



**LA SARITA IOCG**  
and  
**HYBRID PORPHYRY SETTING**

**PROVINCE OF SALTA**  
**NORTHWEST ARGENTINA**

for  
**SALTA EXPLORACIONES/ARGENTINE FRONTIER RESOURCES**

by  
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## **EXECUTIVE SUMMARY**

The La Sarita cateo is underlain by an IOCG system manifest by the presence of a 16 km long, northeast trending belt of hematite veins, stockworks, replacements and breccias. Adjacent and proximal to this IOCG belt, two classic Chilean type porphyries (Taca Taca Abajo and Arriba) are hosted within a northwest trending transverse zone, one (Abajo) of which has proven reserves of 440 mt of 0.58% Cu. Where the northeast trending IOCG hematite system intersects this northwest transverse zone, the IOCG system blossoms out into 3 x 3 km alteration zone that is host to a 1.5-2.0 annular zone of secondary copper mineralization (turquoise/chrysocolla) associated with potassic, argillic and propylitic alteration referred to as the Hybrid La Sarita Porphyry. The La Sarita Hybrid porphyry has affinities to both classic porphyry and IOCG styles of mineralization, marked by vein of hematite, jarosite, turquoise and quartz. The presence of the secondary turquoise associated with jarosite, goethite and local "live" hematite is indicative of surface oxidation and potential secondary enrichment at depth. Although all estimates of size potential are highly speculative, the presence of a copper body of economic significance in the +100,000,000 tonne range is possible. No work has been done on the porphyry system. Two reverse circulation holes were collared along the extreme margins of the hybrid porphyry system, collared to test the adjacent classic Taca Taca Arriba porphyry.

In addition to the presence of a potential porphyry system associated with the IOCG alteration, the IOCG system contains the presence of an anomalous gold system 5 km to the northeast of the porphyry. There poorly exposed veins of hematite/chalcocite/quartz contain gold values to 22 gm/t. There has been no geophysical testing of the regional (16 km) IOCG hematite/k-spar alteration system.

## **LOCATION, ACCESS and INFRASTRUCTURE**

The La Sarita cateo is located 30 km west of the village of Tolar Grande, some 300 km from the city of Salta and 50 km east of the Chilean border. The cateo is reached by all weather roads to the western edge of Salar Arizaro and the Taca Taca Abajo prospect; from there by 4 x 4 track and all terrane vehicles. A railway between Chile and Argentina lies to the immediate north of the property. In Tolar Grande village there is a small hospital with doctor and some basic services, including drinkable water and electricity during the day.

Water is available from a number of springs in the general area and from the salar.

## **EXPLORATION HISTORY**

Two classic, calc-alkaline Chilean-style porphyries are located adjacent the La Sarita property: Taca Taca Abajo prospect lies about 5 km to the immediate east and Taca Taca Arriba to the immediate west. The La Sarita cateo area of SESA adjoins directly Taca

Taca Arriba. All previous work (Fabricaciones Militares, Gencor, RTZ, Corrientes and BHP) focused solely on the porphyry potential.

Salta Exploraciones claimed the prospect in 2006. It has spent the equivalent of 60 man days (including office and travel) evaluating the property. Work on the property was based from the village of Tolar Grande, located some 30 km to the east. Work was supported by trucks and quads owned by Salta Exploraciones. Work included two stages: reconnaissance prospecting of the whole of the La Sarita cateo (2004-2006) and delineation of the zone of copper mineralization by prospecting, sampling and reconnaissance mapping (April 2007).

Two RC drill holes were located on the property from work done by BHP on the Taca Taca Arriba prospect. RC #7 was located near the northeast limit of the copper mineralization and RC #10 at the southeast limit of the copper mineralization.

**PROPERTY OWNERSHIP:**

100% owned by Salta Exploraciones SA.

