

MARIFIL MINES LTD.

SALTA PROVINCE LITHIUM PROJECT
NI 43-101 Technical Report

Salta Province Argentina

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Marifil Mines – December 2009

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1. SUMMARY

The Salta Province Lithium Project is controlled by Marifil S.A., a wholly-owned subsidiary of Marifil Mines Ltd. (Marifil), a publicly-traded Canadian corporation that holds 4 cateos (exploration concessions) for lithium in Salta Province, northwest Argentina. The cateos cover portions of salt lakes (salar) and adjacent alluvial fans. These four cateos cover two separate areas which are called Salar Llullaillaco and Salar Ratones. The two Salar Llullaillaco cateos cover 3457 hectares. The two Salar Ratones cateos cover 19,600 hectares. The properties are located on the Puna plateau, a high elevation basin-like plain on the eastern slope of the Andes Mountains (Figure 1).



Figure 1

The two Llullaillaco cateos lie along the eastern margin of the Salar Llullaillaco, covering a vast alluvial fan that lies on the eastern margin of the salar. The two Ratones cateos cover part of the Salar de los Ratones.

Lithium is probably derived from hot waters of volcanic origin leaching lithium from the volcanic rocks and is concentrated by evaporation in salars (salt lakes) that have no outlet except for evaporation. Hydrothermal solutions emanating from regional faults may be a secondary source of lithium and borates. The cateos have potential not only for lithium salts, but also for potash and borates. Nearby deposits that are being exploited from similar geologic environments contain sodium sulfates, lithium salts, and borates.

The four cateos controlled by Marifil are in a very early stage of exploration. Only surface samples and brines have been sampled thus far on the cateos, and of these only a few brine samples have been taken by Marifil geologic consultants. The brines of the nearby Hombre Del Muerto Salar, which average about 700 mg/l (milligrams/liter; one mg/l is equal to one ppm or one gram/tonne) of lithium, are currently being exploited by FMC Minerals Corporation. This well-known operation is being considered as one possible model for lithium exploration on the Marifil properties.

It is the conclusion of the author that more work should be done on these cateos to study the lithium potential of the properties. The sampling to date has consisted of surface waters which are at the top of the water column. However, brines may stratify based upon density. And indeed, results from well-pumping tests completed adjacent to the Llullaillaco Salar in Salta Province by Salta Agua Ltd. (2008) certainly demonstrate that samples taken from the top of the water column may not be representative of denser brines that exist further down in the water column. During the aforementioned pump-tests, three brine samples taken from the well yielded lithium values of 103 mg/l, 107 mg/l, and 108 mg/l. A verification sample taken from this well (Figure 10) at the top of the water column at a depth of 30m by the author in October 2009 contained only 8 mg/l lithium. Specialized tools necessary for sampling other parts of the water column were simply not available during the site visit. Similarly, it has been demonstrated that lithium is not uniformly distributed throughout a given salar. This probably reflects differing source areas for the lithium-enriched brines.

No brine samples were taken by Marifil Consultants on either the Llullaillaco or Ratones cateos. One verification sample was taken near, but about 4 km south of the eastern Ratones cateo (Figure 11) because much of the salar is covered by Holocene eolian and fluvial deposits. The sample, taken at a depth of about 1.5 meters, contained 1 mg/l lithium.

Some trenching may be necessary for further brine sampling in areas where the brines are too deep to be sampled with a hand shovel or auger. Additional work on these properties should consist of geophysical surveys and exploratory water-well drilling and sampling on widely-spaced intervals, perhaps as much as 3-5 kilometers apart initially. If favorable results are achieved by drilling, closer-spaced wells could be done at a later date as needed. The wells should be cased with perforated pipe to permit free circulation of sub-surface water. By this method, various levels of water may subsequently be tested at depth to determine the stratification of brines and

their respective lithium contents. Perforated casing will permit the water column to stratify as if no casing was present. The wells should undergo pump tests to determine the approximate volumes of sub-surface water available. This will help to determine a rough estimate of any potential lithium resource present. The budget for the entire program will total U.S. \$ 610,000.

2. INTRODUCTION

On behalf of Marifil, Daniel E. Buffone and Juan Carlos Danderfer completed a site inspection of the Salta Province Lithium Project along with an independent consultant, the author, on October 24th and 25th, 2009. The author's qualifications are included in Section 23 of this report. The purpose of the author's visit was to provide a basis for an independent technical evaluation of the data and other information contained within this technical report. The goals of this visit included the following tasks:

- a) Complete an independent confirmation of the Project, verify the level of work undertaken to date and determine the reliability of the key information supporting the potential of the Project.
- b) Confirmation of the potential of the deposit, including an appraisal of the geological characteristics and a detailed review of the relevant available technical information.
- c) Assess the merits of the property and draw generalized comparisons with other similar deposits.
- d) Prepare an exploration program and a budget to support it.

The author completed the assignment on the basis of an inspection of the site, traverses over the most accessible prospect areas, a review of technical data and reports forwarded to his office by Marifil, and verification sampling. The principal reports and data are listed in the bibliography. Project geologist Juan Carlos Danderfer and Daniel Buffone contributed extensive knowledge about the project's geology and valuable lithium exploration expertise. Pedro Vera was responsible for translating most of the geologic reports from Spanish into English and for contributing his knowledge of lithium exploration and local geology. The reports on the various work phases and subsequent studies (in Spanish and English) are accompanied by graphics and maps. This data is available for review at the Marifil office.

Lithium is sold as brines, compounds, or mineral concentrates. Prior to the recent advent of the hybrid gas/electric automobile and the ubiquitous use of cell phones, laptop computers, and similar gadgets, lithium was used primarily in lubricants, ceramics, glass, metallurgy, and the chemical industry. Recently, lithium-ion batteries have become the primary use of lithium. The lithium market has been growing at a rate of 4-5% per annum, and this growth is forecast to continue. Recent demand of roughly 80,000 tonnes per annum of lithium carbonate equivalent is

forecast to rise to nearly 100,000 tonnes per annum in 2010. Lithium demand growth in the United States of America has been even greater, with a 79% increase since 2003. This growth has been caused by an increased consumption in all end uses except for aluminum production. In particular, the greatest growth has been in battery production. In March of 2009, the U.S. Geological Survey estimated that the current use of lithium was as follows:

Batteries	25%
Ceramics/Glass	18%
Lubricants	12%
Metallurgy	10%
Pharmaceuticals/Polymers	7%
Air Conditioning	6%
Chemical Processing	3%
Other	22%

Even if the growing popularity of electric and hybrid automobiles should falter, the great number of other uses of lithium-ion batteries in irreplaceable high-tech devices of the 21st Century may keep lithium prices elevated for many years.

Globally, lithium deposits consist primarily of two types. The first of these are hard-rock deposits hosted by pegmatite. Lithium deposits in these rocks are comprised of lithium aluminum silicates such as spodumene. Lithium, however, is relatively difficult and expensive to liberate from silicate minerals. The second type of lithium deposit consists of brines and evaporite crusts that are of relatively low-grade when compared to pegmatite deposits. However, mining and processing of brines and evaporite crusts to produce lithium carbonate is relatively cheap compared to pegmatite mining. The recent rise in lithium prices has made these low-grade deposits much more attractive. A rush to identify these types of deposits is currently underway.

3.0 RELIANCE ON OTHER EXPERTS

Limited portions of this report have been created by Daniel Buffone, Juan Carlos Danderfer, and Pedro Vera. These Argentine geologists are co-authors of this report. Buffone, Vera, and Danderfer work for Marifil on a consulting basis. Their input was necessary because the author was not familiar with specific details of the regional geology of the Puna plateau. Their experience in lithium exploration was also welcomed. None of the three Argentine geologists cited meet the criteria to be a Qualified Person as defined by NI 43-101 because of the lack of license/registration required by NI 43-101. Nevertheless, all three of these geologists have a minimum of 15 years experience in mineral exploration and are competent, professional

geologists with degrees from accredited Argentine universities. The author has no reason to doubt the veracity of any data that they have contributed to this report. The author has attempted to verify all data input by those three geologists and has found it to be satisfactory and credible.

Disclaimer

The author is an independent consultant that has no financial relationships with Marifil and/or its subsidiaries other than remuneration for completion of this study. The compensation received is standard in the mining industry for this kind of work. Compensation is not based upon the contents of this report.

4. PROPERTY DESCRIPTION AND LOCATION

4.1. Marifil Cateos

Marifil S.A. is a private Argentinean corporation that is wholly owned by Marifil Mines Ltd, a publicly-traded Canadian company (Marifil). Marifil has recently obtained four Exploration Concessions (Cateos) for Lithium in Salta Province. The properties are grouped in two areas called Salar Llullaillaco and Salar Ratones (Figure 2).

The properties are located in the Puna Region, an elevated plateau which lies on the eastern slope of the Andes Mountains. The altitude varies between 3,700 m in the saline lacustrine basins to 5,250 m on the mountainous margins of the Puna Plateau. The geographical location of the area's center is: 26° 54' South Latitude and 67° 30' West Longitude (Figure 1).

TABLE 1

PROPERTY SUMMARY

<u>PROPERTY GROUP</u>	<u>CLAIM NAME</u>	<u>File #</u>	<u>AREA (HECTARES)</u>
Llullaillaco	La Rosadita 2	19185	1,472.15
	Mina Rosa 2	19173	1.984.70
Ratones	Ratones	080/2008	9,700.00
	Sierra de Ratones	081/2008	9,900.00

Total Area = 23,056.85 Hectares

4.2 Marifil/Provincial Agreement Terms

The tenements are Exploration Concessions 100 % controlled by Marifil. According to the Argentinean Mining Code, the legal status for all properties is the “Cateo” which translates to Exploration Concession. A key feature of an Exploration Concession is that they are granted in connection with a limited ground area and for a limited period of time. Each concession is divided into surface units and each surface unit contains 500 hectares. Concessions can have up to 20 surface units and therefore the largest concession might cover an area of 10,000 hectares; however, as the concession term runs, the size should be gradually reduced by the concessionaire.

The term of each Exploration Concession depends on the size of the granted concession area. The basic 500 hectares concession lasts for 150 days and each surface unit added to such basic concession increases the term by 50 additional days, therefore, the largest possible concession will last for 1,100 days.

Provided that the area of the Exploration Concession is entirely free from mining rights or properties previously granted, the exclusive right to claim properties in such areas shall be binding from the date of filing the concession request with the appropriate provincial mining authority. There are no holding costs for the first three years.

Exploration Concessions require minimal obligations for the concessionaire. However, they are mandatory to maintain the concession to keep it in good standing. The required obligations are listed as follows:

- A one-time exploration canon payment;
- Notification of the landowners within the Exploration Concession area and to publish notification with the local official newspaper; in general terms, landowners are not entitled to file opposition against Exploration Concessions, however they can demand a bond from the concessionaire to cover potential damages to the property.
- Provide an accurate forecast of exploration activities. Failure to fulfill such obligations enables the provincial authority to terminate the concession.
- Before exploration activities can begin, an environmental report should be filed and approved by the provincial mining authority. This report should be filed and approved on a bi-annual basis.
- Once the Exploration Concession expires the concessionaire must notify the provincial mining authority and provide all information and documentation resulting from the exploration activities conducted.

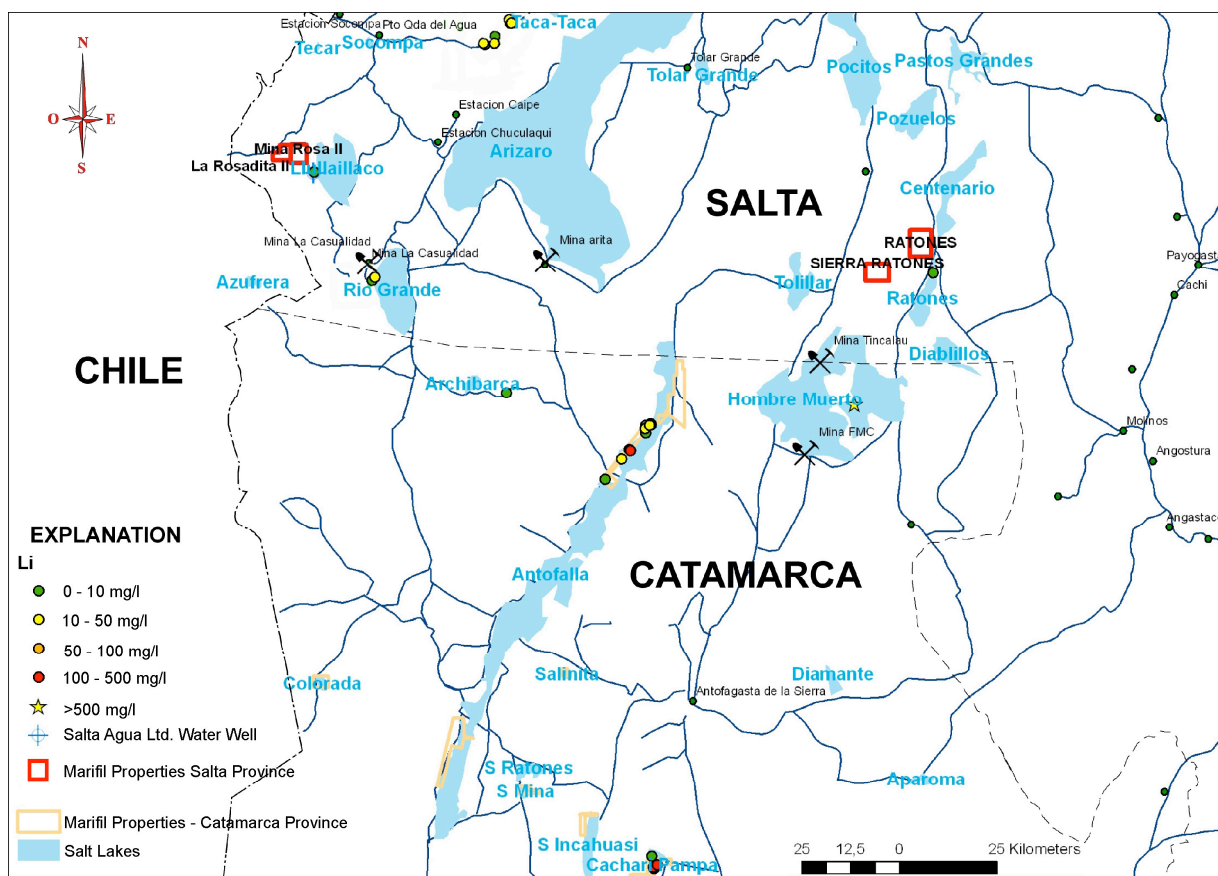


Figure 2.

