mined from seven pits situated along a long-lived (?) high-angle northwest structure. Mineralization is present in two forms, stratigraphically controlled and replacement of cave fill material. Stratabound, disseminated gold is best-developed in the Candland Shale and Big Horse Limestone, while replacement of cave fill sediments is the host to mineralization in the overlying Windfall and Notch Peak limestones. Chemical associations to gold were determined by correlation and factor analysis of multi-element data from rock-chip, soil, and stream sediment samples. From these studies, gold is associated with Te, As, Hg, Sb, Bi, Tl, and Mo. Through the combination of detailed mapping of lithology, structure, and alteration, several models of gold deposition have been constructed.

*(continued on next page...)*

**FIGHT OR FLIGHT: Complying with the Migratory Bird Treaty Act During Mineral Exploration Activities**, *Melissa R. Sherman, Senior Specialist/Resource Manager, Enviroscientists, Inc., Reno, Nevada*

Just when the snow has melted away and your access roads are passable, our feathered friends are entering breeding and nesting season. Your permit and agency authorizations likely have a stipulation requiring that a pre-disturbance nesting bird survey be conducted prior to any surface disturbing activities. After all the hoops you have jumped through and waiting out the long winter, you figure this will be a quick and easy clearance survey and the drills can start turning. To your surprise and at first dismay, the biologist reports that there is an active nest exactly where you want to drill. This presentation will include the following: An overview of the migratory bird treaty act (MBTA) and how it relates to mineral exploration projects; a step-by-step process for compliance with the MBTA; and useful tips on working with the regulatory agencies to ensure a successful outcome for both the exploration project and avian reproduction.

**Allied Nevada Gold Corp's Hasbrouck Mountain Project: Geology, Alteration, and Mineralization**, *Glen Carter*

Hasbrouck Mountain is a low-sulphidation epithermal gold and silver deposit hosted in rocks of the upper Tertiary Siebert Formation. Gold and silver occur in pervasively silicified volcanoclastic conglomerate and tuffaceous rocks as disseminated mineralization, in phreatic breccia bodies, and in banded silica veins.

Hasbrouck Mountain is located in the Divide Mining District, five miles south of Tonopah Nevada. The Divide District produced 3.8 million ounces of silver and 37,000 ounces of gold during the period 1902 through 1984. Production from the Divide District was primarily from replacement and contact veins in the Siebert Formation, underlying Fraction Tuff, and Oddie Rhyolite.

The 43-101 compliant resources as of 2006 include 631,000 oz Au, and 8 million oz Ag. These resources do not include more than 90 holes drilled by Allied, and a preliminary economic assessment is in progress to update the resource model.

Hasbrouck is within the northwest trending Walker Lane structural belt, and fault sets at Hasbrouck include northwest, northerly, and east-west trends. The structures acted as fluid conduits emplacing both disseminated and higher grade banded vein mineralization. Phreatic breccia bodies localized bonanza grade mineralization and high-grade east-west and northwest trending phreatic breccia veins occur along structural trends.

Alteration at Hasbrouck includes strongly silicified and adularized rocks of the Siebert Formation with argillic alteration forming an envelope around the silicified and mineralized zones. The alteration and mineralization was emplaced at near-surface levels as evidenced by siliceous sinter and plant fossil traces in the upper rock units.

Allied has commenced the Klondike Flats exploration drill program in the 17 square mile district land position. The initial phase of drilling will test outcropping zones of epithermal alteration, which is coincident with geophysical anomalies.

## **ALASKA - BEGINNING TO SHOW ITS TRUE POTENTIAL**

**Chairs: Steve Borell**, *Executive Director, Alaska Miners Association, Anchorage, AK*

**Keith Walters**, *P.E., Vice President Planning & Budget, Usibelli Coal Mine, Inc., Fairbanks, AK*

**Mining Operations and Fish Habitat – How we work together in Alaska**, *Dan Graham, P.E. Chuitna Project Manager, Chuinta Project Manager, PacRim Coal, LP, Anchorage, AK*

There is currently a heightened state of sensitivity surrounding any proposed mine operation that may involve fish habitat, especially salmon. While extra concern is justified and warranted, the combination of the two should not be instantly dismissed as detrimental. This talk will review some examples of mining and fish habitat in Alaska that date from the 1800's through to present day mine operations. In all of these examples, the fish populations not only survived the interaction, but in several cases their habitat and populations are now improved. We can use what we have learned from these examples and apply it to proposed mine operations, including the Chuitna Coal Project.

**Mine and Facilities Expansion at Usibelli Coal Mine, Inc.**, *Keith Walters, P.E., VP Planning & Budget, Usibelli Coal Mine, Inc., Fairbanks, AK*

With increases in coal demand in the Pacific Rim Usibelli is enjoying a sales boom in export coal. Projections indicate the possibility of tripling the amount of coal exported from Alaska and from Usibelli Coal Mine, Inc. in the next several years. This talk will focus on the efforts of Usibelli and others ( Alaska Railroad and Seward terminal) to implement this huge growth.

**2011 Exploration Update for the Whistler Project: Aggressive Exploration Results in Discovery and Refinement of Multiple Gold-Copper Porphyry Centres**, *Mark Baknes , V.P. Exploration, Kiska Metals Corporation, Anchorage, AK*

Kiska Metals Corporation (KSK-TSX:V) is focused on an aggressive multipronged exploration program on the Whistler Property, host to the Whistler Porphyry Deposit defined by a NI43-101 Resource containing a total Indicated and Inferred resource of 5.6 Moz Au-equivalent (AuEq). The Whistler property is comprised of 545 km<sup>2</sup> of Alaska State mineral claims located 170 kilometres to the northwest of Anchorage in the Alaska Range. The Whistler property is host to three distinct styles of copper-gold and gold mineralization: 1) the Whistler copper-gold porphyry deposit and clusters of similar systems in the 18 by 9 km Whistler Orbit,

*(continued on next page...)*

## ALASKA - BEGINNING TO SHOW ITS TRUE MINERAL POTENTIAL...

*(continued)*

*2011 Exploration Update for the Whistler Project... (continued)*

2) the Island Mountain, breccia associated (reduced) copper-gold porphyry system, and 3) the younger Muddy Creek Intrusion-Related gold system.

Exploration for 2011 continued on the successes of drilling and geophysical programs carried out by Kiska in both 2009 and 2010. Winter\spring drilling began with the completion of 52 (3453m) shallow grid holes in the Whistler Orbit located on a nominal 200m grid. This was an effort to identify new porphyry centres beneath the low lying till-covered areas of the Whistler Orbit. Two conventional drills tested resultant targets in the Orbit for a total of 27 (13,389m) holes. At Island Mountain, an EM and Magnetic airborne survey was carried out in the spring to highlight areas of conductivity in the area of the Breccia Zone discovery made in 2009. Au and Cu mineralization in the Breccia Zone is centred on peripheral zones of Au-bearing disseminated and vein pyrrhotite mineralization. This disseminated and vein pyrrhotite is often conductive and results from the EM survey not only defined conductive areas, coincident with already-defined gold zones, but revealed completely new and strongly conductive areas such as the SC Zone. Drilling in the Breccia Zone and new target areas totaled 26 (9,532m) holes in 2011. A reconnaissance drilling program at Muddy Creek, consisting of 3 wide spaced holes (955m), was also carried out this year. On the operational side Kiska relocated its Camp from Puntilla Lake to a site adjacent to the Whistler deposit and our newly constructed 3,300' (1000m) all weather runway. The fully winterized Camp and runway enable us to continue exploration and future development year round. Most recently we completed our main road access routes to Whistler, Raintree West and Rainmaker in preparation for our cat-supported drilling programs early in 2012.

