



## **MEXICO EXPLORATION – Finding the Treasure of the Sierra Madre and more**

**TGDG Mini-Symposium , April 9, 2014**

### **ABSTRACTS**

#### ***Mexico Exploration – Trends and Activities***

**Glen Jones, Director, Mining and Metals Database, SNL Financial**

Glen Jones will provide an overview of trends in global, Latin American, and Mexican exploration spending and activity. The presentation is based on SNL Metals and Mining's annual study, Corporate Exploration Strategies, which provides more than 24 years of worldwide exploration trend analysis. Analysis will also come from the InrierraRMG data base. The presentation will focus on Mexico activity including exploration spending, drilling, resource replacement and production.

#### ***Geology of the Morelos Skarn-Hosted Gold and Gold-Copper-Silver Deposits, Guerrero State, Mexico***

**Alejandro Kakarieka, VP Exploration, Torex Gold Resources**

**Alejandro Kakarieka** (presenter)(1), **Cristian Puentes** (1), **Barton J. Suchomel** (2), **Steven D. Bussey** (2), **G. Bradford Margeson** (2)

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The Morelos gold and gold-copper-silver deposits are located 180 km southwest of Mexico City in the center of the Guerrero gold belt, an emerging regional trend of precious and base metal deposits and occurrences within the Balsas-Mezcala basin of the Guerrero terrane. The Morelos property is an exciting exploration area for large skarn-hosted gold-silver and gold-silver-copper

deposits. The total gold endowment of the Morelos Gold Property is 8.81 M oz, including resources in all categories. Several high-quality exploration targets have yet to be tested.

The ore deposits occur within the Mesozoic carbonate-rich Morelos Platform, which has been intruded by Paleocene granodiorite to tonalite stocks, sills and dykes. Skarn-hosted gold and gold-silver-copper mineralisation is developed along the contacts of the intrusive rocks and the enclosing carbonate-rich sedimentary rocks.

At the El Limón-Guajes deposit, originally discovered by Teck Corp. in 2001-2002, current measured and indicated resources are 53.8 million tonnes at 2.79 g/t gold and 4.84 g/t silver and are hosted in retrograde-altered pyroxene-garnet skarn. Open pit mine construction is currently underway at El Limón-Guajes.

The Media Luna deposit, located 5 km southeast of El Limón, is a large new blind discovery made by Torex Gold in March, 2012. A recently released inferred resource for Media Luna contains 39.9 million tonnes at 2.63 g/t gold, 24.5 g/t silver and 0.97 % copper (at 2.0 g/t gold equiv. cut-off grade). Gold, copper and silver are hosted in retrograde-altered pyroxene-garnet-magnetite skarn.

### ***San Dimas Mine, Durango State – a history of continuous exploration success*** **Jose Texidor, Principal Geologist, Primero Mining**

The San Dimas Mine (and district) in Durango has a long history of production, commencing in Spanish colonial times (1757) and continuing intermittently into the 1800s. Modern mining began in the 1880s when the American San Luis Mining Company acquired the Tayoltita mine and American Colonel Daniel Burns took control of the Candelaria mine and began working in the area. More recently, Primero acquired the San Dimas Mine from subsidiaries of Goldcorp in August 2010.

Historical production from the San Dimas district is estimated at 11 million ounces of gold and 582 million ounces of silver, affirming it as a world class epithermal mining province. More than 125 veins are known to have been worked in the district, and more are mentioned in historical documents and remain to be compiled.

The mineralization in the San Dimas district follows the model of high grade silver-gold-epithermal veins characterized by low sulphidation and adularia-sericitic alteration. Typical of epithermal systems, the gold and silver mineralization at the San Dimas Mine exhibits a vertical zone with a distinct top and bottom, generally termed the “Favourable Horizon”. This

favourable, or productive, zone at San Dimas is typically 300 metres to 600 metres in vertical extent and can extend along strike for over 2km. Furthermore, the “Favourable Horizon” can be correlated, based both on stratigraphic and geochronologic relationships, from vein system to vein system and from fault block to fault block.

Primero continues to apply the concept of Favourable Horizon and has improved the modelling and targeting of the mineralized zones by converting modern and historical information into 3D models. There remains much ground to be explored in the San Dimas district as shown by recent discoveries of high grade veins such as Alexa and Victoria.

