



Report of the field trip Ecuador- Geology of Strategic Mining Projects

SEG Student Chapter Universidad Nacional Mayor de San Marcos

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SUMMARY:

In April of this year 2017, between the 2th - 9th our Student Chapter from Universidad Nacional Mayor de San Marcos, Lima - Perú together with the SEG Student Chapter from Universidad Nacional de Colombia - Sede Bogotá and the SEG Student Chapter from Universidad Central del Ecuador realized a field trip in the Ecuador.

The Field trip was guided by Ing. Israel Sangay, currently Exploration Geologist in La Arena's Mine and Msc. Marcelo Llerena, teacher and Academic advisor of SEG-UCE. The participants was 6 students from the SEG Universidad Nacional Mayor de San Marcos, Perú), 6 Students from SEG-UNAL-Colombia, 6 Students from SEG-UCE-Ecuador and 2 guides.

We visit 4 diferent kinds of deposits like VMS,epithermal, Polymetallic veins and porphyries. Located in the Central Cordillera of Ecuador and most of this.

Continously, We are going to describe the technical knowledge learned in the diferent deposits.



SCHEDULE

Guides:

- **Msc. Marcelo Llerena**

Profesor Asociado
SEG Student Chapter UCE.
Universidad Central de Ecuador

- **Ing. Israel Sangay**

Exploration Geologist in Arena's Mine-
STRACON GyM in



Fuente: Ministerio Coordinador de Sectores Estratégicos – "Inversiones Estratégicas 2015"

DATE	ITINERARY	DEPOSIT	COMPANY	ACTIVITY
03-April	Guayaquil-Ventanas	VMS Cu-Zn-Au	Salazar Resources	Domo Project
04-April	Ventanas-El Oro	Polyimetallic hydrothermal veins Cu-Au	CORE GOLD	Zamura Portovelo Project
05-April	El Oro- Azuay	High-sulphidation Au-Cu-Ag	INV METALS	Lomo Larga Project
06-April	Azuay-Zamora Chinchipe	Intermediate Sulphidation	Lundin Gold	Frutas del Norte Project
07-April	Zamora Chinchipe-El Pangui	Porphyry Cu-Au ± Ag ± Mo	Ecuacorriente Sociedad Anonima (ECSA)	Mirador Project
08-April	El Pangui-Tungurahua-Perú		-	Geotourism Pailon del Diablo

VISIT TO EL DOMO PROJECT

LOCATION

The El Domo project is located in the province of Bolivar, Las naves sector to 250 km from the city of Quito, being more precise in the property Curipamba de Salazar Resources in Ecuador.

Geomorphologically it forms part of the foothills of the Andes mountain range in the western flank of the Ecuadorian territory along the Miocénico Belt.