FIGURE 2. PROPERTY LOCATION MAP

4.3 Royalties and Other Cateo Information

All tenements are Cateos, which in fact are Exploration Concessions. They were applied for and officially granted. At any time the company can ask for a change in their status and they or part of them can become Exploitation Concessions. The Cateos are controlled 100% by Marifil. No third parties are involved and no surface owner obligations are pending since all of the claims are located on government lands. Argentine law holds that surface rights for mining on federal lands have priority over other land uses. No official surveys, stakes or signs are required to identify property boundaries for this type of property application. All the properties are free of royalties, payments or other such obligations.

Official maps of Argentina are scaled in both geographic and projected coordinates. Usually, topographic maps are based on a grid system with a limited number of degrees latitude and longitude.

The system used in Argentina is called Conformed Projection Gauss Kruger, a variation of UTM (Universal Transverse Mercator). Argentina is divided into seven meridian bands numbered from west to east. Each band is 3° wide (Longitude) by 34° long (Latitude) with the origin located at the intersection of the South Pole with the central meridian (MCF= Meridiano Central de Faja) of each band. These bands are numbered according the following table:

TABLE 2 – UTM BANDS

Band	Central Meridian
Band 1	72 W
Band 2	69 W
Band 3	66 W
Band 4	63 W
Band 5	60 W
Band 6	57 W
Band 7	54 W

Other parameters used are:

Scale Factor: 1

Distance from the Equator to the South Pole: 10,002,288.30

Ellipsoid of Reference: Hayford International 1924 in all the official cartography and WGS84 in Salta Provincial Property Maps.

Datums: Campo Inchauspe for Hayford 1924 or WGS84

The coordinate systems used in all of the graphic presentations included in this report are Gauss Kruger Faja 2 WGS84. This system was selected because it is commonly used on the Salta Provincial Property Map.

Location- Llullaillaco Cateos

The two Llullaillaco cateos are located immediately east of the Llulliallaco Salar, a salt lake that lies in the southwest part of Salta Province (Figure 1 and 2). Provincial highway 27 and several unpaved roads provide access to the property. The Llullaillaco cateos are located about 100 km west of the town of Tolar Grande.

Location- Ratones Cateos

The two Ratones cateo are located on and adjacent to the Ratones Salar, a salt lake that lies in the southwest part of Salta Province (Figure 1 and 2). They can be accessed by a partially improved highway and some secondary roads. They lie about 130 km north of the town of Antofagasta de la Sierra (Figure 1 and 2).

TABLE 3
CATEO CORNER COORDINATES (WGS 84)

<u>La Rosadita 2</u>	<u>Mina Rosa 2</u>
<u>E/N</u> <u>(BAND 2)</u>	<u>E/N</u> <u>(BAND 2)</u>
1- 2556945/7260795	1- 2559599/7262741
2- 2556945/7262742	2- 2563716/7262741
3- 2559599/7262742	3- 2563716/7257921
4- 2559599/7258742	4- 2559599/7257921
5- 2554945/7258742	
6- 2554945/7260795	
<u>Ratones</u>	<u>Sierra de Ratones</u>
<u>E/N</u> <u>(BAND 3)</u>	<u>E/N</u> <u>(BAND 2)</u>
1- 3415416/7238963	1- 2405000/5813000
2- 3420935/7238963	2- 2413000/5813000
3- 3420935/7231994	3- 2413000/5807000
4- 3415416/7231994	4- 2407000/5807000
	5- 2407000/5810000
	6- 2405000/5810000

4.4 Environmental Liabilities

Prior to the execution of any exploration program, an Environmental Impact Report must be submitted to the provincial mining authority in order to legally initiate exploration activities. This report should be filed and approved on a bi-annual basis. No report has yet been filed. There are no known environmental liabilities on the cateos.

Field work requiring surface disturbances will not be initiated until the first round of sampling finishes. Trenching and drilling tasks that follow require another environmental impact study that will be submitted to and approved by the provincial mining authority. The project area is free of Indigenous reserves, National, or Provincial Parks.

5. ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

The four cateos controlled by Marifil are about 400-500 kilometers by road from Salta, the nearest large city. Salta, with a population of about 500,000 people, is a 400-year old town that has virtually any modern-day service and many industries. Agriculture, ranching, oil field services, and tourism are the main economic forces in the Salta area. From Salta, the cateos may be accessed by National Highway 51 in a westerly direction to National Highway 27 and National Highway 43 which run in a southerly direction. Much of Highway 51 is paved and much of highway 27 and highway 43 are improved gravel road. Semi-trucks (lorries) can use both of these roads. The cateos can be accessed by local roads a short distance from highway 27 and highway 43. The closest village to the two Llullaillaco cateos is Tolar Grande, roughly 100 kilometers to the east. The closest village to the two Ratones cateos is Antofagasta de la Sierra, about 130 kilometers to the south. Lodging and meals are available at Tolar Grande. The closest town to the two Ratones cateos is Antofagasta de la Sierra. Limited services exist there, but the basics of fuel, lodging and meals are readily available.

No tailings storage areas, waste disposal areas, or heap leach pad areas will be necessary because the target here is lithium-rich brines and crusts. However, areas for evaporative ponds may be necessary for brine reservoirs. Areas for waste rock may also be necessary. The salars themselves will be useful for these purposes. They contain thousands of hectares of level ground. Alternatively, many relative flat areas are also found adjacent to the salars on broad, gently-sloping alluvial fans. This land is available for such use because it belongs to the federal government that encourages economic development. By Argentine law, mining takes priority over all other uses on federal lands. These areas can also be used for mine infrastructure.

The Puna is a large block of crystalline basement rocks that was uplifted during the Tertiary Period. The intervening valleys are filled by recent clastic and chemical sediments derived from weathering and erosion of the adjacent mountains. The centers of the valleys are often salt lakes that may contain significant quantities of lithium, borates, and sodium sulfate in both brines and crusts. The flanks of the valleys are often alluvial fans which can contain vast sub-surface water resources, important in such an arid region. Most of the mountain ranges are oriented in a northerly direction, paralleling regional structures. Some of the mountains rise up to 2000 meters above the Puna valleys. These valleys, which often contain lithium-bearing brines, have elevations ranging from about 3500 to 4000 meters above sea level. The mountains in general show a rough topography because of their young age and intense weathering caused by the arid, cold and windy climate. Volcanoes, such as Llullaillaco Volcano which rises to 6710 meters above sea level, tend to dominate the landscape in the west. That volcano is a large, isolated conical shaped mountain surrounded by a vast detrital apron. In many of the intermontane basins, extensive saline lakes and dry salt flats, called salars are found, such as Arizaro Salar which covers 4,700 sq kilometers.

The Climate, named “La Puna Desertica” (the Puna Desert) is controlled primarily by the existence of orographic barriers in the east which remove most of the moisture from the humid Atlantic air before it reaches the Puna plateau. The great amount of sunlight (85% of sunny days in wintertime), the great daily and seasonally temperature ranges (more than 30 Celsius degrees), the frosts and the small amount of precipitation (less than 100 mm annually) are the more typical features of the Puna climate. The nearest official weather station is at Abra Pampa, which lies on the eastern edge of the Puna plateau. The conditions at Abra Pampa are less extreme than that of much of the Puna plateau.

Temperature Ranges			
Summer	Máximo	20º - 25 º C	68 – 77 º F
	Mínimo	(-2º) - (-8º) C	28 -17 º F
Winter	Máximo	5º - 10 º C	41 – 50 º F
	Mínimo	(-20º) - (-25º) C	(-4º) - (-13º) F

Visitors to the Puna Plateau may suffer altitude sickness due to the high altitude and resultant oxygen deprivation. The main symptoms of altitude sickness may include headache, vertigo, shortness of breath, increased arterial pressure, nausea, nasal hemorrhages, or drowsiness. Those with cardiac problems or arterial hypertension should consult their doctor prior to visiting the Puna region. Once in the Puna, they should limit their physical activities.

The weather conditions have substantial influence on the vegetation. Due to environmental conditions present in the Puna, trees are rarely seen. The lack of rain creates a special vegetation cover called “Provincia de la Puna”, which consists of a variety of small, bushy plants and grasses. In some places, however, there is little or no flora, especially in rocky or saline soils.

Although the climate is relatively cool, the lack of precipitation in the area is conducive to year-round operations unencumbered by a rainy season or significant snowfall. The surface of the seven cateos is owned by the Argentine government and is available for use. Power lines come from the east to service the town of Antofagasta de la Sierra. No power lines run to the town of Tolar Grande. The closest power lines are about 60 kilometers east of Tolar Grande. The two Llullaillaco cateos are located about 160 km to the west of the power lines. The two Ratones cateo lies about 130 km north of the power lines that serve Antofagasta de la Sierra. Under these conditions, power for mining operations at either the Llullaillaco cateos or the Ratones cateos would have to be supplied by diesel generators. Sub-surface water resources for mining operations exist beneath many of the alluvial fans in the area. Skilled mining personnel would have to be brought primarily from outside the Puna region, although unskilled workers could be obtained locally, especially if specialized training programs were instituted.

The fauna are typical of the Andino-Patagonica Subregion. The largest of these animals are vicunas, llamas, and Guanacos. Skunks and wildcats are also present. Several small types of rodents are common. Birds present consist primarily of the Andean ostrich, partridges, flamingoes, and small hens. Reptiles found in the Puna region consist primarily of small lizards and snakes.

The Puna region is too high and dry to support agriculture or cattle, although some sheep and llama herds of small size are present. These domesticated animals are used primarily as a subsistence food source for the inhabitants of small villages that are located far apart from one another. The sparse vegetation, arid climate, and high altitude precludes any significant agrarian or livestock-based activity.

6. HISTORY

Prior to the cateo acquisition by Marifil, there were no other claimants that controlled these specific areas. Nearby areas had limited competitor cateos historically, but only recently, with increased lithium demand and prices, has the area become competitive. The Puna plateau contains the majority of the world's known lithium-brine resources, making this area attractive to many mineral exploration concerns. Lithium brines have been recognized as the lowest cost source of lithium with respect to other lithium resources.

Exploration thus far has been extremely limited. Geologic research has been followed by limited surface water sampling. Marifil personnel have taken only a few surface water samples. There is no historic mineral resource or mineral reserve estimate. There has been no production from these properties.

7. GEOLOGICAL SETTING

7.1 Regional geology

The Cenozoic sedimentary basins and related volcanic belts of the Puna have formed on a continental crust which is composed of Precambrian to Early Paleozoic crystalline basement rocks and Lower Paleozoic strata as well as Permian and Mesozoic rocks. A fivefold division of the Cenozoic, whose oldest sediments have a Late Eocene age is present as the most conspicuous unit.

Crystalline basement

Crystalline basement rocks are exposed along the western margin of the Salar de Antofalla associated with reverse faults, west and southwest of the volcano Tebenquicho, south of the Sierra de la Quebrada Honda, and at the southwestern border of the Sierra de Calalaste. Migmatic gneisses and metabasites, penetrated by several generations of granitoids and aplites, predominate. Age determinations on a migmatic gneiss yielded 419.0 ± 8.0 Ma and yielded ages on two granite samples 417.0 ± 8.0 Ma as well as 389.0 ± 8.0 Ma. The Archibarca granite, located

in the NW part of the study area, has an Early Paleozoic age of 485.0 ± 15.0 Ma (Palma et al. 1986). Intensely deformed phyllites and metagraywackes occur in tectonic contact with high-grade metamorphic rocks northeast of the Vega Quiñoas. Based on lithological similarities, they are considered as an equivalent to the Late Precambrian Puncoviscana Formation which crops out in widespread areas of NW Argentina (Aceñolaza et al. 1988).