### ***The Geology of the El Chanate Mine, Sonora, Mexico***

**Chris Rockingham, VP Exploration and Business Development, AuRico Gold**

The El Chanate Gold Mine is a low grade open pit heap leach mine, located in northern Mexico at the northwest corner of the State of Sonora. The mine site is 25km northeast of Caborca, the largest town in the area with a population of 70,000.

El Chanate is within the Sonora MegaShear between the northern flank of Sierra El Batamore and the southern flank of Sierra El Chante. These ranges are tectonic blocks derived from Late Mesozoic compressional events modified by Early Cenozoic extension. The area is underlain by Mesozoic, meta-sedimentary rocks intruded by Late Cretaceous andesites. All of these units are cut by Tertiary felsic to mafic rocks. The post mineral San Jacinto andesite flow located north of the mine is the youngest bedrock unit dated at 51Ma.

The dominant controls on gold mineralization are structural channeling along faults and the development of veins by dilation and hydraulic fracturing. Gold precipitation was dependent on a chemically favorable environment and is not strongly influenced by rock composition, although more permeable rocks such as sandstone and conglomerate are more likely to host the quartz pyrite sericite veins than mudstones. Latite dykes tend to follow the larger structures and gold mineralization is often associated with these dykes.

Relatively deep seated regional structures appear to have been active at the time of mineralization and have played a vital role in the structural preparation of the host rocks and channeling of the mineralizing fluids. The fluids and their contained metals are believed to have been derived either from a deeper magmatic source rock or from deep metamorphic processes associated with the Laramide Orogeny.

## ***Geology and Exploration of the Peñasquito Au-Ag-Zn-Pb Ore System, Zacatecas, Mexico***

**Gassaway Brown, Sr. Corporate Geologist, Goldcorp Inc.**

Peñasquito is a world-class Au-Ag-Zn-Pb deposit centered on two diatremes cutting Cretaceous clastic units above an Eocene-Oligocene felsic intrusive complex. Disseminated and lesser fracture-controlled electrum, sphalerite, galena, and various silver sulfosalts are hosted by milled-clast breccias within the diatremes and by Cretaceous clastic units in the surrounding mineralized halo. Its discovery under post-mineral Quaternary alluvium at the western fringe of the Concepcion del Oro District of northern Zacatecas state was the result of persistent exploration by several companies over more than a decade. Drill-hole 197 cut 472 meters grading 3.3 g Au/t transforming a growing polymetallic resource into a significant gold discovery in 2004. Alteration and mineral zoning indicate that these reserves represent distal mineralization above an underlying quartz-feldspar porphyry system. Deeper exploration drilling led to the discovery of Zn-Au-Ag-Pb replacement mantos in carbonate units underlying the Cretaceous clastic units. These are similar to mantos mined elsewhere in the district since the Spanish conquest. More recent, deeper, drilling has identified skarn and skarn breccias hosting Cu-Au-Ag-Zn-Pb sulfides closely related to adjacent porphyry intrusions. In 2014, exploration at Peñasquito will continue to focus on defining the high-grade core of the copper-gold, sulphide-rich skarn mineralization located below and adjacent to current mineral reserves. Goldcorp is now investigating the potential for producing a saleable copper concentrate at Peñasquito.

Proven and probable open pit mill reserves at the end of 2013 were 529.97 Mt of ore containing 10.62 Moz Au, 528.23 Moz Ag, 8,973 million pounds of Zn, and 3,695 million pounds of Pb. Heap-leach proven and probable reserves at the end of 2013 were 83.46.5 Mt containing 1.00 Moz Au and 76.88 Moz Ag. Full-year 2014 gold production at Peñasquito is expected to be between 530,000 and 560,000 ounces at a mill throughput of 110,000 tonnes per day.

## ***El Gallo, Sinaloa, Mexico – From discovery to production***

**John Read, Sr Geological Consultant, McEwen Mining**

The El Gallo II silver deposit was discovered in 2008 by Minera Pangea (wholly owned subsidiary of McEwen Mining). A feasibility study was completed on the project in September 2012. Current reserves are 28.9 M oz silver at an average grade of 94 g/t Ag. The deposit is hosted in siliceous breccias and stockwork zones in andesitic volcanic rocks associated with a quartz-

feldspar porphyry intrusive. McEwen's nearby El Gallo I gold mine is a past producer that was re-commissioned in 2012 and is currently producing at a rate of 37,000 oz per year (increasing to 75,000 oz in 2015). Gold mineralization at El Gallo I is hosted in veins and stockwork zones in andesitic and dioritic rocks associated with quartz-hematite alteration.