The Whistler deposit is one of several porphyry centres that cluster in the Whistler Orbit. The deposit is hosted by Late Cretaceous diorite porphyry intrusive rocks emplaced into feldspathic sandstones of the Kahiltna terrane, whereas other porphyry targets are associated with diorites intruding co-genetic volcanic rocks. The average grade of the Indicated Resource at Whistler is 0.51 g/t Au, 1.97 g/t Ag and 0.17% Cu (0.88 Au equivalent), establishing it as a gold-rich porphyry system. Results from this year's work, aided greatly by the successful results of the spring grid drilling program, helped to discover and better define four distinct porphyry centres: Raintree West (RTW); Raintree North (RTN); Raintree South (RTS) and Rainmaker (RM). Highlight results from RTW include hole WH11-030 that returned a broad interval of 453m averaging 0.72 g/t Au, 0.12% Cu (1.01 g/t AuEq). The best results from RTN include 79m averaging 0.57 g/t Au and 0.19% Cu (0.99 g/t AuEq) from hole WH11-034 and at RM several holes, with results pending, intersected chalcopyrite-bearing porphyry mineralization. Subsequent drilling at RTW indicate the presence of a deep porphyry system where the Au-Cu potassic core zone measures approximately 300m east-west and is defined over 200m north-

south and remains open both south and to depth. RTW provides an excellent example that also exists at RTN and RTS, where Zn-Pb-Ag-Au mineralization occurs in late stage, lower temperature and even epithermal-type veins, peripheral and in the hanging-wall of the Au-Cu potassic core of the porphyry-system. This halo of mineralization offers an excellent exploration tool and one we rely on in our continuing exploration under cover. The RTW discovery also demonstrated that the magnetite-bearing Au-Cu mineralized porphyry is not clearly evident in the airborne magnetic data, despite the aerial extent and high magnetic susceptibility. Geophysical modeling indicates that shallow magnetic dykes are capable of masking more substantial magnetic bodies at depth. As there is a preponderance of magnetic dykes in the Orbit, even shallow to moderately buried Au-Cu (magnetite mineralized) centres could be concealed. We consider this masking to be a positive since it opens up large areas of potential mineralization regardless of the subdued magnetic response. Our new and better understanding of metal zonation, magnetic response and the nuances in the IP data will allow us to be even more effective in our upcoming winter exploration.

The Island Mountain gold-copper porphyry target, located 23 km to the south of the Whistler deposit, is comprised of a 4.5 by 3 km area of anomalous geochemistry hosting numerous Au-Cu bearing actinolite-albite-magnetite-chalcopyrite-pyrrhotite breccias within diorite and hornfels that are subsequently intruded by monzonite porphyry. Kiska's first hole (IM09-001) in 2009 returned 0.68 g/t Au over 382.9m, including the bottom 106.9 m, which averaged 1.22 g/t Au. In 2011 we continued aggressively drilling the core and periphery of the Breccia Zone using two drill rigs aided by the airborne EM/magnetic survey and positive results from our 2010 campaign that ended with IM10-013 that averaged 0.71 g/t Au and 0.15% Cu (1.02 g/t AuEq) over 252m. Results from this year's drilling are still being received, but results include hole IM11-020 that averaged 1.00 g/t Au and 0.12% Cu (1.27 g/t AuEq) over 161m. With results still pending we have partially defined a core Au-Cu zone extending in excess of 200m north-south, 300m east-west and up to 500m depth, which is further enveloped in a more irregular Au-pyrrhotite zone that so far measures up to 800m north-south and 700m east-west. With the current density of drilling we anticipate determining an in-house resource model that may satisfy a subsequent 43-101 compliant resource. In addition to the Breccia Zone-focused drill program we conducted limited reconnaissance drilling with one hole in the SC conductive zone that returned modest intervals of Au-pyrrhotite mineralization including 21m of 0.50 g/t Au and 30m of 0.40 g/t Au. The SC Zone, centred over a kilometre east of the Breccia Zone, is a large EM conductor and magnetic feature measuring 2.2 km north-south and 1.0 km east-west. Given its size and distance from the Breccia Zone we interpret the SC zone to potentially represent another distinct porphyry system. Our understanding of the IM mineralization has advanced considerably this season and we now view several of the geophysical and geochemical anomalies in the large target region as having excellent potential and several are drill ready.

*(continued on next page...)*

## ALASKA - BEGINNING TO SHOW ITS TRUE MINERAL POTENTIAL...

(continued)

*2011 Exploration Update for the Whistler Project... (continued)*

The nearly 31,000m of drilling completed in 2011 has produced some exceptional results and has advanced our understanding in such a way that we can be more successful in our exploration. We expect more new discoveries in 2012, but concurrent with the frontier work we will grow our resources at the Whistler Deposit and the evolving Breccia Zone at Island Mountain.

### **POGO – GOLD ALL OVER!!! - New Deposits, Updated Exploration Model, and Current Thoughts, Dave Larimer, Sr. Mine Geologist, SMM Pogo, Anchorage, AK**

The Pogo property is located on the Goodpaster River 150 km southeast of Fairbanks Alaska. The property includes nearly 1,200 state mining claims and covers an area approximately 50,000 acres. The property is underlain by highly deformed mid-amphibolites grade sillimanite bearing paragneiss and orthogneiss (mid-Paleozoic) of the Lake George sub-group from the Yukon-Tanana terrane. The Pogo Deposit sits in the middle of the “Tintina Gold Belt”, which represents a region of similar type “Intrusion Related Gold Deposits” associated with mid-cretaceous felsic intrusions.

The Liese zone represents the current mining focus of the Pogo deposit (5 Moz Au). This zone comprises of three (possibly more?) “stacked”, massive quartz shear ± sulfide-gold veins. From shallow to deepest, these veins have been designated L1, L2 and L3. Vein thickness varies from 1ft to 10ft and can locally swell up to 40ft thick.

Studies of the Liese Zone suggest similarities between “Liese type mineralization” and other Intrusion Related Gold deposits of interior Alaska. There is a strong association between bismuth and gold (~3.5:1, R2 0.89), tellurium and gold (.89:1, R2 0.9), and a very weak correlation with arsenic and gold (R2 0.30). Lead isotope studies support fluid sources from magmatic origins and sulfides analysis group with feldspars from 107Ma intrusions. Modes and occurrences of gold in the Liese zone are as follows by precedence: 1) Au<sub>0</sub> as inclusions in arsenopyrite (FeAsS) ~100µm+ to 1 µm (fineness 980-900). 2) Au<sub>0</sub> inclusions in quartz, 1mm to 1µm (fineness 930-850). 3) Au<sub>0</sub> composite intergrowths with Bi-Te+/-S minerals in quartz. 4) Invisible Au, less than 1µm inclusions to solid-solution atomically bound Au in loellingite (FeAs<sub>2</sub>) and “low arsenic” arsenopyrite (ASP1 with composition Fe<sub>33</sub>As<sub>32</sub>S<sub>35</sub>). Paragenetically, the earliest mineral assemblage is loellingite + pyrrhotite and arsenopyrite<sub>1</sub> found as inclusions in arsenopyrite<sub>2</sub> (“high arsenic” arsenopyrite with composition Fe<sub>33</sub>As<sub>35</sub>-36S<sub>32</sub>-21). Later assemblages include arsenopyrite + pyrite (arsenopyrite compositions varying from 35 to 33 at % As) associated with trace amounts of sphalerite (Fe,ZnS), Magnetite (Fe<sub>3</sub>O<sub>4</sub>), Rutile (TiO<sub>2</sub>), chalcopyrite (CuFeS<sub>2</sub>), Scheelite (CaWO<sub>4</sub>), and molybdenite (MoS<sub>2</sub>). Throughout the Liese zone, we suggest that the initial formation was a higher temperature, low fS<sub>2</sub> fluid that formed under “disequilibrium conditions”, followed

by lower temperature higher fS<sub>2</sub> fluids. Mineral assemblages with these fluid pulses are consistent with rapidly-changing “magmatic” fluid pulses as opposed to a prolonged “metamorphic” fluid source.