Lower Paleozoic sediments and volcanics

Among the most common rocks forming the Andean basement are low-grade metasediments with intercalated metabasites of Early Paleozoic age. The sedimentary suite is represented by a thick alternation of mostly turbiditic sandstones and siltstones. Common features are Bouma cycles, sharp erosional contacts, flute casts, and tool marks. Due to lithological and facies similarities, these rocks may be an analogue of Ordovician sediments of the Northern Puna which Bahlburg (1990) interpreted as deep water sediments deposited in a back-arc basin.

Upper Paleozoic and Mesozoic sediments and volcanics

The crystalline basement is nonconformably overlain by unmetamorphosed siliciclastic sediments of Permian age. They are composed of a coarse basal conglomerate, derived from the crystalline basement, followed by an alternation of large-scale cross-bedded quartz sandstones and quartz conglomerates, probably representing a beach environment. In the Salina del Fraile area, an approximately 200 m thick succession of playa/sabkha siltstones and eolian sandstones overlain by an alternation of quartz sandstones and reddish siltstones of a presumably littoral environment is exposed. Petrified fragments of stigmara root of *Lepidodendron* or *Sigillaria* indicate a Late Carboniferous to Early Permian age. Interbedded tuff layers yielded ages of 268.0 ± 6.0 Ma, 276.0 ± 1.0 Ma and 264.5 ± 1.5 Ma. Another age (281.0 ± 6.0 Ma) of a tuff layer from the southeastern margin of the Salar de Antofalla suggests the widespread occurrence of Permian sediments in the study area.

In the Salina del Fraile area, the Permian strata are cut by dikes of intermediate composition of Triassic age (212.0 ± 5.0 Ma, 234.0 ± 1.0 Ma). The Permian is unconformably overlain by a more than 100 m thick sequence of interbedded marls and sandstones with pillow lavas and hyaloclastite breccias at its base and other intercalated lava beds of an Early Jurassic age (198.0 ± 5.0 Ma, 194.0 ± 6.0 Ma). Interbedded are coquina beds and oolitic limestones. Remnants of foraminifera (*Psammosphaera* sp.), cyanophyta (*Rivularia* sp.), ostracods, and echinoderms have been found. These and the occurrence of a 2 m thick magnetite placer bed hint towards a deposition in a littoral to shallow marine environment.

Upper Eocene to Upper Oligocene (Quiñoas Formation)

The Late Eocene to Late Oligocene strata are more than 750 m thick and consist of reddish, sometimes gypsiferous pelites and sandstones locally with conglomeratic

intercalations. The succession shows variations in facies and lithology which allow a subdivision into two members.

The base of the Quiñoas member I is exposed north of the Vega Quiñoas and shows an erosional contact to the underlying pre-Cenozoic rocks. It consists of red conglomerates containing pebbles of phyllites, granites, and schists which originated from the crystalline basement. The remaining part of the first member is dominated by an alternation of siltstones and fine-grained sandstones, rarely interbedded with lenticular bodies of conglomerates. The siltstones show horizontal lamination, bioturbation, and desiccation cracks. Thin gypsum layers are occasionally intercalated. The sandstones display a relatively uniform thickness over a large lateral extent, asymmetrical current-ripples, and erosive basal surfaces. Locally, they are pebbly and contain horizons of mudclasts. Lithology and sedimentary features indicate a deposition in periodically flooded playa sand and mudflats.

Member II is dominated by medium- to fine-grained sandstones reaching a thickness of 300 m. They are massively bedded on a scale of 0.5 - 5.0 m, with a planar or eroded lower contact. Sedimentary structures are delineated by the presence of mudstone intraclasts and scattered pebbles as well as low-angle trough cross-bedding at the base and horizontal parallel laminae towards the top of the beds. Based on its sedimentary features, they are interpreted as deposits of a fluvial distributary system.

In the Quiñoas Formation, unequivocal paleoflow indicators are missing. Paleotransport directions and sedimentary structures for coeval strata in surrounding areas are not available. The only indication for the paleotransport direction was given by Jordan and Alonso (1987) who pointed out that the Oligocene red beds are more conglomeratic in the west than in the east of the Puna. They assumed that an ancient mountain belt located in central and western Chile supplied the detritus which was shed eastwards to a broad alluvial plain.

Intercalated tuff layers indicate the Late Eocene to Late Oligocene age of the Quiñoas Formation. The oldest dated sediments of member I occur at the eastern margin of the Salina del Fraile, but the base is not exposed. A tuff bed in the deepest portion of this section yielded an age of 37.6 ± 0.3 Ma. From another tuff bed near the top of member II an age of 28.9 ± 0.8 Ma has been obtained. The succession is unconformably overlain by conglomerates of the Chacras Formation with a maximum age of 24.2 ± 0.9 Ma. Based on its lithological composition, the Quiñoas Formation is possibly correlative to the Geste Formation of the Pastos Grandes and Arizaro areas as described by Turner (1960), Donato (1987) and Alonso (1992).

Upper Oligocene to Lower Miocene (Chacras Formation)

The Chacras Formation is composed of conglomerates and pebbly sandstones as well as medium to fine-grained sandstones unconformably overlying member II of the Quiñoas Formation. In the Salina del Fraile area, the succession reaches a thickness of about 350 m, whereas west of Antofalla village more than 600 m are

exposed. The conglomerates are massive, poorly sorted, matrix to clast-supported, and form laterally continuous sheets. Basal bedding contacts are erosional. Pebbles display diameters of up to 0.5 m, are subangular, and originated from the crystalline basement as well as Lower Paleozoic strata. The nature of the conglomerates suggests a deposition in an alluvial fan environment close to the source areas.

The uppermost part of the Chacras Formation is dominated by medium to fine-grained sandstones. They display trough cross-stratification with sets 0.5 - 10.0 m thick, bounded by curved erosion surfaces with a wedge-like appearance. Foreset dips vary between 15° and 25°, declining to around 5° at the base. High-angle trough cross-bedding, grain size characteristics, and excellent sorting correspond to modern eolian dunes.

The Late Oligocene to Early Miocene age of the Chacras Formation is indicated by intercalated tuff layers. The oldest age data was obtained from a tuff bed sampled north of Antofallita (24.2 ± 0.9 Ma [ID-86]). East of the Salina del Fraile, a tuff yielded an age of 22.5 ± 0.6 Ma (ID-18). The sediments of the Chacras Formation are unconformably overlain by volcanoclastic sediments of the Potrero Grande Formation whose maximum age is dated at 18.0 ± 0.6 Ma (ID-52) (Fig. 3).

Lower Miocene to Middle Miocene (Potrero Grande Formation)

The Early to Middle Miocene Potrero Grande Formation unconformably overlies the deposits of the Chacras Formation. The thickness of the Potrero Grande Formation varies from 50 m near Quiñoas to more than 250 m towards the west in the Salina del Fraile area. Its lithology is characterized by conglomerates composed of volcanic fragments, intercalated fallout tuff layers, and ignimbrites indicating substantial syndimentary volcanic activity.

Sedimentation started with conglomerates and conglomeratic sandstones locally reaching a maximum thickness of about 100 m. Volcanic fragments prevail with diameters up to 1.5 m. Pebbles of the Eocene-Oligocene strata, Lower Paleozoic sediments and crystalline basement rocks are of subordinate frequency. The matrix-to clast-supported conglomerates exhibit erosional basal contacts, channelling, and partially pebble imbrication, and are interpreted as proximal alluvial fan sediments. Greyish sandstones and siltstones interbedded with conglomerates follow upsection. Sedimentological features like medium-scale trough cross-bedding, erosive basal contacts, and channelling indicate a deposition in a fan-related fluvial system.

Paleocurrent directions measured on imbricated pebbles of coarse-grained alluvial fan deposits show significant variations indicating a subdivision into several narrow, separate basins. This separation was mainly controlled by another interval of contractional tectonism during the Early Miocene

Middle Miocene to Pliocene (Juncalito Formation)

The Middle Miocene to Pliocene Juncalito Formation unconformably overlies the older Tertiary units and is exposed only at the eastern border of the recent Salar de

Antofalla. Two major facies associations can be defined: a coarse-grained alluvial fan facies dominating the lower part of the Juncalito Formation and a pelitic/evaporitic playa facies prevailing in the upper part.

The alluvial fan deposits are characterized by conglomerates interbedded with pebbly sandstones. They reach a thickness of several hundred meters. The conglomerates contain mainly clasts of Quiñoas sandstones as well as Lower Paleozoic metasediments and metavolcanics originated from the adjacent Sierra de Calalaste area. Also, fragments of the crystalline basement as well as andesite and dacite clasts are observed. The alluvial fan deposits are thought to be products of relief-forming processes due to reverse faulting and thrusting. Paleocurrent measurements indicate a transport mainly from a source area in the east, presumably the Sierra de Calalaste area.

The playa deposits represent different subenvironments such as mudflats, sandflats, lakes, and salt pans. Most typical features of the mud and sandflat deposits are reddish sandstones and siltstones. Low-angle cross-bedding, desiccation cracks, interbedded gypsum and halite layers are common. Sheet geometry, large lateral extent, and relatively uniform thickness suggest a prevailing deposition as distal sheetflows. Intercalated in the playa mud and sandflat deposits occur salt pan sediments consisting of alternating millimeter- to decimeter-scale layers of halite and mud. They have been deposited in saline lakes producing successive layers of salt by repeated flooding and subsequent reprecipitation. In the central part of the basin, massive halite reaches a thickness of 50 m. Lacustrine sediments were deposited in marginal parts of the basin. They consist of gypsum horizons, grey marls, and white limestones with frequent stromatolites, pisolites, and oolites. Their widespread occurrence in the middle part of the section is thought to be linked to a stage of relative tectonic quiescence and relief equilibration.

The base of the Juncalito Formation is marked by high diachronism. While deposition of the Potrero Grande Formation in the Salina del Fraile area continued until 10 Ma, sedimentation of the Juncalito Formation in the Salar de Antofalla area started at about 11 to 12 Ma. This age is indicated by intercalated pyroclastic rocks. At the base of the exposed section a brecciated pyroclastic layer possibly a lahar deposit yielded an age of 11.2 ± 0.3 Ma. From other tuffs higher upsection, ages of 9.3 ± 0.2 Ma, 7.9 ± 0.3 Ma, and 4.6 ± 0.5 Ma were obtained. Age equivalence and lithological similarities permit a correlation of the Juncalito Formation with the Sijes Formation of the Pastos Grandes and Arizaro areas described by Turner (1960) and Alonso et al. (1991).

Pliocene to Quaternary (Escondida Formation)

The final sedimentation (Escondida Formation) is marked by the abundance of coarse-grained conglomerates unconformably overlying the Juncalito strata.

The conglomerates are massive and poorly sorted. They are both, matrix- and clast-supported forming laterally continuous sheets and channel-like bodies, respectively.

Basal bedding contacts are mostly erosional. Based on the sedimentary features, a deposition in a proximal alluvial fan environment is proposed. A maximum thickness of several hundred meters is reached directly at the border of the Sierra de Calalaste, whereby in more distal parts the average thickness is about 30 to 50 m. The clasts are subangular to angular, and reach diameters up to 1.0 m. The composition is similar to those of the Juncalito Formation. Paleocurrent measurements also indicate a main transport from a source area in the east, the Sierra de Calalaste. Its uplift along extended reverse fault and thrust systems was connected to the final compressional shortening. Due to ongoing synsedimentary compressional deformation, the coarse-grained sediments of the Escondida Formation show internally some angular unconformities.

The oldest sediments of this succession were tectonically affected. Intercalated tuffs yielded an age of 3.605 ± 0.005 Ma and 3.2 ± 0.1 Ma. For one of the unaffected fan bodies we obtained an age of 0.47 ± 0.01 Ma. Due to lithostratigraphic comparisons we consider the Escondida Formation as an equivalent to the Batín Formation of the Arizaro area (Donato 1987) and the Singuel Formation of the Pastos Grandes area (Alonso and Gutiérrez 1986).

7.2 Project Geology

Llullaillaco is just one of a chain of Quaternary Age stratovolcanoes that define the Andean Central Volcanic Zone (CVZ) and marks the border between Chile and Argentina. The volcanic edifice is constructed from a series of thick dacitic lava flows, forming one of the tallest (6739 m) active volcanoes in the world. K-Ar and new biotite laser $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating dates indicate that the volcano was constructed during the Pleistocene Era, with a youngest age of 48,000 years $\pm$ 12,000 years being recorded for a fresh dacite flow that descends the southern flank of the volcano. Additional $^{40}\text{Ar}/^{39}\text{Ar}$ measurements for andesitic and dacitic lava flows from the surrounding volcanic terrain yielded dates ranging from 11.94 ± 0.13 Ma to 5.48 ± 0.07 Ma, corresponding to an extended period of Miocene volcanism which defines much of the landscape in this region. Major-element and trace-element compositions of lavas from Llullaillaco are typical of Miocene-Pleistocene Age volcanic rocks from the western margin of the CVZ. They may be related to shallow-dipping subduction of the Nazca Plate beneath Northern Chile and Argentina (Richards and Villeneuve, 2001).