Property name and size: LA SARITA I & II

Property name	Area (hectarea = 100 m x 100m)
La Sarita I	1492.28 hectares
La Sarita II	1493.91 hectares

**GEOLOGIC SETTING**

**Regional Setting**

The prospect area underlies the prominent northeast trending Sierra Taca Taca horst block located along the northwestern margin of Salar Arizaro, in the western part of the Puna, in the province of Salta, near the Chilean border. The Sierra Taca Taca horst is bounded and defined by prominent north northeast trending fault structures. The horst is host to a variety of styles of mineralization that include the known Taca Taca Abajo and Arriba porphyry copper/gold systems, Taca Taca Sur low sulphidation gold system and recently recognized high sulphidation and IOCG settings.

The western and southern part of the horst range is underlain by Late Eocene to Oligocene felsic and intermediate volcanic rocks of the Santa Ines Formation. To the immediate east of the volcanic rocks are granitic rocks that includes a Permo-Triassic complex and Late Eocene-Oligocene age stocks and numerous dykes and sills that cut the Santa Ines volcanics. A northeast trending graben structure separates the Taca Taca horst block into eastern and western sectors. This graben is underlain by facies of the red bed lacustrine-evaporite sediments of the Oligocene-Miocene Viscachera formation of the (informally named Siete Curvas basin). The Sierra Taca Taca horst is transected by

northeast trending structures and by a major transverse northwest trending structure. This northwest trending cross-structure marks the location of the Taca Taca Arriba and Abajo porphyries, the La Sarita hybrid porphyry and by an aligned suite of Quaternary to Recent rhyolite and basalt cones.

### **Regional Mineralization**

The La Sarita prospect is part of a newly recognized Late Tertiary-aged IOCG belt in the western Puna. Numerous differing styles of mineralization are associated with this belt and it includes the 500 million tonne El Laco magnetite-hematite deposit in Chile and the Rio Grande-Arizaro-Lindero Cu/Au prospects in NW Argentina (Hitzman, personal communication 1999). These deposits are characterized by not only the abundant presence of hematite and/or magnetite, but also by anomalous to economic quantities of Cu, Au, REE, Co, U and Ag. Alterations associated with the Puna IOCG include: potassic, albite and propylite (chlorite, epidote, actinolite), and associated minerals that include fluorite and barite. The Puna IOCG occurrences and deposits appear to post-date a Late Eocene-Oligocene (Early Miocene) evaporitic sequences of the Siete Curvas basin. It is thought that this evaporate sequence represents the source of the salt for the hydrothermal brines related to the formation of the IOCG mineralized systems.

Classic, Chilean style porphyry showings in the western Puna include Taca Taca Abajo and Taca Taca Arriba. The Taca Taca Abajo deposit has been dated at 29-30 Ma, and pre-dates the evaporate sequences.

### **Mineralization of Sierra Taca Taca**

Numerous and differing styles of mineralization have been noted and investigated on the Sierra Taca Taca horst block. Mineralization includes: calc-alkaline Chilean porphyry settings (Taca Taca Abajo and Arriba), epithermal high and low sulphidation, IOCG settings and travertine/onyx-U deposits. The La Sarita cateo hosts most of the IOCG settings and includes a large (3km x 3 km) zone of copper-hematite mineralization classified informally as a hybrid IOCG porphyry setting.

### **Chilean Porphyry Settings**

The younger (Late Eocene) intrusions that host the Taca Taca Abajo and Arriba porphyries appear to be older than the red-bed evaporate sequences. Along the eastern margin of the horst complex, adjacent Salar Arizaro, the dominant bed rock is comprised of Paleozoic granitic rocks intruded by a small stock (3 x 1.75 km) that hosts the 29-35 Ma Taca Taca Abajo porphyry.