Through the last couple of years, exploration activities have focused on identifying, targeting, and drilling near mine prospects. Located ~2.5 miles east of the Liese zone, the 4021 prospect is coming along as a 440+Koz Au (inf) deposit. Focused infill drilling commenced in 2010 and will continue through 2012. Gold in the 4021 prospect is hosted in two stacked, shallow dipping (north) quartz veins (thickness between 5ft and 0.5ft), hosted in granitic gneiss. Lead isotope of sulfides and metal ratios (Bi:Au = 2:1) suggest mineralization in 4021 is related to Liese zone mineralization and may represent the distal expression of the system.

The North Zone deposit is located north of the Liese Zone on the adjacent ridge. These are two (possibly 3?) sub-vertical dipping quartz veins that strike NNW and appear to intersect/interact with the L1 vein of the Liese Zone. To date, North Zone veins one and two represent an inferred resource of 396Koz Au. Bismuth to gold ratios (3.5:1) and electron microprobe analysis of selected arsenopyrite samples are very similar to the Liese zone. Gold and loellingite inclusions are frequently observed in arsenopyrite with compositions identical to arsenopyrite<sub>1</sub> of the Liese Zone (at % As 35.5). Potentially, the sub-vertical orientation and near identical mineralogy of the North Zone may represent a feeder zone for ore forming fluids into the Liese Zone.

The newly discovered East Deep prospect has been the main effort of drilling for the 2011 exploration season. This body is located under the ridge just north of the Liese Zone. A quartz-diorite dike (94 Ma, post dates mineralization) spatially separates the East Deep prospect from the Liese Zone. The E1 vein has a similar orientation and superficially has the same mineral assemblages as the Liese Zone. Further petrographic and analytical analysis is in progress. To date, the E1 vein represents a inferred resource of 1.5Moz Au. During the drilling of the 2011 season, it was discovered that a smaller, shallower vein exists above the E1. This was recently modeled as the E0.5 vein and is pending resource evaluation. Every indication suggests that the East Deep vein is the same structure as the Liese Zone and has been cut off (and possibly off set vertically) with the intrusion of the quartz diorite down the Liese Creek fault. To date, the total extents of the East Deep area remain unknown. Mineralization limits have been established in the east and south, but the resource remains open to the west and north!

The three above mentioned deposits, by no means represent the limit of mineralization on the Pogo property. Through the years we have identified over 8 other prospects that require further investigation. With limited time available for exploration activities in interior Alaska; planning and resource prioritization become the decisive factor in successful exploration activities at Pogo. It has taken many years to understand the mineralization we have identified thus far and it will take many more to fully understand the full potential of the Liese Zone system. The Gold potential is here, it may even be under our noses and we do not even know it!

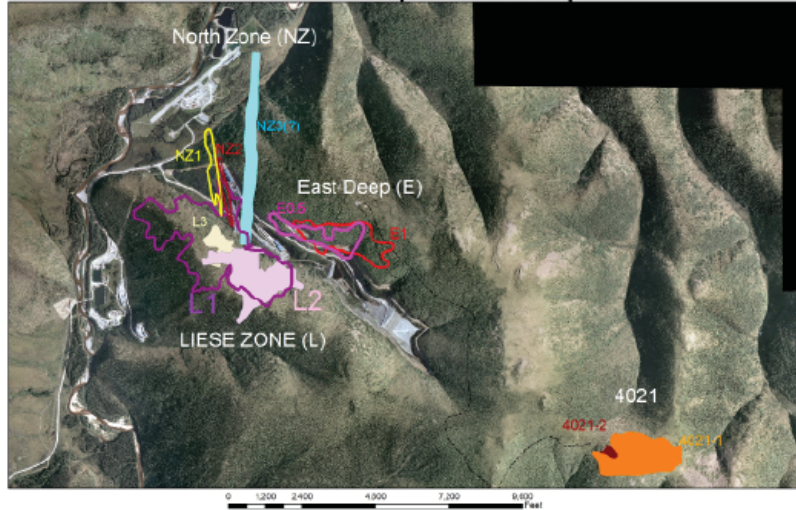
*(continued on next page...)*

## ALASKA - BEGINNING TO SHOW ITS TRUE MINERAL POTENTIAL...

(continued)

2011 Exploration Update for the Whistler Project... (continued)

### 2011 POGO Near Mine Deposits/Prospects



### Golden Range – A New High Grade Gold Discovery, Chris Brown, Alaska Manager, Corvus Gold, Fairbanks, AK

The new Golden Range discovery reflects the enormous exploration potential of Alaska. Golden Range, with a strike length of 10 kilometers and area in excess of 24km<sup>2</sup>, was discovered using stream sediments with follow up soils. There were no documented mineral occurrences within the area and it is only 15 kilometers from the nearest paved highway. During the summer of 2011 eighty nine surface rock samples with grades in excess of 10g/t gold were collected over a strike length of 9 kilometers. The most important zone discovered to date is called “The Notch” and consists of quartz-arsenopyrite mineralization hosted in a mylonitic shear zone with >10g/t rocks in outcrop for a strike length of over 1 kilometer. Six holes have been drilled at The Notch with assays pending. Possible reasons that the district was undiscovered are the fact that best mineralized zones weather recessively while poorly mineralized pyrite mineralization creates eye catching stained outcrops. Additionally, recent glaciation has left valley moraines and prevented significant placer formation in the vicinity of the mineralization. The handheld XRF has been instrumental in this discovery by allowing real-time analysis of soil samples for arsenic to highlight areas of hidden mineralization which could be exposed by hand trenching. The lesson is that stream sediments still have a role to play in Alaska and that exciting new discoveries await persistent explorers.

## **INTERNATIONAL PROJECT ENVIRONMENTAL AND SOCIAL PERFORMANCE**

**Chair:** *Barbara Filas, Presidnet, Geovic Mining Corp., Denver, CO*

**The AREVA Way: Profitable Growth, Social Responsibility and Respect for the Environment,** *Didier Fohlen, Vice President, Environment & Social Responsibility, AREVA, Business Group Mines, Washington, DC*

**Economic Development for Protection of Investment, Profit, and Personnel,** *Carole Ramsay, Consultant, Social and Economic Services, Behre Dolbear, Denver, CO*

Mining enterprises worldwide are seeing the bottom-line wisdom of proactively designing systems for corporate social responsibility (CSR) to facilitate social license and minimize social risks. But, by strategically designing economic development-based tactics, and then networking tactics together, firms can do even better. Too often firms get frustration, reactivity, and zero return on their CSR investments for their efforts. Looking at new research and current standards, learn how to go beyond compliance to create greater risk mitigation, avoid the frustrations of reactivity, gain control and predictability while increasing the return on invested CSR dollars and strengthening social license.

This paper will introduce the ideas above and then describe them in a case study example of economic development in action- how it works - and the benefits to the firm. A specific company working in a specific, to be determined locale, will provide case study basis. CSR should not be done for moral purposes but because it actually improves the firm bottom line – when done well. This case study example will illustrate that approach which will maximize success with CSR dollars, to both the firm and the local stakeholder.