### ***La India, a new mine with lots of exploration potential.***

**Manuel Padilla, Director Exploration, Mexico, Agnico Eagle**

La India is Agnico Eagle's newest gold mine in Mexico. It is expected to reach commercial production in the first quarter of 2014, with a mine life of approximately eight years.

The La India mine is located approximately 200 km East of Hermosillo in Sonora, Mexico. The 589-square kilometre property includes the La India mine site, the Tarachi gold resource and several other prospective exploration targets, situated in the prolific Mulatos gold belt. The La India mine hosts probable reserves of 0.8 million ounces of gold contained within 33.5 million tonnes of ore grading 0.7 g/t Au. Agnico Eagle's Pinos Altos and Mascota mine complex is approximately 70 kilometres southeast of La India, providing operating synergy between the two properties.

Agnico Eagle acquired the La India property from Grayd Resource Corporation in November 2011, and within 22 months the Company had completed the design, permitting, construction and commissioning of the La India mine. The construction capital cost remained on budget at \$157.6 million. Mining began in September 2013, with initial leaching the next month. The first gold from La India was poured in November 2013. Commercial production is anticipated in the first quarter of 2014. La India is expected to pour 40,000 ounces of gold in 2014, 81,000 ounces in 2015, and to average 90,000 ounces of gold per year over the reserve life.

The La India mine lies within an extensive ancient volcanic field. It is in an area dominated by outcrops of volcanic tuffs from different explosive volcanic events that were affected by large-scale north-northwest-striking faults and intruded by granodiorite, diorite and dacite stocks. Canyons cut through the uppermost layers to expose the Lower Series volcanic strata. The mineral occurrences are similar to several other gold-silver mineralization centres recognized in the region, such as Alamos Gold's Mulatos gold mine immediately east of the La India project, which has been a commercial gold producer since 2006.

La India lies in a large area of intrusion-related alteration dominated by high-sulfidation epithermal-style gold mineralization. The gold mineralization is confined to zones of advanced argillic alteration originally containing sulfides and subsequently oxidized. All of La India's

reserves are in oxidized material, amenable to heap leaching in three zones: Cieneguita, La India and Main Zone.

On the other hand, the gold system at Tarachi is best classified as a gold porphyry deposit, comprising sheeted veins that deposited gold within the wallrock outside the source dacite porphyry intrusions, suggesting that it has the potential to grow into a much larger deposit.

The hydrothermal alteration mineral assemblages observed at Tarachi contrast with those of the Cieneguita, La India, and Main zones; the latter are characterized by massive, pervasive silica-alunite alteration, which has thus far not been observed at Tarachi as it is interpreted that this upper portion of the system has been eroded away. Stratigraphic controls to mineralization are dominant in the Cieneguita, La India, and Main zones, but are not at Tarachi. Gold mineralization at Tarachi appears to show a strong structural control combined with the spatial association with porphyry intrusives including the presence of porphyry black dikes. Sheeted-wavy-banded quartz veining at Tarachi, which locally host high grade gold concentrations and minor amounts of molybdenite, are typical of gold porphyry systems like those seen in the Maricunga gold belt of Chile.



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**SPEAKER BIOS**

**Glen Jones, Director, Mining and Metals Database, SNL Financial**

Glen Jones is a Director for SNL Metals and Mining and has over 35 years' experience in the mineral resource industry. SNL recently purchased IntierraRMG where Glen worked for the past 11 years. With IntierraRMG his role was Head of Data Products and Technology and was responsible for data content, production and software development. Glen was instrumental in the expansion and growth of the company especially the data base and web applications. With SNL, Glen will be working with a team to help with company integration, product development and merging of the data bases.

Glen started his career in the mineral exploration industry over 35 years ago mapping underground stopes and logging drill core. He founded Mineral Information Maps in 1980, a company which monitored global exploration activity, compiled data bases and produced global activity maps. In 1992 he developed the "Hot Play" map concept and began publishing maps that showed rapidly developing area plays around the world. With his detailed knowledge of the mining industry and activity globally, Glen is often invited to speak at seminars and conferences around the world.

**Alejandro Kakarieka, VP Exploration, Torex Gold Resources**

Alejandro Kakarieka, VP Exploration Torex Gold Resources, Exploration Geologist with + 30 years of experience in minerals Greenfield Exploration across Latin America (Chile, Argentina, Colombia, Honduras), including 17 years in several senior management roles with WMC Resources, Breakwater Resources, Iamgold Corporation, and since 2011 leading Exploration at Torex Gold Resources in Mexico.