The Taca Taca Abajo property contains a large Andean type "porphyry copper" hydrothermal system that has generated a significant amount of supergene and hypogene copper, molybdenum and gold mineralization. The supergene zone is typically 20m to 60m thick and consists of chalcocite and covellite coatings on hypogene chalcopyrite and pyrite. A 200m to 300m thick leached cap sits above most of the supergene zone. Global

Copper is the present owner of the Taca Taca Abajo porphyry deposit.

Deep Hypogene and Supergene	0.3 % Cu cutoff	440 mt	0.58 % Cu	0.18 ppm Au	0.020% Mo
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Taca Taca Arriba porphyry lies to the immediate west of the La Sarita claims. The age of the porphyry is unknown but is likely of Late Tertiary age, similar to the Taca Taca Abajo porphyry dated at 29 Ma. The porphyry measures some 2.5 x 2 km in dimensions. Thirteen, widely spaced, drill holes (9 core-Fabricaciones Militares and 5 RC- BHP) have been collared. No commercial grades of mineralization were encountered in these drill holes, with grades of 0.33% Cu over 30+ meters reported. Surface exposures are strongly leached with the widespread presence of jarosite, goethite and subordinate 'live hematite'. Much of this porphyry prospect remains untested.

### **Epithermal Low and High Sulphidation**

A low sulphidation system is noted in the eastern and southeastern part of the Taca Taca horst area, south of the Taca Taca Abajo porphyry. The Desierto prospect area is underlain by numerous, but widely spaced quartz veins hosted in Eocene? or younger volcanic rocks. Values of gold to 26 grams (Mansfield Minerals) and 36 grams (Salta Exploraciones) have been reported. Associated with this low sulphidation mineralization system is a marked, 5 km long to 5 m wide ridge of intensely silicified quartz/biotite/feldspar porphyry with low precious metal values.

High sulphidation alteration is exposed in the central part of the La Sarita cateos and peripheral to the Taca Taca Arriba porphyry. This alteration is marked by the presence of argillic and silicic alteration. The argillic alteration comprises alunite, kaolinite and local pyrophyllite. The silica alteration comprises the silicification of the Eocene volcanics. Vuggy silica style of silicification was not noted associated with this phase of high sulphidation alteration. Gold values to 1 gm/tonne were noted locally associated with the alteration.

### **IOCG (Iron Oxide/Copper/Gold)**

The third and youngest stage of mineralization that underlies Sierra Taca Taca can be classified as an IOCG setting. This IOCG mineralization on Sierra Taca Taca comprises three different, interrelated styles:

Most obvious of the IOCG systems is a regionally extensive, 16 km long system of veins, stockworks, replacements, and breccias of specular hematite associated with regional potassic alteration. This zone is exposed mainly on the La Sarita cateo, (although much of its northern parts are held by a third-party cateo (mina)). Mineralization in this zone is dominantly specular hematite with minor magnetite. Quartz is common and fluorite a minor accessory. Copper and gold mineralization in this zone is very sporadic. Cobalt geochemistry show values up to 400 ppm. The iron-oxide mineralized system comprises up to 5 sub parallel, northeast trending zones distributed across 1-2 km. Its locus is

mainly near the contact of the granitic rocks with the volcanic rocks, dominantly within the granite.

Off the northeast flank of Sierra Taca Taca is a set of poorly exposed veins of hematite, chalcocite, quartz and gold (to 22 gms/tonne). These veins appear thin (to 50 cm) and widely spaced, although no trenching or follow-up work has been carried out. The highest grade values of these veins are located at and immediately east of the boundary of the La Sarita cateo of Salta Exploraciones.