## **TRADITIONAL LARGE LEFT LATERAL LEAPS**

**Chairs:** *Ann Carpenter, President & CEO, Remote Energy Solutions, Reno, NV*  
*Curt Everson, Exploration Geologist, Sirius Exploration LLC, Murray, ID*

**Could Commercial Analytical Laboratory Services Become Obsolete? Just how advanced are portable XRF (x-ray fluorescence) analysers today for exploration applications over a range of commodities including Gold?,** *Todd Houlahan, Director, International Mining Group, Olympus InnovX, Woburn, MA*

This provocative paper will utilize case studies from junior explorers and major mining houses around the world who utilize portable XRF as part of their daily exploration efforts, to demonstrate the strengths and limitations of the technology. It will pose the question: “Why are western US exploration efforts far behind the rest of world in adoption of the technology? Is there a collective technological

*(continued on next page...)*

## **TRADITIONAL LARGE LEFT LATERAL LEAPS... (continued)**

*Could Commercial Analytical Laboratory Services Become Obsolete?... (continued)*

conservatism in this part of the world or is it related to the sales and marketing strategies of XRF manufacturers and individual scientific sales professionals?"

With some major mining houses owning 20 portable XRF units around the world for their multiple exploration projects and single project junior explorers owning 3-4 instruments, why is it that some geologists understand the return on investment of portable XRFs and some do not? Should the marketing of XRF manufacturers change? Should XRF manufacturers start providing consulting services to assist companies develop robust methodologies and assist more with the best practice application of the technology in the field?

The paper will also discuss global scientific efforts across portable XRF manufacturers to develop standard operating procedures and in field quality control and quality assurance protocols to ensure the correct, consistent and appropriate use of portable XRF for mineral exploration and mining projects. Discussion will be provided on the publication of portable XRF results in stock exchange announcements and the official policies of the exchanges with respect to this increasingly common practice.

Portable XRF is a vastly under-utilised tool in the western USA and Mexico. This paper will draw on the authors 10 years of global experience over several XRF manufacturers to provoke discussion on the possible reasons for this, while using case studies to demonstrate just what portable XRF can and cannot provide this regions portable analytical needs. And NO, commercial laboratories will not become obsolete! Portable XRF is simply another tool in the geologists tool box, complimentary to the laboratory, not a replacement.

## **Hunting REE in Northernmost Idaho, James G. Evans, U.S. Geological Survey, Spokane WA**

The Hall Mountain area in northernmost Boundary County, Idaho, has been noted for its thorium (Th) and rare-earth minerals (Staatz, 1972) that occur in quartz-carbonate veins and mylonites in Belt Supergroup. These veins are found on the east of the Purcell Trench, just south of the Canadian Border. Initial focus of REE investigations in the region has been on these occurrences. Vein samples contain up to 20% Th, suggesting the possibility of high-grade Th deposits. Anomalous concentrations of rare-earth elements (REE) commonly parallel high concentrations of thorium.

The NURE (National Uranium Resource Evaluation) stream sediment data from the 1970s were reexamined to determine REE distribution in the region, specifically, the Bonners Ferry 30' x 60' quadrangle that includes Hall Mountain. An anomaly threshold of 500 ppm, determined by a previous broader regional study of the NURE REE data by the USGS, was used. Anomalous REE concentrations were plotted on drainage maps to locate rocks having high REE (in this case Ce, Dy, Eu, La, Lu, Sm, Tb, Yb).

No drainages on the eastside of the Purcell Trench had  $\geq 500$  ppm REE. The rocks and veins there may be partly buried by glacial deposits, and colluvium and scree of quartzite and diorite which may mask the geochemistry of bedrock, and (or) the veins are very small and (or) few. Field observations and rock samples from the east side of the Purcell Trench containing elevated REE suggest that relatively high concentrations of REE are restricted to a 20-km-long NW-trending zone of faulted rocks close to the trench that include Cretaceous granite, suggesting introduction and (or) redistribution of REE in rocks bordering the plutons.

Numerous drainages with 500-2000 ppm REE occur on the western side of the Purcell Trench, in an area of 850 km<sup>2</sup> mostly underlain by units of the Priest River Complex (Cretaceous-Proterozoic) and certain Cretaceous plutons. The REEs may be in 1) heavy mineral deposits formed in broad glacial valleys, and (or) 2) certain highly radioactive plutons and their border areas, and (or) 3) parts of the Monzonite of Long Canyon (Mesozoic), an elongate NW-trending body in the NE part of the complex and which contains very abundant sphene and allanite.

Staatz, M.H., 1972, Thorium-rich veins of Hall Mountain in northernmost Idaho: *Economic Geology*, v. 67, p. 240-248.

**The Digital Terrain Revolution: What Can It Do For Explorationists?**, Paul Jewell, Associate Professor, Department of Geology and Geophysics, University of Utah, Salt Lake City, UT

In the past decade airborne laser swath mapping (ALSM) has brought about a revolution in the imaging and understanding of surficial geology. LiDAR (Light Detection and Ranging) instruments mounted on airplanes or helicopters, pulsing at 10 kHz or more can acquire millions of georeferenced elevation points per day and produce "bare-earth" models of the Earth's surface that digitally strip off vegetation from the land surface. LiDAR surveys have revealed a multitude of heretofore unknown earthquake and landslide scarps, alluvial channels and a variety of other geologic features. How might this technology be effectively applied to the exploration for ore deposits?

The most obvious application of ALSM in mineral exploration would be to frontier areas of the boreal and tropical forest where outcrop location is invisible on traditional aerial photographs and geologic mapping is most challenging. Preliminary investigation of existing LiDAR surveys suggest that the technique is most effective in sedimentary or other stratiform geologic terrains (e.g., volcanic flows) where geologic structures such as fault offsets can often be identified. Hydrothermal alteration features such as gold-bearing jasperoids that are resistant to weathering and extensive argillic alteration that weathers recessively can also be detected in LiDAR surveys, although the size of such features are typically at the horizontal resolution (1-2 m) of most LiDAR surveys and often do not have topographic signatures significantly different from unmineralized rock outcrops.

This presentation will explore the promise, pitfalls, and cost/benefit aspects of using ALSM in conjunction with techniques such as airborne EM. Examples of

*(continued on next page...)*

## **TRADITIONAL LARGE LEFT LATERAL LEAPS... (continued)**

*The Digital Terrain Revolution: What Can It Do For Explorationists?... (continued)*

LiDAR imaging of hydrothermal alteration from the Cascade and Blue Mountains of Oregon and various forested and unforested terrains in Utah will be presented along with suggestions for future research.

## **Source-Generated Seismic Noise in 2-D Reflection Surveys in the Basin and Range Physiographic Province: Issues, Attenuation and Case Histories, David**

*A. Smith, Chief Geophysicist, Jim Hild, Jim Pfeiffer, Senior Geophysicists, ZAPATA Incorporated; Peter Drakos, Staff Geologist, Ormat Technologies Inc.*

Igneous rocks present in geothermal and other hard rock sites are notorious for seismic signal scattering because of internal heterogeneities in those environments. The complex structural settings create intricate subsurface wave fields. Given these factors, continuous reflections across stacked sections at these sites are seldom apparent. Rather, subsurface acoustic interfaces will typically manifest themselves as a series of short, discontinuous reflections within a background of scattered acoustic energy. The resulting data sets are not easy to process and interpret.