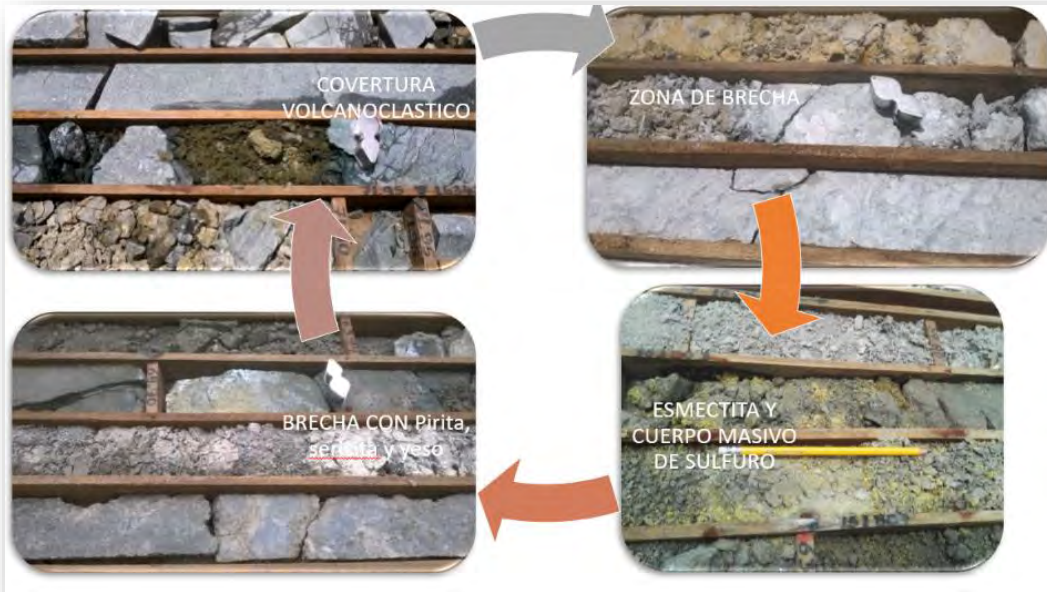


GEOLOGY OF THE DEPOSIT

- The El Domo project is a **VMS (Vulcanogenic of Mass Suffrage) deposit**. The geological environment and drilling tests suggest that it would be a Kuroko type body that is specifically rich in gold and silver.
- The **rock box** that allows mineralization, are part of the volcanic rocks of the arch of islands known as the Macuchi Unit which comprises volcanic rocks underwater volcanoclastic, with minor andesitic-basaltic flows.
- **Structural control** presents an N-S and NE-SW orientation, through graven-like structures which are surrounded by rhyolitic domes.
- The project has a total **mineral resources** of 6.08Mt with average laws of 2.33% Cu, 3.06% Zn, 0.28% Pb, 2.99g / t Au and 55.8g / t Ag.

FORMS OF MINERALIZATION IN THE DOM

- Stratiform, massive sulfur vulcanogenic
- Stockwork in the feeder areas, mainly sphalerite, below the VMS.
- Fault zones with dismemberment of massive sulphide blocks, usually developed in the contacts of andesitic intrusions and dikes.
- Mineral faults.

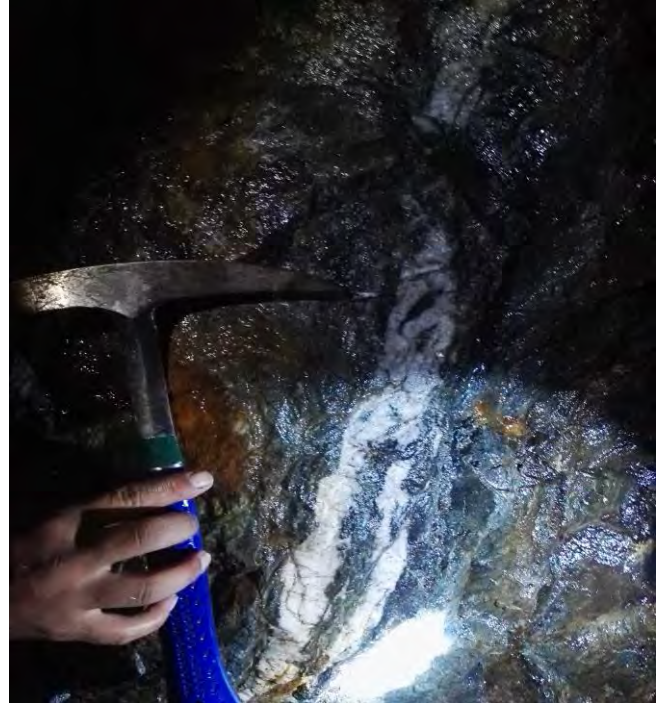


Zaruma-Portovelo Mining District

- The Mining District Zaruma-Portovelo is located to the South West of Ecuador, in the Province of El Oro, to the border with Peru.
- Altitude: 1200 m.s.n.m
- Start of Operations: Products: Mainly Au and Cu.
- Presence of Fe, Cu, Zn, Pb Sulphides and Ag and Au sulfosalides.

- Handicraft Mining: 351 Hectaries
- Concessions Deysi \approx Cu (2-5%), Au (1.8 t)
- Deposit type: Polyimetallic hydrothermal veins
- Box Rock: Andesite
- Structural control:
- Regional: 1st Order NS to NNE-SSO
- Location: Megaestructuras of 2nd Order E-O, NE-SO, NO-SE.
- Subordinate Faults or 3rd Order of Course N-S, NE-SO
- Age Mineralization: Between 21-10Ma
- Paragenesis: Quartz + Sphalerite rich in Fe + Chalcopyrite + Marcasite + Bornita + Galena + Sphalerite deficient in Fe + tetrahedrite + Gold followed by deposition of an enrichment of calcosine and covelina.
- Alteration: Propitiation, Sericy
- Geometallurgy: Flotation

Photo 1: We observe the kinematics of faults in Quartz veins



*Photo 2: Low angle → We observed a widening, compressive regimen
SIGMA 1 → Parallel to the tension*



VISIT TO LOMA LARGA PROJECT

Loma Larga project is located south of Ecuador in the Andes Western Cordillera, in the province of Azuay, about 480 km south of the capital Quito and 30 km southwest of the city of Cuenca, 3,500 to 3,900 meters above sea level.