Off significance, in the central part of the La Sarita cateos, where the 16 km long system of hematite-potash feldspar system intersects the northwest trending transverse zone (that hosts the Taca Taca Abajo and Arriba porphyries), and a hybrid porphyry is exposed. This hybrid porphyry is marked by veins, veinlets and stockworks comprised of variable amounts of hematite, quartz, jarosite and copper (as turquoise) associated with potassic, argillic and phyllic alteration. Here, the sub parallel vein/stockwork/breccia system of the regional hematite system expands to a broad 3 km x 3 km, subcircular area that is host to the copper mineralization. Within this roughly 3 x 3 area, a ring structure hosting anomalous copper measures 1.5-2.0 km in diameter. Eighty per cent of this hybrid IOCG porphyry lies within the Salta Exploraciones ground and overlaps onto the Taca Taca Arriba prospect to the west and onto third-party ground to the adjacent east. The zone of mineralization and alteration measures some 3 km x 3 km and is described below.

The age of this iron oxide/hematitic (IOCG) regional alteration appears to be late (post-Late Eocene) in the geologic evolution of the Sierra Taca Taca area. Veins of hematite-potash feldspar cut the argillic alteration in Taca Taca Arriba. Late, unaltered (propylitic) granitic quartz/feldspar/biotite dykes that cut the alteration in Taca Taca Arriba have been altered and veined by specular hematite.

## **IOCG HYBRID PORPHYRY SETTING**

### **Alteration and Mineralization**

The IOCG hybrid porphyry of La Sarita is located where the 16 km long, northeasterly trending hematite vein, stockwork and breccia system intersects the northwest trending transverse zone that hosts the pre-existing Taca Taca Abajo and Arriba porphyries. There, the regional NE IOCG system blossoms out into a broad, northeasterly trending zone measuring some 3 x 3 km hosting a zone of copper mineralization associated with potassic, argillic and propylitic alteration.

The zone of copper mineralization is represented by a dough-nut shaped ring within the hybrid alteration system. Mineralization within this ring, noted by the presence of turquoise (chrysocolla), measures in three zones with the approximate dimensions of 600 x 1000 metres (Sarita North), 400 x 1000 metres (Sarita South) and 200 x 500 metres (Sarita East). The zone central to the ring appears to be barren and dominantly with k-spar alteration.

The mineralized zones are marked by the presence of common to abundant veins, stringers, stockworks, and local breccias. The mineralization comprises a sequence of hematite, hematite-jarosite-copper, hematite-jarosite-quartz, hematite-jarosite-quartz-copper and jarosite-quartz-copper veinlets. Locally, veins of hematite-tourmaline (+/- copper) with potash feldspar selvages are noted. This hybrid IOCG porphyry style of mineralization has also only been recently recognized and its significance remains to be documented.

Preliminary investigations show the presence of potash feldspar alteration associated with and peripheral to the main zone of mineralization at La Sarita. Within the main Cu-bearing zone, the alteration includes clay minerals, sericite/illite, potash feldspar and (primary?) alunite. In many cases, the potash feldspar within this zone is transposed to a soft, friable, reddish mixture of fine sericite and dust hematite (from PIMA investigations). This zone of alteration associated with the copper mineralization (turquoise) is readily apparent on the satellite (aster) imagery, where it shows up as a more than subtle lighter colour than the surrounding unaltered rocks, but more subdued than the strong argillic and leach-cap assemblages that outline the classic porphyry systems of Taca Taca Abajo and Arriba.

From the abundant presence of jarosite, it appears that surface leaching of the mineralization has been extensive. "Live hematite" suggestive of the former presence of secondary chalcocite has been noted from a number of locations within the mineralized zone. All copper mineralization noted has been of the insoluble residue copper species of chrysocolla and turquoise. It is possible, from the surface leach mineral assemblages that there may exist at depth, the presence of secondary copper mineralization.

### **Geochemistry: IOCG Porphyry**

All the samples taken from the IOCG hybrid porphyry were grab samples and sampling concentrated on those samples with the presence of obvious mineralization: turquoise with or without jarosite, hematite and quartz. The presence of widespread jarosite (iron aluminum potassium sulphate) and turquoise (copper aluminum phosphate) is suggestive of the weathering and alteration of pyritic copper-bearing rocks within a potassic/phyllitic alteration zone.