A common problem in geothermal seismic data is coherent source-generated noise. This noise includes ground roll, which is amenable to attenuation by using appropriate source and receiver arrays, survey geometry, and specific processing algorithms. In addition to ground roll, these seismic data commonly include linear noise trains parallel to first breaks. A third type of coherent noise is reflection multiples.

The first section of this paper examines the causes of coherent noise, its attenuation during data acquisition and processing, and provides a review of basic quality control checks on the data acquisition and processing sequence. The second section of the paper contains case histories of successful 2-D seismic reflection surveys. The first is at a geothermal site where access was limited and the main objective was detection of vertical faults. Alteration of the underlying rocks is pervasive. The second is a hard rock mining project where low angle and intrusive features were of interest. Mining activities taking place during the survey added to the noise issues. Success at these sites resulted from application of various noise avoidance and attenuation factors discussed above, plus extensive collaboration between the project geophysicists and the project geologists and geophysicists.



**UNDERGROUND OPERATIONS - NEW OR NOVEL MINING METHODS TO IMPROVE OVERALL MINING PERFORMANCE**

**Chair:** *Kyle Rhoderick, President, Connors Drilling, LLC, Montrose, CO*

**Effective Uses of TBM's in Mine Development at the Stillwater and East Boulder Mines,** *Justus Deen, Stillwater Mining Company, Billings MT*

Stillwater Mining Company (SMC) has an extensive history with Tunnel Boring Machines at the Nye and East Boulder underground PGM mines in Montana. The first use of a TBM at SMC was a 13' diameter main beam unit at the Stillwater Mine in the late 1980's/1990's, where 4 miles of tunnels were driven parallel to the J-M Reef Orebody on the 5000E, 5500W, 5700W, and 5900W levels. TBM's were central to the development of the East Boulder Mine as two 15' diameter main beam units drove (2) 18,000 ft parallel tunnels to access the J-M Reef; these access tunnels have become the ventilation intake and main travel/haulage way for the mine. Currently, one of the 15' diameter units used during initial development of the East Boulder Mine is being used at that property to drive 8,000 feet West, parallel to the J-M Reef, for the Graham Creek Project. For the Blitz Project at Nye, a 18' diameter main beam unit will be utilized to drive a ventilation and rail haulage level 4 miles East, parallel to the J-M Reef. TBM's have been preferred method for developing new mines and sections of the J-M reef as the geometry and geology of the reef zone allow for faster development compared to conventional methods.

**New Technologies in Underground Electronic Blasting For Enhanced Safety and Productivity,** *Raphael Trousselle, Davey Bickford USA Inc., Sandy, UT*

The blasting industry is now well into its second decade of commercial use of electronic detonators. As an increasing number of blasters are introduced to the technology, the benefits are becoming more widely monitored and accepted in many surface blasting operations. However, their use in underground applications is not yet as widely established. This is primarily due to the distinct cost dynamics and processes associated with underground blasting.

This paper will have two primary focal points. First we will examine new technologies such as RFID, GPS, multi-blast, remote blasting through wireless networks, etc. and discuss the safety and productivity advantages they bring to the blasting process.

Secondly we will look at several case studies to see what we have learned from both domains and whether or not the many advantages which have been well documented in surface blasting applications are just as relevant in underground works.

*(continued on next page...)*

## **UNDERGROUND OPERATIONS... (continued)**

*New Technologies in Underground Electronic Blasting For Enhanced Safety and Productivity... (continued)*

Case studies include a North American underground metal mine, a large open cast mine, and surface quarries where electronics have been adopted for specific reasons, including safety, environmental, productivity and economic concerns. The current initiation techniques are described as well as key performance indicators used in the quantification and justification process.

### **Reverse Circulation Drilling Underground as an Additional Tool for Short Range Planning and Stope Definition, Jeff Burton, Connors Drilling LLC, Montrose, CO**

Historically, Metal mines have used geologic mapping in conjunction with traditional core drilling methods to define ore bodies prior to extraction. Core drilling provides the highest level of geologic data prior to mining activities. This high level of data comes with some consequences. Productivity rates are not as high as percussive drilling methods and core drilling typically tends to have a higher unit cost than percussive drilling methods. Reverse circulation methods can often strike a balance between acquiring the necessary data needed to develop the ore body, maintain high levels of drilling productivity, and keep overall drilling costs lower than if only employing core drilling methods. Finally, the best of both worlds involves dual purpose drilling where a single drilling rig can offer both core and reverse circulation methods as conditions change.

### **Innovative Solution to Lining Underground Boreholes, Jason Teuscher, DMC Mining, Salt Lake City, UT**

Lining underground boreholes is necessary to ensure long term stability for ventilation, muck flow or escape-ways. With longer and larger boreholes, the weight of steel liners can be significant and difficult to safely install. DMC Mining Services has designed a Raise Lining System, (RSL-450), capable of systematically installing up to 450,000 pounds of liner steel into a circular borehole. This device also automatically monitors the weight during installation to verify that the liner is not hung-up. This presentation will focus on the development and implementation of the next generation of liner installations system.

### **Stope Optimizer in Vulcan 8.1, Jesse Oldham, Mining Engineer – Technical Services, Maptek, Lakewood, CO**

Stope Optimizer is a new mining software tool capable of computing the optimal size, shape and location of stopes for underground mine design. The Optimizer allows the user to perform preliminary reserve estimation and optimize the final location of stopes and pillars for mining dilution, narrow or dipping ore bodies, and maximization of recovered value.

This tool allows the user to create multiple stope iterations, comparing each stope

design to the block model, until satisfactory designs are generated.

Three methods are provided for determining the optimal stopes, depending on whether just a grade value is available; a value can be calculated from the grade taking into account price, mining and processing costs etc; or if the user can supply a calculated value estimate for the blocks in the model.

Multiple passes through the model are used to identify stopes, sub-stopes, and the development of economic ore.

First, the wireframes for the stope geometry are defined for full sized stope shapes using the defined stope and pillar width parameters. Sub-stopes can then be defined to identify ore that would satisfy a portion of the full height or in the simplest case generating half or quarter stopes. A further pass can be completed to identify economic ore on the levels outside the stopes that could be mined during development.

Reserves can be generated using the existing Advanced Reserves tool and the stope triangulations generated by the Stope Optimizer. This new design tool can greatly reduce the time it takes an engineer to generate and reserve optimum stope layouts and makes the completion of the stope optimization process more efficient.

**Friday December 2, 2011**

Sessions - 8:00 - 11:30 pm



## **NEVADA PROSPECTORS FORUM - PART II**

**Chairs: Eric Struhsacker**, *VP Exploration, Renaissance Gold, Inc., Reno, NV*

**Mark Abrams**, *MSc, PG, RG, VP Exploration (USA) Golden Predator Corp., Reno, NV*

**Crown Gold's Nevada Epithermal Gold-Silver Portfolio**, *Anthony P. Taylor, Ph.D*  
*Executive Chairman, Crown Gold Corporation*

Crown Gold, a TSV listed Canadian corporation holds leases in four, volcanic hosted, epithermal districts in Nevada. Three, namely Monte Cristo, Sugarloaf Peak and Blue Sphinx, lie within the Walker Lane structural province in western Nevada. The fourth, Gold Springs, is located in the Stateline District in the eastern part of the state.

All properties cover multiple, outcropping, epithermal vein systems hosted in Tertiary volcanic rocks. All carry highly anomalous to potentially ore grade gold and/or silver values at surface or in shallow underground or open-pit workings. Veins mapped at surface and logged in core show classic multiphase epithermal textures and geochemistry, evidence that, in general, all systems are high level and essentially preserved.