In the Llullaillaco Salar and Salar Ratones areas of northwestern Argentina, Late Eocene to Pliocene (and possibly even Pleistocene) Age sediments are exposed with thicknesses of up to 1,600 meters. These sediments consist of fluvial, lacustrine, and eolian deposits that are intercalated with pyroclastic rocks and volcanic flows. The sedimentary units represent alluvial fan-playas complexes that accumulated under semi-arid to arid climate conditions. From the Late Eocene to the Early Miocene, sedimentation took place in broken foreland basins while from the Early Miocene to the Late Pliocene (and possibly the early Pleistocene); sediments

accumulated primarily within compressional retroarc basins in which volcanoes partly formed additional basin boundaries.

Seven stratigraphic units, many of which are described in detail in the previous section, can be differentiated on the basis of different lithofacies, angular unconformities, and different regional distributions:

- Late Eocene to Early Miocene Quinoas Formation
- Early (?) to Middle Miocene Potrero Grande Formation
- Late Miocene Antofalla Formation
- Late Miocene Salina beds
- Late Miocene Pozuelos Formation
- Late Miocene to Early Pliocene Sijes Formation
- Late Pliocene (?) to Early Pleistocene Singuel Formation

These salar basins are of tectonic origin with centripetal drainage and are filled by clastic and evaporitic sediments. The Salar basin itself belongs to a dynamic geomorphological unit conditioned by climatic variations, evaporation, precipitation, surficial and underground runoff, phreatic level variations and eolian deposition. The basin's chemical and mineralogical characteristics may create a number of units with different qualitative and quantitative salt compositions, particularly in respect to the sulphate and chloride contents. Quaternary piedmont sediments surround the basin. They can be subdivided into a number of units:

- The piedmont deposits (bajada, playa, dune formations) covering the surrounding pediment, the source for the sand and silt windblown facies found in the salt zone.
- Alluvial fans carrying water to the basins.
- Two terrace levels surrounding the basins.
- Mudflows and scarp slidings.
- Playa and deltaic sands.

8. MINERALIZATION

Mineralization of interest on the cateos consists of lithium-rich brines. Lithium is leached from volcanic rocks primarily by hydrothermal solutions emanating from deep-seated faults. This may also involve circulation of meteoric waters within fault systems. The length, width, depth, and continuity of lithium-bearing brines are uncertain at this early stage of exploration. Although only a cursory amount of sampling has been done thus far on the Llullaillaco and Ratones cateos, lithium-

bearing brines have been discovered. Some of the results from this preliminary sampling can be seen in figures 7 and 8. Sample data can be seen in Appendices A and B.

The brines found on the Llullaillaco cateos are found at a depth of about 30 meters. Thus, no samples have yet been obtained by Marifil consultants. However, preliminary near-surface water samples taken near the two Llullaillaco cateos were obtained in 2008 by Salta Agua Ltd. during a pump-test performed on a water well that lies about 1 km to the east of the Llullaillaco cateos, and roughly 500 meters west of the Llullaillaco Salar (Figure 10). These three brine samples yielded lithium analyses of 103 mg/l, 107 mg/l, and 108 mg/l. A verification sample taken there at the top of the water column, at a depth of 30 meters by the author (MFM # 17040) contained 2 mg/liter lithium. This is just one line of evidence suggesting that caution must be used when interpreting analytical results derived from near-surface waters. Denser brines probably exist near the bottom of the water column simply due to gravity.

Preliminary near-surface water samples from the two Ratones cateos have not yet been taken. Part of the reason for this is that the cateos have alluvial and eolian cover, precluding sampling at shallow depths. A verification sample taken 4 km south of the ratones cateo by the author (MFM # 17041) contained 1 mg/liter lithium (Figure 11). Sample data can be seen in Appendices A and B.

9. DEPOSIT TYPE

Lithium is a comparatively rare element, although it is found in many rocks and some brines, but always in very low concentrations. The average amount in the earth's upper crust has been estimated to be about 20 ppm by Vine (1980), although others have quoted values as low as 7 ppm (Bach et al., 1967; igneous rocks 6 ppm, sedimentary rocks 11.5 ppm) and as high as 60 ppm (Deberitz, 1993; 27th in rank of elemental abundance). Even with these small numbers, however, there are a fairly large number of both lithium mineral and brine deposits, but only comparatively a few of them are of actual or potential commercial value.

The deposits have been formed because of lithium's higher solubility than most other cations, so it sometimes has concentrated in flowing and cooling magma and/or its accompanying aqueous fluids, as well as in evaporating brines. Thus, hydrothermal fluids may be an important lithium source.

The high-lithium brines usually have obtained most of their lithium from geothermal waters, with perhaps some of the lithium coming from surface leaching of volcanic ash, clays or other rocks. However, lithium is very difficult to leach from the lattice structure of all rocks and minerals, so little is dissolved unless the water is very hot. Experimental studies have shown that at ambient temperatures, only 55–170 ppb dissolves from extended contact with granitic rocks, but at 275–600°C 0.25–2.4 ppm Li can be extracted in the same agitated, long contact-period (Dibble and Dickson, 1976).

Other rocks or higher temperature leaching conditions must allow a greater amount of lithium to be removed, since some geothermal springs have lithium values of 6–50 mg/l, but in all cases the lithium concentration is still very low. When these dilute geothermal waters are concentrated by the evaporation occurring in arid climate, within closed, reasonably impervious basins, comparatively strong lithium brines have resulted in a few large playa deposits.

The Puna Lithium bearing salars have these particular features in common:

- Favorable tectonic setting which produces enclosed valleys with their correspondant salt lakes
- Presence of geothermal centers as a Lithium source and thermal waters which dissolved lithium from the volcanic rocks
- High evaporation ratios and extremely low precipitation that help to concentrate Lithium in brines.

Actually, this genetic process took place during two different periods. There are two types of evaporite deposits with two ages. Stratified evaporites are of both Miocene age and Holocene-Pleistocene age. Both of these contain similar mineralization.

Most of them would have deposited prior to the last ice ages 10,000–21,000 years ago, and then been buried by the sediments carried into the Salars with the massive ice age water flows. This would make their depth below 18–20 m, and indicate that there could be many millions of tons of lithium buried in the Salar's mudflat and or the marginal alluvial fans. For example, high lithium and potash values were detected in water analyses from a water well drilled in the alluvial fan situated on the west side of Llullaillaco Salar within a few hundred meters of Llullaillaco Salar. Marifil consulting geologists reported that a water sample taken from water well POLL-1 contained 108 mg/l lithium and 3955 mg/l potassium. A verification sample taken there by the author contained 8 mg/l lithium and 308 mg/l potassium.

Lithium-brine deposits are the primary target of the Marifil exploration program. Marifil is proposing to evaluate un-tested lithium targets adjacent to Salar Llullaillaco and Salar Ratones. The deposit model they are using was developed by extrapolating common stratigraphic features from local deposits to the Marifil properties (Figure 3). The following description of the deposit types is based on field work performed by J.C. Danderfer and the available literature. In general, at surface, the salars present two facies; clastic and evaporite. Commonly the clastic facies is on the margins of the salars, grading into an evaporite facies toward the depocenter.

Clastic facies

They extend, as discontinuous ribbons, on the edges of salars and they do not reach any appreciable extent. The width of this band is very variable. As it is to be expected the greater development of this facies is related to the rivers which feed the salars. With respect to grain sorting, in all the cases grain sizes decrease towards the salar and graduate from coarse gravel, to medium size and fine gravel, then sands and finally to silts and clays. The coarser units are in the alluvial fan, sands in the sand flat and finally the silts and clays in the mud flat (Alonso 1992). The development of these zones is variable and it is not always easy to identify them and to separate them clearly, especially where their width is reduced.

Evaporite facies

Four different evapofacies are present from the edge to the center of salars. They are:

- Carbonate facies: Composed mainly by travertine of two types; thermal and lacustrine. Thermal travertines are at the same level of salar, have rounded shape and resemble geyserites. Lacustrine travertine are elevated from the salar surface as terraces of up to two meters high. They are patchy and sometimes form islands or barriers that run from the beach to the center of the salar. A third facies is represented by some plants called “yaretillas” which trap carbonates in their structure. These plants form colonies that are rounded and domed shape at the edges of salars, constituting a barrier of up to 20 km long in some places. They may be algal in origin.
- Gypsum facies: This facies is commonly well-developed, forming a continuous belt around the salars. This facies is composed mainly of gypsum in the form of gypsum sands, selenite crystals and desert roses.

MARIFIL MINES

LITHIUM BRINE GENESIS

Lithium - Potassium Bearing Surface Water

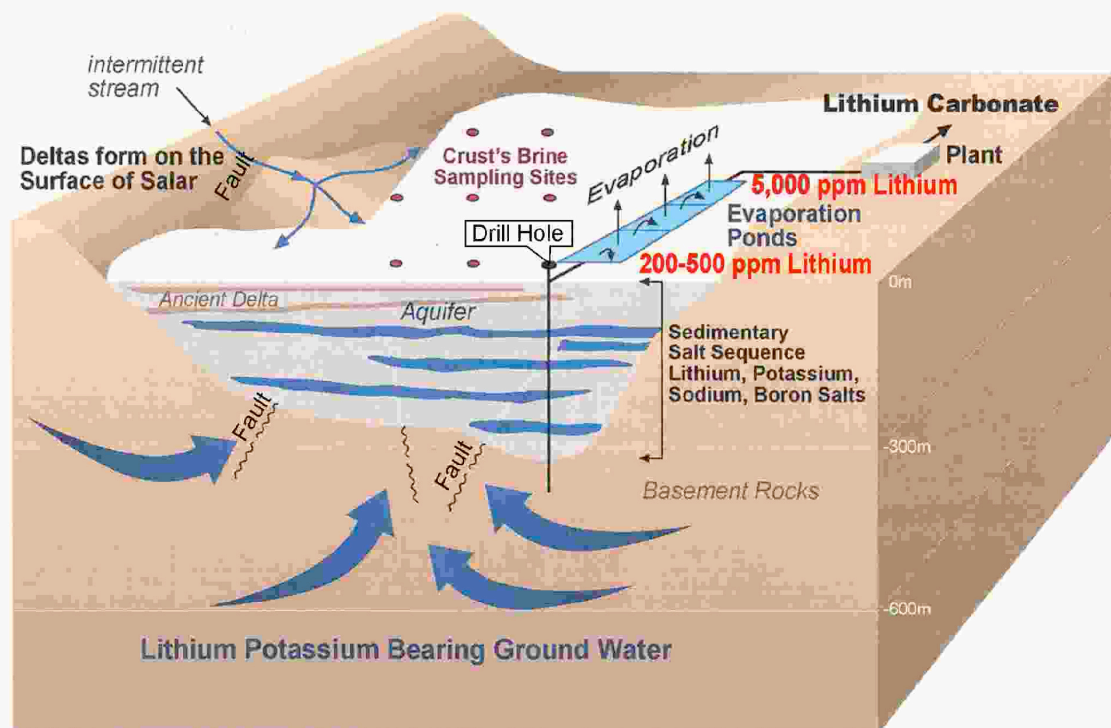


Figure 3.

- **Borax facies:** This facies occurs in the depocenter where borates are highly concentrated. It is often surrounded by the gypsum facies and interlayered with the halite facies. The salars have many times more than one single depocenter. Ulexite is the main mineral, sometimes present as mantos, sometimes stratified and interlayered with clastic facies or other salts. The ulexite occurs mainly as nodules. The brines also contain potash and lithium salts in this facies.
- **Halite facies:** The halite facies is present in the more active part of the salar where halite is currently being deposited. Older halite facies are easily recognized by their irregular texture in the form of sharp-edged crusts of brown color due to clastic impurities. The active halite facies are seen as flat-surfaced polygons with clean fractures. The halite facies represent the final stage of the brine with the most soluble salt which is the last one that precipitates in the deeper part of the basin. FMC Company carried out several gravimetric surveys which suggest that the thickness of the halite can reach up to 900 meters.

9.1. Geological Model

The Salar del Hombre Muerto was used as geological model because it represents the typical brines occurrences in la Puna area and also because this is one of the best explored salars. Here in which work includes geological, stratigraphic, geophysical and metallurgical studies. In the “Salar de Hombre Muerto”, the best geological known deposit, a >50 m thick massive salt body underlies much of the Salar, and contains a high lithium brine in its porous upper section. Its lithium content averages 521 mg/l, but varies from 190–900 mg/l and the brine is estimated to contain 800,000 tons of lithium, 1.1 million tons of B_2O_3 and 80 million tons of potassium. The Salar’s average air temperature has a high of 7°C and a low of -6°C, with a maximum and minimum of 13 (also noted at 28°C) and -32°C, respectively. The average rainfall is 60–80 mm/yr, and the evaporation rate about 1500 mm/yr.