In the La Sarita hybrid porphyry, the turquoise mineralization is associated with potassic (k-feldspar) and locally, alunite, alteration. Turquoise is a secondary mineral, formed from the oxidation of pre-existing copper sulphides within the zone of potassic alteration. It is generally thought of as a supergene secondary mineral, but may originate from very high level (near-surface), late hydrothermal solutions. Once formed, it is generally insoluble in the weathering process and reflects only the secondary copper mineralization that could not be further leached from the weathering system. Typically turquoise mineralization is restricted to a relatively shallow depth (+100 metres) and may overlie copper and pyrite mineralization. The origin of the phosphate in the turquoise is usually attributed to apatite, a primary magmatic mineral. (The Arizona copper porphyries are a

major source of turquoise where it is commonly found in the highly altered leach capping near the centre of the deposits).

Grab samples from the copper (turquoise) zone at La Sarita gave Cu values up to 4700 ppm and Mo values to 128 ppm, although most values of Cu were less than 1000 (approximate mean of 650 ppm for 50 samples from Sarita North) and Mo less than 100 ppm. Although a single grab gave a gold value of 500 ppb, most are below 100 ppb. Anomalous P (phosphorous) reflects the bias of the sampling to the turquoise-bearing rocks. Other elements appear to represent normal background values.

### **PROPOSED EXPLORATION PROGRAM:**

The property has three, possibly four potential targets of significance. The first stage of work should be directed to document the viability of each of the zones with respect to its economic potential and provide an outline for the follow-up stages.

1. IOCG Hybrid Porphyry: A potential significant porphyry setting has been defined by the distribution of secondary copper minerals associated with potassic and argillic alteration in the central part of the La Sarita cateos. Mineralization appears to be marked (on surface) by a circular zone. It is recommended that a geophysical survey (IP and Mag) be run across the zone of mineralization to determine the possible presence of sulphide mineralization at depth (both secondary enrichment and protore copper mineralization).
2. The High sulphidation system is similar to other known high sulphidation systems and represents directly a target area for exploration. Work on this should include:
  - a) Location and sampling of all high sulphidation areas on the property, in particular, the silica/siliceous zones.. It is known that this zone extends to the north and is suspected to continue to the west towards the western side of Sierra Taca Taca. Silicified zones have been noted from previous work cutting the volcanics to the northwest of Taca Taca Arriba and to the south, on La Sarita Sur (of Salta Exploraciones)
  - b) Map the system
3. The IOCG system will require mapping a both a regional and at a property scale. It is known that IOCG systems have the potential to contain very large tonnages of metal and that not all IOCG systems are fertile.
4. The high grade gold veins located along the border of Salta Exploraciones and Teck ground need to be evaluated. Further prospecting to locate more possible veins is required. A small back-hoe should be rented to expose these veins to assist in this exploration as at present, their orientation is unknown.



## TARGET TYPE AND SIZE

The main type of target for the La Sarita area is the hybrid porphyry area, as it has the most obvious potential for the presence of a large tonnage copper deposit. The potential for this area is enhanced by the size of its surface expression (approximately a 1.5-2.0 diameter ring structure hosting anomalous Cu and alteration). The presence of jarosite, minor live hematite and turquoise is indicative of strong surface leaching indicating the possibility of secondary copper enrichment at depth. The La Sarita system is located along a prominent structure known to host economic grades of copper mineralization as outlined by the Taca Taca Abajo system. Although any estimate of tonnage is highly speculative, the system does have the potential to host an enriched porphyry mineralized system >100,000,000 tonnes.

In addition, the high grade gold system in the NE of the area remains to be evaluated. As the system is of the IOCG type, the presence of a large-scale mineralized system somewhere below the presently exposed trace of the hematite vein-breccia system remains a possibility. To test this hypothesis would require a regional geophysical program across the prospect. The determination of the location of the proposed survey would be dependent upon geologic interpretation.

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