Surface field work including careful district scale geological mapping, rock chip

*(continued on next page...)*

## **NEVADA PROSPECTORS FORUM - PART II... (continued)**

### *Crown Gold's Nevada Epithermal Gold-Silver Portfolio... (continued)*

and partial soil geochemistry have defined multiple, high quality drill targets on all properties.

The most thoroughly explored prospect to date, Monte Cristo, has a 43-101 resource of 275,000 ounces gold at a 0.5 g/t gold cut-off, with 1,400,000 ozs silver at a 9.0 g/t silver cut-off under the old McLean Pit. Numerous other targets lie along 7 km strike of the host fault system.

On the Sugarloaf Peak property, a 43-101 resource of 60,000 ounces gold at a 1 g/t gold cut-off surrounds the old Tip Top adit. There, an additional 3 km of strike length remains untested. Well defined targets at both Blue Sphinx and Gold Springs still await initial, angled, diamond drilling.

The Crown Gold properties represent a premier opportunity to develop new high grade, underground gold/ silver mines in relatively unexplored volcanic terrane in the western United States.

### **La Quinta Resources Corp.'s Easter Project, S.E. Nevada, Walter Martin**

The Easter project, located in Lincoln County, Nevada, can be classified as a low sulfidation epithermal gold-silver vein and stockwork resource. The project has 121 historic drill holes plus 5 adits from which an indicated resource has been determined, containing approximately 2.6 million tons at grades of 1.3 ppm gold and 14 ppm silver, or 100,000 oz gold and 1 million oz silver. The quartz-adularia vein stockwork system is hosted within faults in the late Tertiary Hiko Tuff, a silicic unit in the Delamar caldera. The Main Vein zone trends east – west and dips 50 to 60 degrees north. This gold-silver bearing system has been traced along strike for approximately 6,500ft and sparsely tested downdip to a depth of 1,700ft. La Quinta's work plan is a systematic infill of the historic drill pattern, both downdip and laterally. Another area 1 km west of the indicated resource, the West Vein zone (WVZ), was found in Spring 2011 during routine field reconnaissance. Assays as great as 10 ppm gold (0.29 oz/st) were obtained from thinly banded quartz-adularia-sericite veins in select rock chip samples. The WVZ has a footwall vein as much as 10 m (33 ft) thick, a stockwork mid-zone an estimated 30 m (100 ft) thick and a hanging-wall vein approximately 8 m (25 ft) thick. The WVZ appears to be oriented 280AZ with approximately 200 m (650 ft) strike length. The La Quinta is drilling this target currently.

### **American Vanadium's Gibellini Deposit; Moving Forward Toward Production,**

*Lonny Hafen, Chief Geologist, American Vanadium Corp., Richard Lippoth, Senior Geologist, American Vanadium Corp.*

The Gibellini vanadium deposit is associated with a carbonaceous marine phosphorite facies of the Devonian Woodruff formation, locally enriched in metals including V, Zn, Mo and P. Late Paleozoic orogenic events brought sections of the Woodruff formation into thrust bounded contact with clastic rocks of the Antler

foreland basin south of present day Eureka, Nevada. Tertiary graben faulting has preserved an isolated klippe of metal rich Woodruff at the Gibellini property where intense shattering and the present topography have facilitated deep weathering of the deposit, redistributing metals and removing carbonate minerals. Concerted exploration in the area first began in the 1950's however extraction scenarios involved construction of a conventional mill whose capital cost could not be supported by the relatively low grade nature of the deposit. American Vanadium acquired the property in 2006 and after additional drilling and bulk sampling demonstrated that an adaption of modern acid heap leach technology could profitably recover a large percentage of the contained vanadium.

**Bravada Gold Corporation's Wind Mountain Gold/Silver Project, Washoe County, Nevada, J.W. Cox & J.A. Kizis, Jr., Bravada Gold Corporation, Reno, NV**

Bravada's Wind Mountain Project hosts a high level, low sulfidation gold/silver deposit in Tertiary volcanics and sinter. From 1989 through the mid 1990's AMAX Gold produced nearly 300,000 ounces gold and 1,770,000 ounces of silver from the property. Low strip ratio and good metallurgy contributed to the success of the heap leach mine.

Bravada originally intended to explore for the feeder system of the near surface gold deposit. With the rising price of both gold and silver it is now obvious that significant potential remains for additional shallow deposits as well as the deeper feeder systems.

Analysis of historic work and ongoing exploration is defining a large region with anomalous precious metals mineralization. This area has been identified as a 3,750+ meter zone along a north northwest trend. The width of the mineralized trend has been established at a minimum of 1000 meters. In 2007 a 43-101 compliant study estimated 406,000 ounces of gold averaging 0.411 g/t Au of Measured plus Indicated Resource and nearly 100,000 ounces of Inferred Resource. A preliminary economic study was completed in early 2010 which showed a positive NPV on a portion of this resource at a gold price of \$850 per ounce. Large under-drilled areas remain and recent drilling results demonstrate that additional near-surface gold/silver resources exist. Significant potential also remains for high-grade gold/silver at depth along "feeder" structures that are now being identified by mapping and drilling.

Bravada's current exploration program is designed to find additional near-surface leachable resources, enlarge the existing 43-101 compliant resource, define feeder structures beneath the shallow mineralization and complete metallurgical testing. Other studies are underway that are necessary to advance the project through feasibility.

*(continued on next page...)*

## NEVADA PROSPECTORS FORUM - PART II... *(continued)*

### **Silver Predator Corporation Taylor Silver Deposit, White Pine County, Nevada,**

*Dave Hembree*

The Taylor Silver Deposit is an epithermal, high-silica, low-sulfide replacement deposit in Devonian carbonate rocks. The deposit occurs as argentiferous jasperoid replacement bodies in the upper Guilmette Limestone. These jasperoid bodies are localized by a combination of steep structural conduits and damming effects of overlying shale units. The mineralizing fluids traveled upward along the near vertical fracture zones to the crest of an antiform. Here, the fluids brecciated and replaced limestones with silica, barite, sulfides and other minerals including argentiferous sulfosalts. Elsewhere on the property, mineralization occurs in the silicified portions of the Chainman shale and along north-northwest trending structures as well as in jasperoids and silicified structures cropping out in the overlying Joanna limestone. The highest silver assays within the surface mined areas are near apparent structures (feeders). Silver assays above one ounce per ton form a blanket at the top of the Guilmette Limestone that averages about 15 m (50 ft) thick over the axis and flanks of the anticline and covers an area of approximately 16 hectares (40 acres). Measured and indicated resources at Taylor are 5,835 ktonnes at 79.2 gpt for 14.9 million contained ounces of silver. Inferred resources are an additional 686.7 ktonnes at 87.1 gpt for 1.9 million contained ounces of silver.

### **Snowstorm Exploration Project Update 2011, Humboldt and Elko Counties, Nevada,** *Robert E. Thomason, Winthrop A. Rowe and Charles M. Ross*

The Snowstorm Project is a privately funded "grass roots" gold exploration project located in the northern Snowstorm Mountains, and extending west to Chimney Reservoir. A large land position covers approximately 47 square miles. Project activities began in early 1999 and have continued to present.

The project was initiated to explore the unique intersection of northern extensions of the Carlin Trend, Getchell Trend, and northern Nevada Rift. Data collection includes geologic mapping and over 8,000 surface samples with multi-element geochemistry. There is an extensive geophysics database of 4,180 gravity stations, and 465,848 ground magnetic stations. Drilling data includes 66 holes totaling over 70,000 feet of RC and over 50,000 feet of core drilling.