**Jose Texidor, Principal Geologist, Primero Mining**

José Texidor Carlsson is Principal Geologist with Primero Mining. José graduated in 1998 with a degree in Electronic and Electrical Engineering by the University of Surrey, U.K., and whilst working as a systems engineer continued his academic education by studying Geology part-time with the Open University and later completing a M.Sc. in Geology at Acadia University, Nova

Scotia in 2007. José has worked in gold projects in many countries, including China, the Maricunga trend in Chile, Dominican Republic, Mexico and the Canadian provinces of Nova Scotia, New Brunswick, Newfoundland & Labrador and Ontario. The main focus of José's work over the past few years has been in epithermal gold-silver veins in Mexico and Archean lode gold systems in the Abitibi Greenstone Belt. José has been working with the San Dimas mine in Durango, Mexico, since 2012.

### **Chris Rockingham, VP Exploration and Business Development, AuRico Gold**

Chris Rockingham brings over 30 years of extensive exploration experience, various geological, geographic and cultural settings in North and South America. He held the position of Vice President of Exploration and Business Development with Northgate Minerals for eight years prior to its amalgamation with AuRico. In this role, Chris identified Young-Davidson as a site with considerable exploration potential, negotiated the terms of the acquisition, and assembled the team that developed the project into one of the largest underground gold reserves in Canada. Chris is currently working on getting the Kemess Underground gold copper deposit through the federal and provincial permitting process. He has a Master of Science degree in Geology from the University of Western Ontario and an MBA (with distinction) from the Richard Ivey School of Business.

### **Gassaway Brown Goldcorp Inc. Sr. Corporate Geologist, Goldcorp**

After earning an MS in Geology from the University of New Mexico, Gassaway initiated a minerals exploration career focused on the American Cordillera. His career has taken him from early work in Colorado, Montana, Nevada and Alaska to Mexico, Central America, and South America. He has explored for gold, silver, porphyry copper, SEDEX massive sulfides, polymetallic, and uranium deposits for Exxon Minerals, Newmont, Echo Bay, and Hecla prior to his current assignments with Goldcorp. His early career was focused on grassroots and early-stage exploration, while the last 20 years have been devoted to exploration discoveries in Latin America and their advancement through feasibility and to initial production. He was Exploration Manager for Goldcorp subsidiary Minera Peñasquito, based in Zacatecas, Mexico prior to relocating to Santiago, Chile in 2011 as Goldcorp's Regional Exploration Manager for Chile and Argentina. Gassaway recently relocated back to his home base of Reno, Nevada, where he is currently Senior Corporate Geologist, working largely on Goldcorp's major growth projects in northern Mexico.

### **John Read, Sr Geological Consultant, McEwen Mining**

Mr Read has been a consulting geologist for McEwen Mining since 2006, first in Nevada and since 2008 in Mexico, serving as QP for the company's exploration activities there. Prior to

working with McEwen, he has worked as an exploration geologist for such companies as Newmont Mining and Gold Fields Mining in various parts of the western US, Mexico, Alaska and Brazil.

### **Manuel Padilla, Director Exploration, Mexico, Agnico Eagle**

Manuel Padilla has over 25 year experience in Mineral Exploration, predominantly focused on precious metals in Mexico. Manuel has worked for government agencies (Mexican Geological Survey), for junior companies (Galway Resources) and for private both national and international major companies (Peñoles-Fresnillo and Agnico Eagle).

Manuel played a key role in the discovery of Orisyvo, a new, world class, 10 M oz gold deposit in the Sierra Madre in Mexico; Manuel had also an important participation in the evaluation and development of the Pinos Altos Gold/Silver District, (3.5 M OzAu), Chihuahua, and in the recent exploration of the Tarachi/La India Gold District (+1 M OzAu), Sonora, México.

Manuel was also leader of the team for the discovery of Presón and Leones, (polymetallic,hydrothermal breccias related to Mo Porphyry) located in Eastern Chihuahua, Mexico.

Manuel obtained with honors a degree in Geological Engineering from University of Chihuahua, a Diploma in Evaluation of Reserves and Geostatistical Methods from University of Guanajuato, and a Master degree in Mineral Exploration from Colorado School of Mines. Manuel is a Certified Professional Geologist and is currently the Vicepresident of the National Board of the Asociación de Ingenieros de Minas, Metalurgistas y Geólogos de México A.C., the main mining association in Mexico.

Manuel's current responsibility is Director of Exploration for Agnico Eagle in Mexico.