The north-south fault of Rio Falso is the main structure for the alteration and the mineralizing fluids, the Quimsacocha Formation is the host rock of the Loma Larga deposit. High-sulphidation mineralization of gold-copper-silver in the Loma Larga deposit occurs in lithological contacts between lavas and andesitic tuffs and reaches a greater thickness in tufts. Barium sulphides and minerals associated with gold mineralization were deposited by late fluids within the silicified bodies.

The mineralized zones are characterized by multiple breccias and events of filling open spaces and sulfides such as pyrite, enargite, covellite, chalcopyrite and luzonite, or in lower sulphuration states, tennantite and tetrahedrite. The mineralization of gold is found, for the most part, in one of the following mineralogical groups: (a) vuggy silica, plus fine-grained pyrite and enargite; B) massive pyrite, including a bright arsenical pyrite; C) vuggy silica with bands of gray silica, filled with sulfide spaces and banded pyrite.

The probable mineral reserves are calculated at 4.6 Mt with average laws of 7.67 g / t Au, 38.4 g / t silver and 0.46% Cu.



Breccia hydrothermal plus barite and free gold.



VISIT TO FRUTAS DEL NORTE PROJECT

Part of the field trip was visit Frutas del Norte, the 6th of April. This deposit located in the “Cordillera del condor” was discovered in 2006 by Aurelian Resources, then bought by Kinross and currently running in the factibility stage with Lundin company. As a summary, of the discovery, this project was part of regional greenfields program, then a systematic drilling program based on conceptual models have success in the 51 drill and make a intercept of 237.25 mts with 4.14 g/t Au.

This deposit is Jurassic age and is host in the Piuntza unit in the Santiago formation, is structurally controlled by a pull-apart system in Las Peñas strike-slipe fault zone, wich have N- S trend. Is consider a intermediate sulphidation system, the mainly mineralogy is quartz-illite-pyrite alteration. The deposit comprises two principal vein types, one in the south dominated by quartz, manganoan carbonates, and abundant base metal sulfides and the other in the north dominated by manganese- and base metal-poor quartz and calcite.

Currently defined resources shows 9.81 million ounces (Moz) of gold and 15.0 Moz of silver, with an indicated resource grade of 9.59 g/t Au and 12.9 g/t Ag.

In the visit we checked drill cores:



Py Veins in the feldspar porphyry.



Silica Veinlets with pyrite and marcasite, that contains the Au.



Hydrothermal Breccia, Clasts of volcanic Piuntza with disseminated sulphides and matrix of silica

VISIT TO EL MIRADOR PROJECT

The Mirador porphyry Cu-Au district is located in the east flank of the Cordillera del Condor, Zamora-Chinchi province, southeastern Ecuador. The district contain two significant porphyry Cu-Au \pm Ag \pm Mo deposits, Mirador and Mirador Norte, and an interconnected series of narrow, mineralized structures known collectively as Chancho. The principal mineralization in the porphyries is disseminated chalcopyrite developed primarily in potassic alteration, with overlying chalcocite supergene enrichment zones. Prior to radiometric dating presented in this study, these deposits were considered Late Jurassic based on close similarity, and therefore assumed age equivalence, with the well-dated Panantza and San Carlos porphyry copper deposits located 40 km to the north. Middle Jurassic age for granodiorite of the Zamora batholith at this location (162 Ma), and Late Jurassic ages for subvolcanic intrusions (158 Ma). The mineralization age is 155 Ma approximately, this indicates a coeval mineralization between Mirador and Mirador Norte. Mineralization and related subvolcanic igneous activity are closely associated at Mirador and represent the same temporal event recorded at Panantza-San Carlos, as well as coeval porphyry, skarn, and epithermal Au mineralization extending at least 80 km south, defining a north-south Cu-Au metallogenic belt spanning over 120 km.

Currently, the Mirador Project is in the development phase. It was possible to observe the construction of the Cu ore concentrator plant in which 60TM / d will be processed. Using a 0.4% Cu cut-off, with indicated resources of 609Mt of 0.58% Cu, containing 7.8 billion pounds (Blb) of Cu, 3.2 million ounces (Moz) of Au, and 22 Moz of Ag. The life time is 30 years old approximately.



Foto 1: Brecha freática con mineralización de Py y Cpy



Foto 2: Vetilla tipo A en granodiorita con alteración K y diseminado de Cpy, Py, Mo+AN