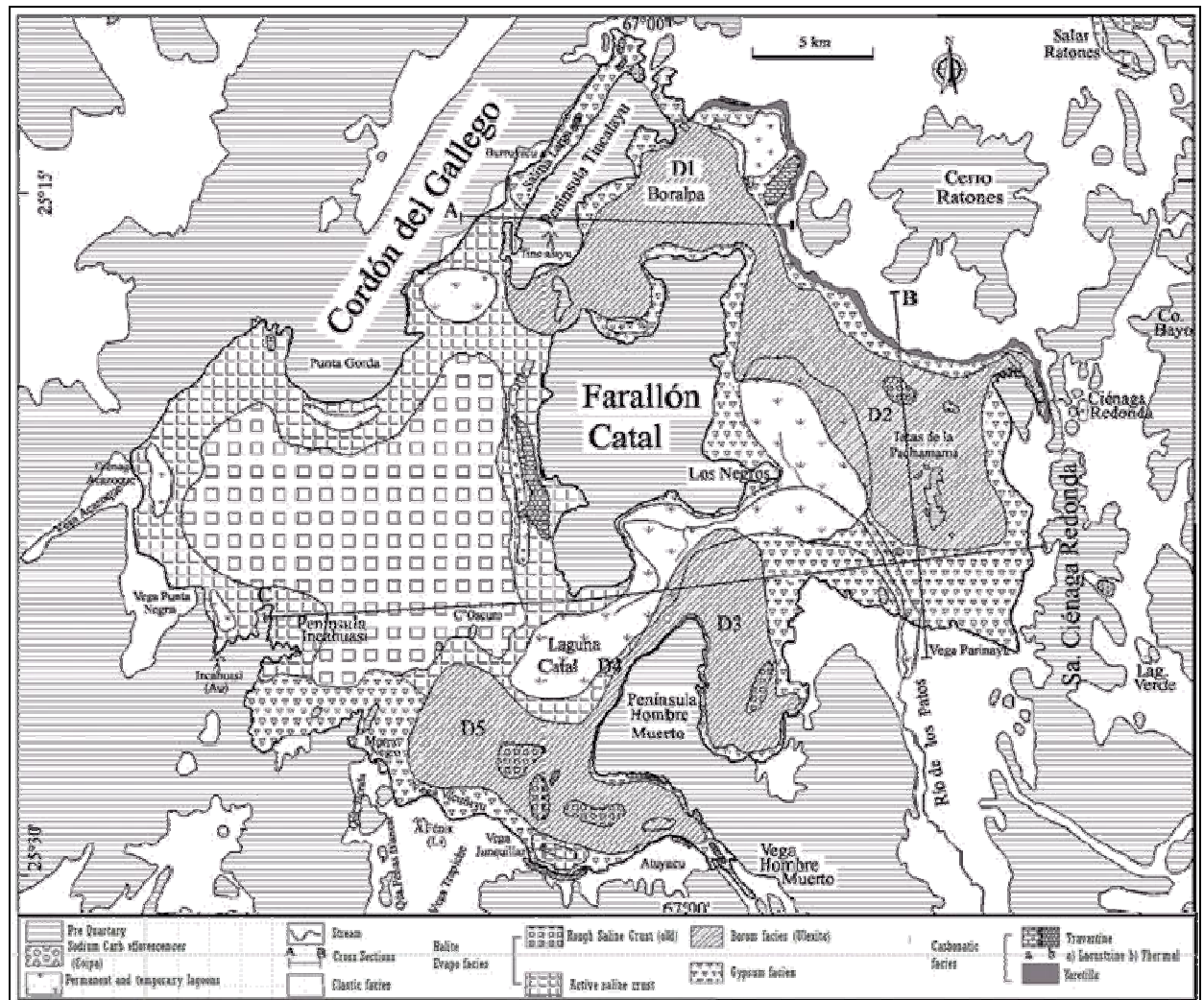


Figure 4. Geological Map of Salar del Hombre Muerto showing the different sedimentary facies

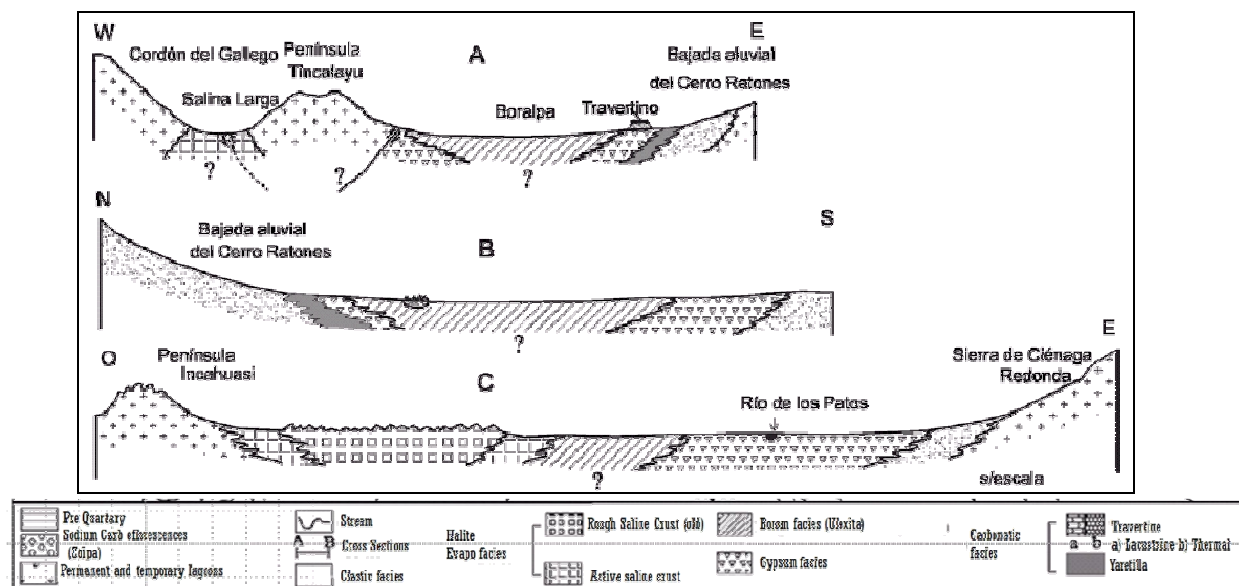


Figure 5: Diagrammatic Cross Section showing the lateral variation of different facies

MARIFIL CLAIMS - CRITERIA FOR PROSPECTING

Marifil consulting geologists have determined that the following characteristics are favorable for lithium brine development:

- Presence of Salars
- Presence of nearby young volcanic centers
- Favorable structure and morphology
- Evidence of lithium mineralization from water wells and literature
- Presence of well developed playas and/or alluvial fan where sub-surface mineralization may be concealed at depth

Despite the existence of other lithium sources such as pegmatites, brines are the most attractive sort of deposit in terms of economics. The Puna region is the highest plateau associated with abundant magmatism and is second only to Tibet in height and areal extent. The elevated Puna Plateau is approximately 1800km long and 350-400 km wide, and it contains hundreds of salars. Historically the Puna salars were exploited for borates and sulfates, so there is an extensive record of the salars and some records of their geochemistry. Marifil consulting geologists have determined that sulfates and boron are reliable pathfinders for lithium. In this high Andean plateau area with its many volcanoes and geothermal springs, each of the salars appeared to have originated from the region's hot springs. As the groundwater from rain and snow percolates through the region's many faults it would be heated by contact with rock still hot from the recent or active volcanism, and in some cases leach both lithium and boron (always an accompanying mineral in these salars). This is the theory for the much-studied El Tatio geyser field (Chilean Atacama Salar), and it may hold true for many of the region's high-lithium salars. A

tectonic model is shown in Figure 6, demonstrating how the uplifted area of the Puna plateau and its salar basins may have formed.

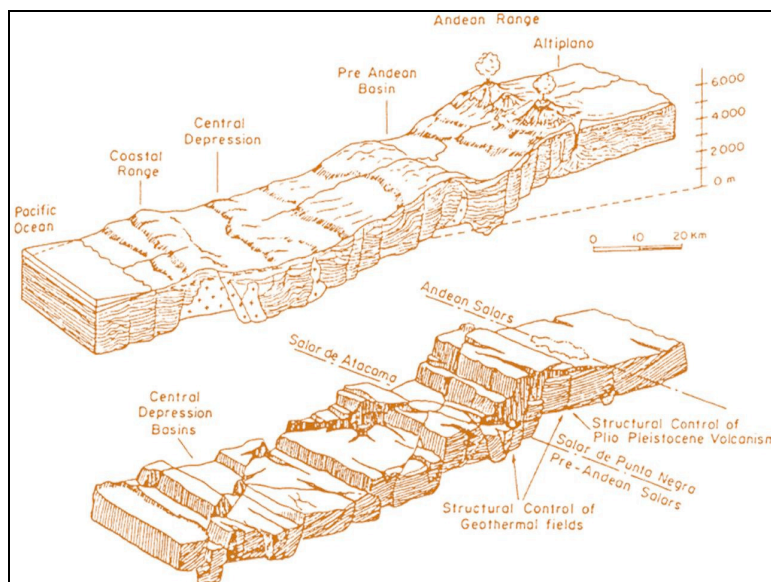


Figure 6. Geologic Process Creating the Puna Plateau and the Salars

The Marifil properties have been prioritized based on expected lithium preservation at depth. Preservation of lithium can be greatly affected by local fresh water drainage. The higher priority targets are those found near the edges of the salars and where recent alluvial fans are developed. Most of the salars show a tectonic control evidenced by their N-S oriented length, corresponding mainly to crustal fractures in a block-faulting tectonic style which has been active until present.

10. Exploration

Exploration work performed to date by Marifil consists of extensive data compilation, detailed stratigraphic studies of the Puna Quaternary basins, and limited water sampling. A key part of this effort was to develop a strong understanding of the basin stratigraphy and determine where lithium-bearing sequences are most likely to be deposited. There has been little exploration work conducted with respect to stratigraphy, and that was primarily directed toward sodium sulfates and borates. Much of this information is private and unavailable to the public. Marifil consulting geologists used research papers, official maps and reports, and our own field work.

The Marifil properties were identified by the presence of favorable stratigraphy. Evidence of lithium bearing brines is inferred due to the presence of boron as a pathfinder and the nearby volcanic and geothermal centers. Additional evidence in support of the model was achieved by obtaining information that is in the public domain.

An ongoing work program consists of sampling the salars with samples taken at intervals of 500 to 800 meters spacing. A crew of a geologist and four assistants is auger drilling the salars. Two types of samples are being obtained. Both liquid brines and solids (evaporate crusts) are analyzed by a special lab protocol called ICP 13 in Alex Stewart Lab, Mendoza branch. Surface brine samples are shown in Figure 7. The next phase of this program includes detailed geologic mapping, trenching, geophysical surveys, and drilling. Resistivity and possibly seismic surveys are planned to delineate the salt body geometry.

Pumping tests are planned for those drill holes with better lithium-brine grades.

Marifil intends to produce a Prefeasibility Study on the most favorable targets; it will include a detailed description of infrastructure and logistics as well as resources defined.

No previous operators have conducted work on any of the two lithium-brine targets that are the subject of this report.

11. DRILLING

No previous drilling has been done on these properties.

The initial drilling phase planned by Marifil for each of the exploration properties will consist of completing several widely spaced drill holes on each group of cateos for a total of 2,000 meters. Drill depths are expected to range between 50 and 200 meters. Each drill hole will be drilled using the Reverse-circulation rotary (RC) method, sampling sediment every 1 meter for stratigraphic analysis and sampling brines separately.

12. SAMPLING METHOD AND APPROACH

12.1 Historical Surface Samples

There are no historical surface samples on the four cateos under investigation

12.2 Historical Drill Samples

There are no historical drill samples on the four cateos under investigation. However, in 2008, three brine samples taken from a water-well pump test 1 km east of the Llullaillaco cateos from the same alluvial fan covered by those two cateos yielded geochemical values of 103 mg/l lithium, 107 mg/liter lithium, and 108 mg/liter lithium.

12.3 Current Surface Samples

No water samples have been taken by Marifil consultants on the Llullaillaco cateos because the target lies at depths of about 30 meters and no wells exist on the Llullaillaco cateos. No water samples have been taken by Marifil consultants on the Ratones Cateos because the area is covered by alluvial and eolian deposits, precluding the existence of water at shallow depths. Both targets at Llullaillaco and Ratones are buried targets that will require drill-testing.