Miocene volcanic and volcanoclastic rocks and young sediments dominate the surface exposures of the project area. Drilling has defined a volcanic rock sequence with lithologic equivalents to those of the Midas District. In addition, drilling and geophysics demonstrate that much of the project area is underlain by Paleozoic rocks at relatively shallow depths. Paleozoic rocks found in drill holes are interpreted mostly as being Preble, Comus and Valmy Formation rocks. Facies changes, gradational contacts, few age indicators, and a lack of marker units hinder placing these rocks into the established formations. The structural setting is commensurate with the complexities of intersecting structural trends.

Three different styles of exploration targets occur, as defined by multiple types of exploration data. Target styles include:

- Midas style vein systems
- Miocene age near surface silicification and brecciation
- Turquoise Ridge style targets hosted in limey sedimentary rocks of the Comus Formation

The highest priority targets going forward are Turquoise Ridge style.

Geophysics, geochemistry, geologic mapping and drilling information have been integrated and modeled in GIS and 3-D platforms to identify high quality targets. Sequence stratigraphy provides a predictive, stratigraphic and sedimentologic model for the best gold-host rocks. The targeting tools are utilized to outline Eocene age gold targets hosted in Paleozoic rocks that lie beneath Miocene age volcanic rock cover.

Discovery of new gold deposits along the projection of known Nevada gold trends is the intended purpose of Snowstorm Project. The authors are of the opinion that exceptional progress and breakthroughs have been made within the context of this objective.

## **POWER SESSION: ENERGY OPPORTUNITIES IN MINING**

**Chair: Zack Gorstein**, *Senior Analyst, Vice President Exploration, Remote Energy Solutions, Albuquerque, NM*

### **Controlling the “Uncontrollable” – Reducing Diesel Expense in Mining Operations**, *Debra Johnson, CEO, Eco-Edge, LLC, Chandler, AZ*

When one single commodity can typically represent about 25% of your total mining budget, and the average price of that commodity has fluctuated by no less than 21% each of the last 5 years, and by as much as 35%, how do you plan for next year? The roller coaster of diesel fuel prices will not stop any time soon. It is, therefore, essential that your team focus now on what it can be doing to manage what many operations have traditionally seen as an uncontrollable cost. Increasing the profitability and life expectancy of your mine depends on changing this mindset around diesel fuel usage and cost management.

This session will examine the five major categories of controllability that can be used as a diagnostic tool to identifying ways to reduce your diesel usage upwards of 10%. Additionally, you will learn about ways that other mines have found to successfully measure and manage this expense.

### **Why Solar PV Makes Sense at Your Mine?**, *Ravi Menon, Manager, Engineering & Business Development, Solar Frontier Americas, Inc., Santa Clara, CA*

Energy derived from the most available source has long been overlooked by the mining industry. Given the high availability of solar modules from a matured manufacturing industry at reasonable prices, makes this a good time to switch

*(continued on next page...)*

## **POWER SESSION... (continued)**

### *Why Solar PV Makes Sense at Your Mine?... (continued)*

some of that load to photovoltaic (PV) energy. Thin-film modules using Copper, Indium and Selenium (CIS or CIGS) are growing in popularity due to their increasing conversion efficiency and improved performance compared to the incumbent technology using crystalline silicon cells.

Regardless of whether your mine is 'on grid' or 'off grid', see how harnessing this free source of energy using CIS modules can have a lasting positive impact on the financial and sustainability aspects of your mining operations.

## **OPEN PIT MINING**

**Chair: Russ Downer**, *Engineering Superintendent, Barrick Goldstrike, Inc., Elko, NV*

**Innovative Landslide Repair and Rockfall Mitigation Concepts, Including the Use of Self Drilling, Open Hole Method and Ballistic Soil Nails**, *James Chincholo, CEO, Landslide Solutions, Inc., Elk Grove, CA and Bryan Wavra, P.E., Soil Nail Launcher, Inc. - Northwest, Keizer, Oregon*

This presentation will focus on case histories of multiple landslides and rockfall of various magnitude mitigated using innovate Design/Build/Warranty contracting and new technologies including self drilling, open hole method and ballistic (or launched) soil nails. The case histories have a specific focus on landslides, rockfall and severe erosion problems repaired on AML sites, gas transmission pipelines, and energy/mine access roads.

Design/Build/Warranty contracting is particularly suited to landslide, rockfall mitigation and severe erosion repair. This contracting approach combines designer and contractor into an integrated team able to respond quickly to unforeseen conditions and continued slope/slide/rock movement before and during construction. During this portion of the presentation, multiple large landslides repaired using this contracting technique will be examined from initial site visit through stability modeling and design to construction techniques and challenges.

The second part of the presentation will outline new technologies for landslide, rockfall and severe erosion repair, including self drilling, open hole method and ballistic soil nails. Ballistic soil nails were developed in Europe in the late 1980s to repair shallow landslides and severe erosion problems at a fraction of the time, cost, and environmental impact of traditional repair techniques, the technology was never successfully commercialized in Europe, and only recently gained momentum in the United States. Self drilling soil nails are particularly suited for active slides because of their ability to be installed into active slide material. This state of the art technology has gained worldwide acceptance. Open hole soil nails have been in use for over 30 years for permanent stabilization on construction projects

throughout the world. Their relatively new use to repair landslides is now seen as an economical alternative to traditional slide repair techniques. In addition, bond breakers can be added to open hole soil nails thus converting them to rock bolts for rockfall mitigation.

**Creating a Safe Environment for Open Pit Mines: Anglo's journey toward Zero Harm**, David Howell, *International Manager, Safety, Preco Electronics, Boise, ID*

Anglo American's corporate safety goal is simple to explain, but hard to achieve: Zero Harm. In this presentation, you'll learn how Anglo's Sishen began their quest for Zero Harm. Specifically, how they have overcome one of their biggest safety concerns: slow moving collisions. This presentation will discuss

- Sishen's accident scenarios
- The pros and cons of each solution researched by scenario
- How integrating a multi-vendor technology approach solved their main problem areas
  - And how those vendors were able to work together seamlessly
  - The final implementation and training
  - The next steps

Their results have included operating 78 pieces of heavy equipment fatality free in for the first time in 2009 in five years. In that same span, they logged 5.4 million hours without a lost-time injury.

**Dynamic Control, Vision and Collision Avoidance for Safe Dump Truck Haulage in Open Pit Mining**, S. Frimpong, *Professor and Chair, Department of Mining and Nuclear Engineering, Missouri S&T, Rolla, MO*, Y. Li, *Structural Engineer, Bucyrus International, Milwaukee, WI*, R. Suglo, *Associate Professor, University of Mines and Technology, Tarkwa, Ghana*

The creation and maintenance of a healthy working environment in surface mining operations require sustained efforts in pursuing advanced research initiatives toward the development and deployment of powered haulage technologies. This paper contains progress summary on a frontier research in truck dynamic control, vision and collision avoidance. This research is required to provide solutions to challenging problems regarding operator visibility in truck haulage in a surface mining environment. The paper focuses on truck control kinematics and dynamics, truck-haul road interactions, intelligent truck sensing, intelligent truck collision avoidance system, integrated system for situational awareness, augmented visualization and operator interface, and field testing and error variance modeling of developed technologies. A sensor suite of four subsystems, including front-side stereo-camera, front-side Doppler radar, close range sonar proximity sensors, and rear-side camera system have been recommended for developing a 360° truck operator vision to allow safe operations. This research initiative is significant because it will provide a strong basis for developing technologies to improve truck haulage safety in surface mines and construction sites.