FIGURE 7. LLULLAILLACO CATEOS SAMPLE LOCATION MAP

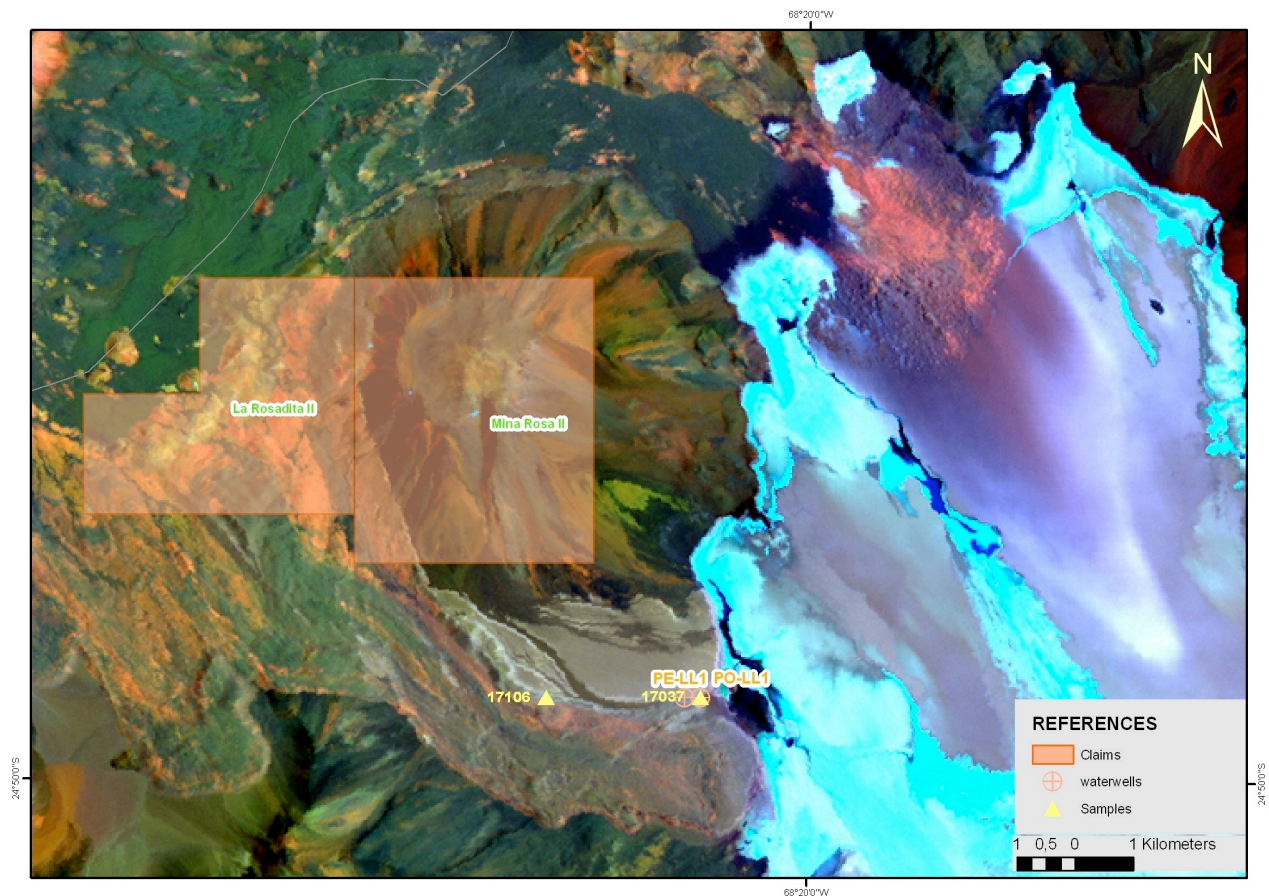


FIGURE 8. RATONES CATEO SAMPLE LOCATION MAP

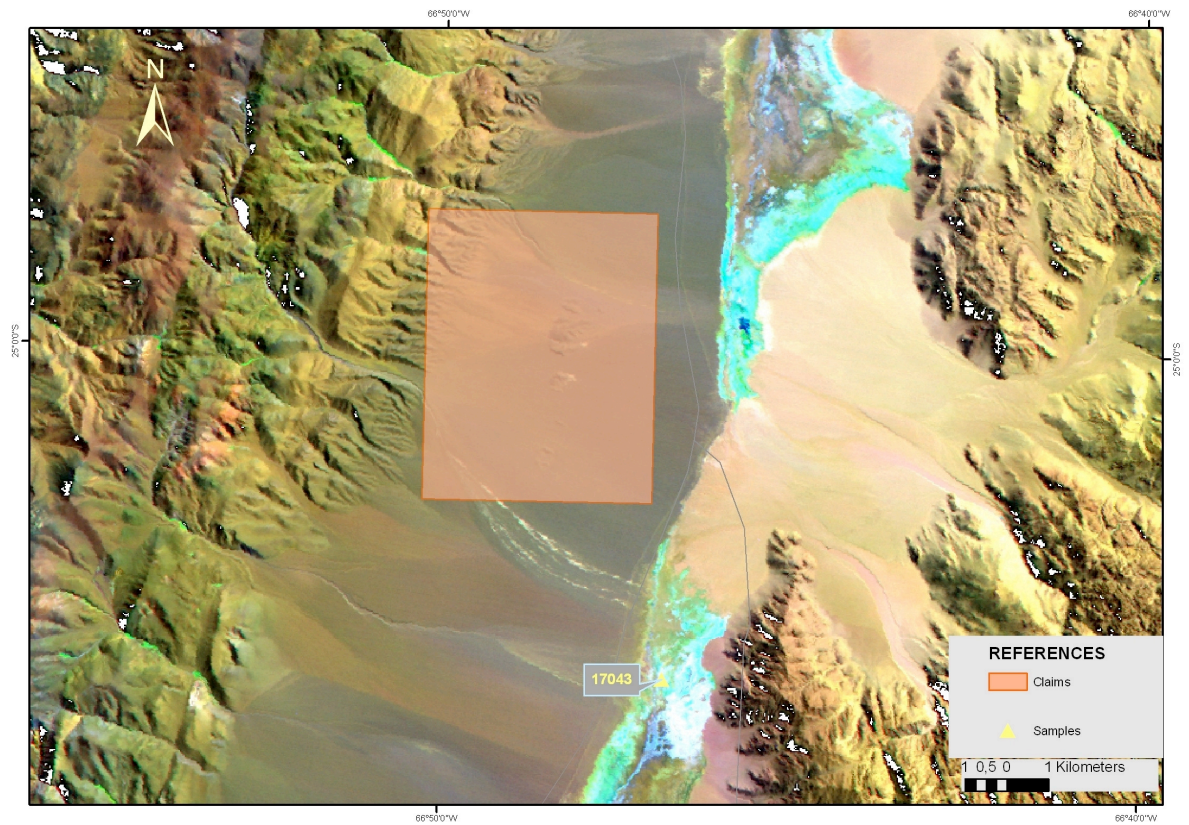




FIGURE 9. LLULLAILLACO CATEOS EXAMINATION (OCTOBER 24th, 2009)
(Standing on a vast alluvial fan that slopes toward Llullaillaco Salar)



FIGURE 10. LLLULLAILLACO WATER-WELL SAMPLING (OCTOBER 24th, 2009)

(Well is located about 1 km east of the two Llullaillaco Cateos)

12.4 Current Drill Samples

There are no current drill samples.

12.5 Verification Samples

One verification sample was taken about 1 km east of the Llullaillaco Cateos on October 24th, 2009 by the author (Figure 10). This sub-surface water sample was taken from the water-well referred to in Section 12.2 from the top of the water column at a depth of about 30 meters (location of UTM WGS 84, 7255637N/2565557E: Band 2). This sample, MFM #17037, contained 8 mg/l lithium (Appendices A and B). No samples were taken on the Llullaillaco cateos because the brines are at depths of about 30 meters and no wells exist on the cateos.

One verification sample was taken about 4 km south of the Ratones cateos on October 25th, 2009 by the author. This sub-surface water sample was taken from a depth of about 1.5 meters at a location of UTM WGS 84, 7226145N/2723991E (Band 2). This sample, MFM # 17043, contained 1 mg/liter lithium. No verification

samples were taken directly on the Ratones cateos because much of it is covered by Alluvial and eolian deposits and access to near-surface water is unavailable.



FIGURE 11. VERIFICATION SAMPLING 4 KM SOUTH OF THE RATONES CATEO (OCTOBER 25th, 2009)

13. SAMPLE PREPARATION, ANALYSES, AND SECURITY

13.1 Historical Sampling

There has been no historical sampling on the five cateos under investigation

13.2 Current Sampling

Samples taken by Marifil consultants consist of near-surface water samples. Water samples are taken at shallow depths on the salars. If water is not present on the surface, shallow holes are dug using a hand-shovel or auger until the water table is encountered. Samples of this water are taken in clean bottles specifically used for water samples. If sediment is present in suspension, the sample is decanted once the sediment settles to the bottom of the bottle. All samples are secured in locked vehicles until they can be sent for analysis. The brines samples are shipped to the

lab at intervals not longer than four days. All samples are shipped to the Alex Stewart Assayers Argentina S.A. lab in Mendoza, Argentina.

Alex Stewart Assayers is an ISO 9000:2000 certified laboratory with headquarters in England. QA/QC procedures include the use of barren material to clean sample preparation equipment between samples. Analytical precision and accuracy are monitored by the analysis of reagent blanks, reference materials, and replicate samples. Alex Stewart Assayers also maintains an extensive library of international and in-house standards for quality control purposes. The water samples are filtered and read directly by ICP analysis. The results of current sampling were reviewed by the author, and in his opinion, there are no unusual or suspect analytical results reported.

13.3 Verification Sampling

Two verification samples were taken by the author. Results of these samples, MFM #17037 (Llullaillaco cateos) and MFM # 17043 (Ratones cateos), can be seen in Appendix A. The brine sample from a water-well 1 km east of the Llullaillaco cateos contained 8 mg/liter lithium and the near-surface brine sample taken from the Ratones cateos contained 1 mg/liter lithium. These results are generally similar to some of the previous results obtained by Marifil consulting geologists. However, some greater lithium contents were detected in a few of the samples taken by Marifil consulting geologists.

14. DATA VERIFICATION

14.1 Data Examination

Marifil data was examined by the author both in the field during the site visit and later upon examination of geochemical results. Presently, due to the early stages of this project, the data consists primarily of plan maps with a limited number of sample sites and a few spreadsheets with geochemical results. No previous work is included in this data because there has been no previous work on these properties. In the author's opinion, the data is reliable and accurately reflects the level of work done to date.

14.2 Site Visits

The Llullaillaco cateos were visited by the author on October 24th, 2009 (Figures 9 and 10). At that time, the author took one verification sample of water from a water-well that lies about 1 km east of the cateos. No near-surface water is available for sampling on the Llullaillaco cateos. The water level in the nearby water-well was at a depth of 30 meters.

On October 25th, 2009, the author visited the Ratones cateos (Figure 11). One near-surface brine sample was taken about 4 km south of the Ratones cateo. No samples were taken on the Ratones cateo because it is covered by recent eolian and fluvial deposits. It will be necessary to test this area using shallow rotary drill holes.

14.3 Verification Sampling

No verification samples were taken by the author on either the Llullaillaco cateos or the Ratones cateos. There is simply no near-surface water on these cateos. One sample was taken from a water-well one km east of the Llullaillaco cateos. This sample, MFM # 17037, contained 8 mg/liter lithium. No near-surface water is available for sampling on the Llullaillaco cateos. One other sample was taken about 4 km south of the Ratones cateos. This sample, MFM # 17043 contained 1 mg/liter lithium. Most of the Ratones cateos are covered by eolian and fluvial deposits. In short, the targets are at depth, not readily amenable to cursory sampling procedures. The samples that were obtained adjacent to the cateos were water samples (brines) that were groundwater samples. These samples were sealed and stored in a locked vehicle with other samples taken by the Marifil field crew. They were later transported to the Alex Stewart assay lab in Mendoza, Argentina by Juan Carlos Danderfer, one of the senior consulting geologists working for Marifil. Geochemical results can be seen in Appendix A.

15. ADJACENT PROPERTIES

Although there are several exploration prospects in the Puna basin, only three of them have subsurface information available and reported resources.

Salar del Hombre Muerto (FMC Company)

This medium sized (565 km²) playa lies about 395 km from Salta, Argentina and 1300 km NW of Buenos Aires, in the remote altiplano area of the Andes Mountains. The nearest large town is Salta in the Andes foothills to the northeast. The Salar is at an altitude of 4300 m (4100 and 3964 m have also been reported) with a small mountain-peak island in its western center. Its surface is always partially flooded (from the Catal Lagoon in the southeast corner) and partially dry. The Salar's surface near the Lagoon often floods in the winter from the perennial Los Patos River. After the water evaporates, it is usually covered with smooth white salt, while most of the other areas have a dirty, very uneven salt-clay surface, similar to most of the other salars in the region.

The brine in the Salar is usually within 20 cm of the surface, and it appears to be relatively constant in composition to a depth of at least 15 m. Analyses of some brines were taken from samples mostly at a depth of 0.7–0.9 m, and in these holes the average amount of insolubles in the salt was 1–11%. The average porosity of the salt to 15 m was about 15%. There appeared to be some circulation of the brine in the salt mass and there was capillary evaporation from the surface. Most of the calcium, and some of the magnesium and sulfate in the Los Patos River water precipitated as it advanced to the edges of the Catal Lagoon and into the main brine body. About 32% of the salar's near-surface crust contained on average 12.7 cm of cotton ball ulexite.

In a 40 m core sample uranium–thorium age dating on layers of ash indicated that the bottom was about 82,000 years old. At a 6.4 m depth the age was about 8000 years. The amount of mud in the halite from 8,000–26,000 years indicates that the weather had been comparatively dry, as at present, followed by a brief period of wetter weather. During the period from 64,000–82,000 years the Salar appeared to have been a saline lake, and the weather was much wetter.

Salar de Rincon (Admiralty Resources)

The Salar de Rincon project, located in Jujuy province of northern Argentina, is targeted to produce 17,000 tons per year lithium carbonate. It is at 3,700 meters altitude and has an evaporation rate of 3,000 mm³ per sq cm evaporation per year. There are two areas delineated on the basis of their chemistry; in the east the NaSO₄ is dominant while lithium and boron are much higher in the West area. Boron is always present on the edges of the salar in the hard salt crust and lithium appears in rich brine pods at depths of 20 meters and below. The infrastructure is good with a gas pipeline (to Escondida) nearby, power and subterranean water. Railroads and highways connect the project to Jujuy and Salta cities.

Its extreme arid conditions have remained constant over the last 150,000 years. This deposit remains active with Lithium concentrations reaching 400 ppm in brines occurring in the interior of the evaporite basin. Weakly saline surface waters that are presently running into the salar are also enriched in lithium (63 mg/l) and boron (186 mg/l).

Salar Pastos Grandes (New World Resource Corp.)

The following summary is an excerpt from the Report entitled, 'Salar de Pastos Grandes - Evaluation of Brine Samples' dated April 12, 2009;

"Preliminary conclusion from the data shows that the low Mg/Li ratio of 2.2 in the Pastos Grandes brine is very promising for a viable, profitable and economical Li recovery. Its brine composition mix with Li content greater than 1,000 ppm is competitive against the currently processed brines in Chile and Argentina. Additional investigation of this valuable lithium and potassium resource is recommended."

TABLE 4**HISTORICAL BRINE CHEMICAL DATA OF PASTOS GRANDES**

LI PPM	K PPM	Mg PPM	CA PPM	SO4 PPM	Mg/LI	K/LI	SO4/LI	Mg/CA	K/Mg
1,640	14,200	3,480	3,100	2,460	2.12	8.66	1.50	0.89	4.08
675	81,000	1,250	1,650	3,370	1.85	120.00	4.99	1.32	64.80
350	3,600	550	900	1,120	1.57	10.29	3.20	1.64	6.55
710	5,800	2,600	1,150	1,500	3.66	8.17	2.11	0.44	2.23
940	7,100	2,600	2,230	3,600	2.77	7.55	3.83	0.86	2.73
1,720	8,520	3,330	2,750	1,780	1.94	4.95	1.03	0.83	2.56
1,160	9,800	2,560	2,380	3,240	2.21	8.45	2.79	0.93	3.83
880	8,000	1,500	1,730	3,620	1.70	9.09	4.11	1.15	5.33
AVERAGE (Li greater than 500 ppm)					2.24	17.4	2.53	1.16	7.76

In conclusion the report states:

"The Salar de Pastos Grandes represents brine of excellent quality for lithium and potassium recovery. While it is much smaller in size compared with the Salar de Uyuni, its composition mixture of Li, Mg, Ca, K, SO₄, may be easier to process economically. The Mg/Li ratio of 2.2 is less than the Atacama ratio of 6.4. Additional studies are recommended for the Salar de Pastos Grandes."

16. MINERAL PROCESSING AND METALLURGICAL TESTING

No mineral processing or metallurgical testing has been completed on the Salta Province Lithium Project.

17. MINERAL RESOURCES AND MINERAL RESERVE ESTIMATES

The Salta Province Lithium Project is in a very early stage of exploration. Therefore, no mineral resource or mineral reserve estimates are available at this time.

18.0 OTHER RELEVANT DATA AND INFORMATION

The author is unaware of any other available data or information relevant to the Salta Province Lithium Project.

19. INTERPRETATION AND CONCLUSIONS

The Salta Province Lithium project requires subsurface exploration methods in order to confirm the geologic model and to determine its potential to contain an economic lithium deposit. Although it is a conceptual model, there is sufficient information available to lend credence to the target concept. Drilling is the most expensive part of the program. The initial work intended to prioritize drill targets is of relatively low cost. The area of the cateos covers land with significant mineral potential and is large enough to contain a significant resource. The Puna Plateau is a lithium-rich region.

The exploration rational of sampling surface waters and shallow sub-surface waters is a straightforward method of trying to prioritize target areas. It is the only logical first-step in sampling. However, it should be kept in mind that brines can stratify due to density differences and near-surface samples may not be representative of brines that are at depth. In fact, surface brine pools of very shallow depth may contain water with little dissolved salts due to the stratification, especially if capillary action may be impeded or blocked by clay layers. Alternatively, shallow pools of water might contain much meteoric water that could dilute any brines.

One example of this stratification was recently demonstrated by geochemical results from a water-well drilled by Salta Agua Ltd. (2008) adjacent to the Llullaillaco Salar in Salta Province. During a pump test on this well in 2008, three brine samples returned lithium results of 103, 107, and 108 mg/l lithium. A verification sample (Figure 10) taken from this well at the top of the water column by the author in October 2009 contained only 8 mg/l lithium. Specialized tools necessary for sampling other parts of the water column were simply not available during that site visit. Thus, caution must be exercised when interpreting these sample results. Near-surface samples with highly anomalous lithium contents should certainly be considered as a priority indicator, but samples with low lithium contents should certainly not rule out areas for exploration.

Local geological conditions should also be considered. For example, if regional faults can be projected into the area, the target value may be enhanced because these regional faults may provide great amounts of lithium-bearing waters to the plumbing system. Deep-seated graben-margin faults might be of primary importance. The relatively low cost of maintaining the cateos should not make it necessary to rapidly reject areas with lithium potential due to a couple of surface water samples that might not contain highly anomalous lithium contents.

Some of these salars may have clay layers within the salar stratigraphy. This should not be considered a reason to terminate a drill hole. The clay layer might merely represent a period of increased clastic supply, perhaps representing periodic, rapid basin subsidence. Beneath the clay layer, other evaporite layers or brine aquifers may exist as stacked zones (Figure 3). Drill holes should be not only a brine test, but also a stratigraphic test to determine whether or not other evaporite stratigraphy is present at depth.

Many of the cateos contain clastic wedges and alluvial fans along their margins. These clastics could contain large amounts of water that may be lithium-bearing. Somewhere within that alluvial fan there also may be paleo-salars in basins covered by the gravels. In fact, any large alluvial fan in the Puna region might conceal paleo-salars that need to be drill-tested. No one has yet tested this concealed target concept, yet this type of thinking often separates the geologist from the prospector. Any drill-hole proposed to test alluvial fan waters could produce heavy artesian flow. One should be prepared for such an event.

Finally, a number of geophysical survey methods may be useful in locating salars that are buried beneath alluvial fans. First, CSAMT (Controlled Source Audio Magneto Telluric) Surveys, using a distant source, may be the best method of finding conductors. Results can be read at different frequencies, and results from these different frequencies can be compared for modeling. Simple resistivity could be a viable method of locating the salars which may display a resistivity low. A Schlumberger Array Resistivity survey could be employed initially since the depth to the hypothetical salars is uncertain. In this type of survey, near-surface conductors and conductors at depth can both be detected by moving the receiver in a logarithmic fashion. Once a conductor is located at an approximate depth, it can be studied further by spacing receivers at an appropriate distance determined by the depth indications of the initial survey. A third possibility would be a seismic survey, although the cost of this is often prohibitive. Only testing of these methods will determine which of them will ultimately be the most effective. However, it is the opinion of the author that CSAMT may be the most effective geophysical tool available because of the large areas to be covered and the enhanced modeling produced by data read from many different frequencies.

Salta Province is mining friendly, and the areas are remote from populated centers or tourist attractions. Moreover, people involved in the project have a good relationship with governmental authorities. Commodity prices make this project quite attractive. That is why many competitors are also present in this part of the basin. Follow-up work should begin as soon as all geochemical and geological data have been compiled and studied.

20. RECOMMENDATIONS

An exploration program is proposed in order to determine the existence and potential of the resource. This is a two phase program. Phase two is contingent upon positive results from the phase one program. This is a tentative plan which should be

adjusted as required. More geological and interpretative work is recommended prior to drilling. This work includes reviewing the surface geology along with some traverses. This surface data is very important to the identification of different evaporite facies which in the end may aid in drill-hole placement in the salars.

First, compilation and integration of geochemistry and geology should be done to prioritize targets. Many brine samples should be taken over salar targets.

Second, a CSAMT survey should be done over large alluvial fans if they are suspected of hiding significant salars based upon geology and topography. Survey lines could be widely spaced initially, perhaps one kilometer apart. They should be oriented in a westerly direction because the regional structure, and thus the probable long axis of any concealed salars, trends in a northerly direction. If anomalies are found, follow-up survey lines could be spaced much closer together for optimum target definition. Any proposed survey would necessarily have to be done only if the fans are large enough to conceal a significant salar. Minimum size of alluvial fans to be considered for geophysical testing might be 20 square kilometers. The geophysicist should ultimately be responsible survey planning and implementation.

Third, trenching may be necessary for brine sampling in areas where the brines were too deep for sampling using a hand-shovel or auger. Once ground water chemistry and sample location have been fully compiled, sites requiring trenching will become apparent.

Fourth, drilling should be prioritized based initially on water chemistry. The more samples taken over a salar, the better chance of finding anomalous water geochemistry. Salar areas with lithium-bearing brines containing greater than 100 ppm lithium should be the first target. Salar areas with brine geochemistry of less than 100 ppm lithium, but anomalous boron and potash contents should be considered a second-order target that will need support of favorable geology based upon the target concept. Brines with high lithium contents may be representative of near-surface brine aquifers or they may indicate leakage from potentially valuable brine aquifers at depth. Either of these scenarios would be favorable.

Alluvial fans should each have several holes drilled in them initially. These holes should be both stratigraphic tests and water tests. No drill holes exist on either Llullaillaco cateos or the Ratones cateos. Their placement should be determined by the results and integration of geological, geochemical, and geophysical studies completed during the Phase One program. One hole already exists adjacent to the Llullaillaco cateos, but several holes are needed specifically on the Llullaillaco cateo, perhaps targeting areas where gravels may be deepest or any areas of low resistivity that could indicate buried salars or brine aquifers at depth. For all drilling, different levels of the water column should be sampled and a pump test should also be done on these wells to determine the volume of water available. Any salar crusts intercepted by drilling should also be tested for lithium, boron, and potash contents. Down-hole well-logging will be performed on each drill hole, including caliper, SP-Resistivity, and Gamma Ray. All of these measurements will be useful for defining

the resource. Ideally, the drill holes should be terminated in bedrock. A two phase budget for this project is shown following. Phase two is contingent upon positive results in phase one.

Budget – Phase One

Geophysical Survey	\$ 50,000
Trenching	\$ 22,000
Geologist Wages	\$ 25,000
Geotech Wages	\$ 15,000
Field Expenses/Supplies	\$ 9,000
Travel (Vehicle Rental/Fuel/Lodging/Airfare)	\$ 17,000
Geochemistry	<u>\$ 12,000</u>
TOTAL PHASE ONE	\$150,000

Budget – Phase Two

Drilling (2000 meters @ \$90/meter)	\$180,000
Drill Mob/Demob, Move and Set-up, Hourly Charges	\$ 30,000
Drill Roads, Site Preparation, Reclamation	\$ 45,000
Geophysical Well-logging	\$ 45,000
Water Truck Rental	\$ 25,000
Perforated Casing	\$ 35,000
Geologist Wages	\$ 30,000
Geotech Wages	\$ 20,000
Geochemistry	\$ 10,000
Travel (Vehicle Rental/Fuel/Lodging/Airfare)	\$ 30,000
Field Expenses/Supplies	<u>\$ 10,000</u>
TOTAL PHASE TWO	\$460,000
GRAND TOTAL	\$610,000

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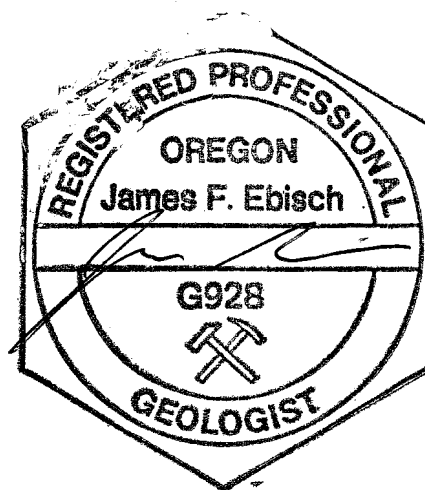
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22. DATE AND SIGNATURE PAGE

Spokane, Washington, U.S.A.

James F. Ebisch, R.P.G.