*(continued on next page...)*

## **GROUNDWATER ISSUES IN MINING**

**Chair: James Davis, P.G., Senior Hydrogeologist, Montgomery & Associates, Tucson, AZ**

### **Groundwater Modeling in Support of Environmental Impact Statement for the Project Pima County, Arizona, Hale W. Barter, Senior Hydrogeologist, Montgomery & Associates, Tucson, AZ**

The Rosemont Project is a proposed open-pit mining operation in the Santa Rita Mountains along the western edge of the Cienega Creek basin in southern Arizona. A groundwater flow model was developed using MODFLOW-SURFACT with a lake simulation package. The purpose of the model was to simulate groundwater conditions prior to pit development, during pit dewatering, and after mine closure for 1,000 years. This presentation will provide a description of model development and projections used in support of Rosemont's EIS process.

The model was developed from data obtained from the Rosemont hydrogeologic drilling and testing program, the Rosemont groundwater monitoring program, public agency databases, and from previous groundwater and surface water studies conducted in the adjacent Cienega Creek basin. The geologic framework was defined in the mine area by the Rosemont geologic database and was defined in the surrounding areas by regional geologic maps and cross-sections published by public agencies. Following initial model development, the model domain was expanded to include the riparian areas and perennial reaches along Cienega Creek and Davidson Canyon, east and northeast of the Rosemont Project.

Steady-state model calibration was conducted assuming current groundwater conditions are relatively undisturbed. Transient model calibration was conducted using data from a multiple-well aquifer test conducted for a 30-day period in the proposed mine area. The resulting model was used to simulate drawdown resulting from pit dewatering during a 22-year mining period and to project groundwater level changes, pit inflows, and pit-lake development for 1,000 years after mine closure. The model projections were used to evaluate potential impacts to groundwater resources, riparian areas, and perennial stream reaches. Projections indicate that substantial long-term impacts will be limited to the mine area and immediately adjacent areas including upper Davidson Canyon, with minimal impact to lower Davidson Canyon and Cienega Creek.

### **Technical, Administrative and Legal Challenges in Water Supply Planning for the Rosemont Project, Pima County, Arizona, James S. Davis, P.G., Senior Hydrogeologist, Montgomery & Associates, Tucson, AZ and Katherine A. Arnold, P.E., Vice-President, Environmental & Regulatory Affairs, Rosemont Copper Company, Tucson, AZ**

The Rosemont Project is a proposed open-pit copper, molybdenum, and silver mining operation in the Santa Rita Mountains near Tucson, Arizona. This presentation provides an overview of the planning process for the mine water supply system.

In 2006, Rosemont assembled a team of technical, legal, and planning consultants to develop plans for the mine water supply and transmission facilities. After evaluating all possible sources of water supply, the team focused on identifying favorable areas for groundwater development in the Santa Cruz basin located several miles west of the mine property. The planning process involved many complex technical, legal, and policy issues.

Three properties were acquired by Rosemont Copper for development of the water supply wellfield. Wells were installed and tested on two of the parcels to characterize aquifer properties, well production potential, and groundwater quality. Based on results of drilling and testing, it was concluded that the properties could sustain the number of wells and provide sufficient well production to meet mine water requirements. The planning team then designed the supply wells and wellfield layout, and delineated the water transmission pipeline route to the mine, while resolving numerous legal issues associated with easements, right-of-ways, and permits.

Because groundwater modeling indicated that drawdown impacts from the mine wellfield could have substantial localized impacts on groundwater supplies, measures were developed to mitigate these impacts. These measures included: development of a residential well protection program; partnering for the design and installation of a groundwater recharge facility to replace the pumped water with excess CAP water; and implementation of water conservation in mine processing operations.

**The Nevada Water Rights Process**, *Michael Stanka, P.E., WRS, Senior Engineer/President of Stanka Consulting, LTD, Carson City, NV*

Nevada Water Rights often fall into the domain of engineering and legal issues. This lecture will focus on the types of Nevada water rights, how to obtain a water right, modifying existing rights, and navigating the Nevada Water Right Process from an engineering prospective.

**The Interaction of Groundwater Flow Evaluations and Geochemistry: The Issue of Scale Disparity**, *Andrew Nicholson, PhD., Senior Managing Geochemist, Integral Consulting, Louisville, CO and Sean Kosinski, Managing Hydrogeologist, Integral Consulting, Louisville, CO*

Water quality impacts from mining are a product of the amount of groundwater flow that occurs and chemical processes that effect groundwater and surface water chemistry. Often the scale of analysis is much larger for hydraulic evaluations as compared to geochemical evaluations. One example of this scale disparity is the case of pit dewatering and infilling. The groundwater models used to assess the scale of modern mining operations are typically hundreds of square miles or larger to accommodate the stresses imposed on the regional hydrologic system. In contrast, geochemical models, used to predict the loading and fate of metals to a pit lake, need only be the size of the pit itself. Hydrogeologists are often less concerned with the flux distribution across the pit-aquifer interface than the aggregate rate and ultimate stage of the lake itself. However, geochemists focus on smaller scale

*(continued on next page...)*

## **GROUNDWATER ISSUES IN MINING... (continued)**

### *Interaction of Groundwater Flow Evaluations and Geochemistry... (continued)*

features, such as mineral composition, grain size distribution and fracture density of pit walls, as these variables influence pit lake chemistry. Therefore, it is important to reconcile the objectives across multiple scales during the conceptual modeling phase to identify and accurately evaluate mine-water quantity and quality.

### **Enhanced 3-D Visualization as a Powerful Data Analysis and Stakeholder Communication Tool in Mine Site Hydrogeology**, *M. S. Spurlin, ARCADIS US, Inc., Boulder, CO; C. E. Divine, ARCADIS US, Inc., Highlands Ranch, CO and E. Rogoff, ARCADIS US, Inc., Scottsdale, AZ*

Three-dimensional subsurface visualization techniques are well developed and have proven to be a powerful data analysis tool for many geosciences applications, including mine planning and design. However, they are currently underutilized by environmental practitioners to analyze geologic and hydrogeologic data and effectively communicate to non-technical stakeholders. While conventional two-dimensional methods are commonly employed, only a full three-dimensional analysis can integrate all geologic data and reveal the spatial correlations that are critical for conceptual site model development. The use of Environmental Visualization System (EVS) software to integrate geologic, hydrologic and geochemical data into a comprehensive, three-dimensional framework, provides a more thorough evaluation of multiple coincident data types. Specifically, this tool can effectively combine and integrate quantitative analytical results from soil and water analyses with lithologic data obtained during visual core logging, cone penetrometer testing (CPT), hydraulic profiling testing (HPT), and geophysical logging to develop a comprehensive site model. Geologic and hydrogeologic information such as orientations of bedding and major fracture sets and faults, hydraulic head and gradient, mobile and immobile porosity, soil bulk density and moisture content, can be utilized in combination with lithologic and contaminant data to identify preferred groundwater migration pathways and zones of high contaminant mass flux. EVS can also be used to generate grids and matrices for quantitative flow and transport models, and the output from model simulations can be imported and displayed alongside other data types. Furthermore, EVS can manage millions of datum and therefore can maximize the value of information stored in large databases generated over decades of site management. This presentation highlights several examples of where EVS was effectively applied at mine sites to more thoroughly understand and effectively communicate hydrogeologic and environmental conditions; these examples support our recommendation that three-dimensional analysis should be more widely applied.





*Save These Dates...*

December 3 *thru*  
December 7,

**2012**

Northwest Mining Association's  
118th Annual Meeting,  
Exposition and Short Courses

*December 3 - 7, 2012*  
*Sookane Convention Center*  
*Spokane, WA USA*