December 16, 2009



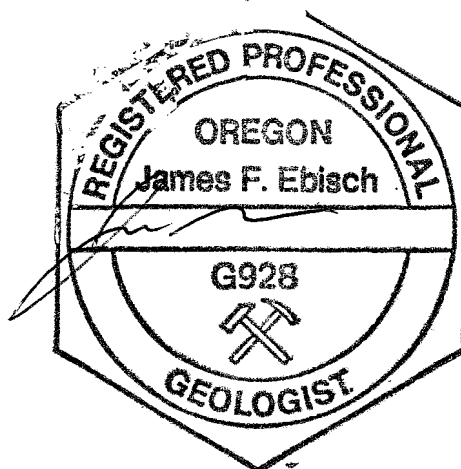
23. CERTIFICATE OF QUALIFIED PERSON

1. I, James F. Ebisch, of 12108 N. Forker Rd, Spokane, WA., 99217, U.S.A., am currently a Registered Professional Geologist (RPG) licensed in the state of Oregon (License # G928). My registration has been in good standing since 1986.
2. I am the primary author responsible for the preparation of the technical report titled "Salta Province Lithium Project-Technical Report" prepared for Marifil Mines Ltd. and dated December 2009.
3. I graduated with a B.Sc. degree in geology from the University of Wisconsin-Oshkosh in 1980 and a M.Sc. in geology from Sul Ross State University, Texas in 1984. I have been directly involved in resource exploration for the last 30 years. I have worked for a number of major companies including U.S. Borax, TexasGulf Resources, and Kennecott. I have read the definition of qualified person set forth in National Instrument 43-101 (NI 43-101) and certify that by reason of education, affiliation with a professional association as defined in NI 43-101, and past relevant experience work experience, I fulfill the requirements to be a qualified person for the purposes of NI 43-101.
4. I am responsible for the contents of this report. I visited the Llullaillaco cateos on October 24th, 2009 and visited the Ratones cateos on October 25th, 2009.
5. I am independent of the issuer applying all the tests in section 1.4 of NI 43-101.
6. I have had no previous involvement with the Salta Province Lithium Project.
7. I am the owner of 107,545 shares of Marifil Mines Common Stock
8. I certify that, as of the date of this Certificate, to the best of my knowledge, information, and belief, this Technical Report contains all scientific and technical information required to be disclosed to make the Technical Report accurate and not misleading.

Dated this 16th day of December, 2009

Spokane, Washington, U.S.A.

JAMES F. EBISCH, R.P.G.



24.0 CONSENT OF AUTHOR

TO: Toronto Stock Exchange

Ontario Securities Commission

British Columbia Securities Commission

Alberta Securities Commission

Saskatchewan Securities Commission

Manitoba Securities Commission

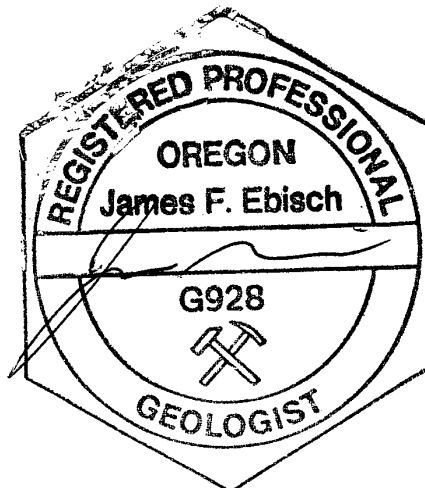
New Brunswick Securities Commission

Nova Scotia Securities Commission

I, James F. Ebisch, R.P.G., of 12108 N. Forker Rd., Spokane, WA. 99217, U.S.A., do hereby consent to the filing, with the regulatory authorities listed above, of the Technical Report titled "Salta Province Lithium Project" prepared for Marifil Mines Ltd. and dated December 2009 (the "Technical Report") and to the written disclosure of the Technical Report and of extracts from or a summary of the Technical Report in any written disclosure by the regulatory authorities.

Dated this 16th day of December, 2009

James F. Ebisch, R.P.G.



APPENDIX A
ROCK/WATER SAMPLES

CERTIFICADO DE ANÁLISIS

N° Orden: M091805

Ciiente: MARFIL S.A.
Atencion: PEDRO VERA
Proyecto: NOALI

Fecha de Informe: 29/10/2009
Fecha de recepción: 24/10/2009
Fecha de Instrucción: 26/10/2009
Total de muestras: 6

Preparación: No corresponde
Análisis: Detallados

MUESTRA	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Si	Sr
Unidades	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LD	1	0.01	2	0.02	0.05	0.3	2	1	1	0.01	2	0.1	2	0.5
CACHARI-1	4	< 0.01	41	< 0.02	< 0.05	< 0.3	66	2	45	< 0.01	1556	< 0.1	28	< 0.5
CACHARI-2	4	< 0.01	40	< 0.02	< 0.05	< 0.3	68	2	46	< 0.01	1630	< 0.1	28	< 0.5
CACHARI-3	380	0.07	109	0.02	< 0.05	2.1	4636	171	2854	0.23	106266	< 0.1	35	1.4
CACHARI-4	531	0.08	157	< 0.02	< 0.05	1.6	6854	261	4000	0.24	126370	< 0.1	32	2.1
RG2-1	3	0.06	118	< 0.02	0.06	11.2	275	11	268	0.34	3782	< 0.1	69	1.1
V. ARCHIBARCA-1	< 1	< 0.01	93	< 0.02	< 0.05	< 0.3	9	< 1	11	0.01	76	< 0.1	27	< 0.5

Lic. OLGA HERRERO
Gerente Laboratorio Ambiental
ALEX STEW RT ASSAYERS ARG. S.A

CERTIFICADO DE ANÁLISIS

Nº Orden: M091827

Cliente: MARIFIL S.A.
Atención: PEDRO VERA
Proyecto: NOALI

Fecha de informe: 09/11/2009
Fecha de recepción: 30/10/2009
Fecha de Instrucción: 30/10/2009
Total de muestras: 15

Preparación: No corresponde
Análisis: Detallados

MUESTRA	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Si	Sr
Unidades	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LO	1	0.01	2	0.02	0.05	0.3	2	1	1	0.01	2	0.1	2	0.6
MFM 17037	30	0.07	230	<0.02	<0.05	<0.3	308	8	159	<0.01	3012	<0.1	39	1.5
MFM 17038	21	0.10	277	<0.02	<0.05	0.7	436	17	488	0.08	11341	<0.1	62	2.7
MFM 17039	2	0.06	106	<0.02	<0.05	<0.3	80	2	104	0.10	813	<0.1	36	0.7
MFM 17040	<1	0.07	188	<0.02	<0.05	1.1	75	2	84	1.21	1230	<0.1	31	2.6
MFM 17041	16	0.14	43	<0.02	<0.05	<0.3	360	9	31	<0.01	5962	<0.1	38	0.6
MFM 17042	524	0.05	722	<0.02	<0.05	1.2	8531	823	1914	3.24	107045	<0.1	18	9.6
MFM 17043	2	0.05	19	<0.02	<0.05	1.3	36	1	7	0.01	454	<0.1	19	<0.5
MFM 17057	7	0.07	85	<0.02	<0.05	<0.3	34	2	49	<0.01	634	<0.1	30	2.6
MFM 17058	255	0.28	2054	<0.02	<0.05	1.0	2499	119	2182	0.03	65923	<0.1	53	69.6
MFM 17059	45	0.04	1597	<0.02	<0.05	0.4	424	25	562	0.02	24357	<0.1	27	36.5
MFM 17060	3	0.13	64	<0.02	<0.05	<0.3	48	2	25	<0.01	1715	<0.1	26	1.1
MFM 17061	2	0.07	8	<0.02	<0.05	1.4	74	1	6	0.08	1447	<0.1	33	<0.5
MFM 17062	1	0.07	28	<0.02	<0.05	<0.3	28	<1	14	<0.01	702	<0.1	27	0.6
MFM 17063	50	0.04	2276	<0.02	<0.05	0.4	448	25	599	0.02	28542	<0.1	28	40.8
MFM 17064	163	0.11	2241	<0.02	<0.05	1.0	2080	89	1789	0.09	83329	<0.1	14	37.6

LIC. OLGA HERRE
Gerente Laboratorio Am.
-LEX STEW RT ASSAYERS AI



CERTIFICADO DE ANÁLISIS

N° Orden: M091830

Cliente: MARIFIL S.A.
Atención: PEDRO VERA
Proyecto: NOALI

Fecha de informe: 09/11/2009
Fecha de recepción: 30/10/2009
Fecha de instrucción: 30/10/2009
Total de muestras: 18

Preparación: P-5 - Muestras sólidas
Análisis: Detallados

VUESTRA	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Si	Sr
Unidades	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
MFM 17026	28	4.84	4195	0.14	0.59	25.4	1063	17	677	2.34	31679	< 0.1	1405	28.4
MFM 17027	93	37.91	275	0.16	5.24	50.1	1372	14	184	15.80	24639	1.2	1138	4.4
MFM 17028	5	0.93	993	< 0.02	0.32	20.5	399	5	84	8.56	3075	0.3	550	4.9
MFM 17029	10	3.03	811	0.08	0.80	79.5	328	4	421	3.79	1148	1.4	1469	4.8
MFM 17030	13	1.66	82	0.25	0.64	88.7	299	3	46	1.00	4718	< 0.1	650	1.5
MFM 17031	59	1.50	3664	< 0.02	0.10	8.2	1186	32	774	1.56	52665	< 0.1	710	20.1
MFM 17032	10	5.47	64	0.08	0.47	81.1	413	7	471	2.59	1289	0.3	1565	1.4
MFM 4841	10	0.99	1774	0.04	< 0.05	1.3	724	19	219	0.04	10048	0.2	266	28.2
MFM 17044	13	9.66	663	0.43	1.38	203.0	773	3	250	6.50	2327	1.4	1640	9.0
MFM 17045	182	10.79	2418	< 0.02	0.70	3.8	2352	89	233	0.36	13881	< 0.1	1410	139.7
MFM 17046	28	3.72	47054	0.02	0.21	3.1	237	3	263	1.31	4308	< 0.1	795	467.4
MFM 17047	11	6.16	628	0.18	0.75	156.2	314	5	412	19.50	1171	0.4	1410	6.7
MFM 17048	13	7.05	989	0.17	0.79	181.7	594	7	381	13.97	2038	< 0.1	1410	7.0
MFM 17049	13	7.90	2300	0.10	0.33	89.7	544	10	1028	27.58	3649	0.6	2207	11.9
MFM 17050	100	3.38	71206	0.04	0.08	1.7	537	17	798	0.28	69309	0.6	270	911.5
MFM 17051	63	2.16	54999	0.05	0.07	1.8	361	9	489	1.53	9998	0.5	216	638.6
MFM 17054	59	2.24	63077	0.04	0.22	1.4	448	13	691	32.28	18312	1.5	100	398.4
MFM 17055	46	1.77	2349	< 0.02	0.12	7.6	289	6	137	0.35	7011	< 0.1	1414	85.4

LIC. OLGA HERRERO
Gerente Laboratorio Ambiental
ALEX STEW. RT ASSAYERS ARG. S

APPENDIX B – SAMPLE DATA

MFM	Z	LABOR	NIVEL DEL AGUA	TIPO MUEST
4836	3517	Pozo de 2 metros de profundidad	0,50 m.	Salmuera
4837	3517	Pozo de 3 metros de profundidad	0,60 m.	Salmuera
4838	3516	Pozo de 2 metros de profundidad	0,50 m.	Salmuera
4839	3516	Pozo de 2 metros de profundidad	0,50 m.	Salmuera
4840	3517	sin labor-laguna	0.00 m.	Salmuera
4841	3517	Pozo de 3 metros de profundidad		rock
17026	3517	Pozo de 2 metros de profundidad		Sedimento
17027	3517	calicata de 1,2 metros	xxx	Sedimento
17028	3517	Pozo de 3 metros de profundidad	0,60 m.	Sedimento
17029	3516	Pozo de 2 metros de profundidad	0,50 m.	Sedimento
17030	3516	Pozo de 2 metros de profundidad	0,50 m.	Sedimento
17031	3685	calicata de 1 metro de profundidad	xxx	rock
17032	3684	Pozo de 2 metros de profundidad		Sedimento
17033	3027	sin labor	0.00 m.	Salmuera
17034	3025	sin labor	0.00 m.	Salmuera
17035	3025	sin labor	0.00 m.	Salmuera
17036	3025	sin labor	0.00 m.	Salmuera
17037		Pozo Agua Salta Observacion	24-00 m. ?	Salmuera
17038	3516	sin labor-laguna	0.00 m.	Salmuera
17039		Pozo Agua Salta	30.00 m. ?	Salmuera
17040	3359	calicata de 1 metro de profundidad	0,50 m.	Salmuera
17041	3029	calicata de 1 metro de profundidad	0,50 m.	Salmuera
17042	3985	sin labor-laguna	0.00 m.	Salmuera
17043		calicata de 1,5 metro de profundidad	1.00 m.	Salmuera
17044	3353	Pozo de 2 metros de profundidad		Sedimento
17045	3347	Pozo de 2 metros de profundidad		rock
17046	3352	Pozo de 2 metros de profundidad		Sedimento
17047	3352	Pozo de 2 metros de profundidad		Sedimento
17048	3350	Pozo de 2 metros de profundidad		Sedimento
17049	3347	Pozo de 2 metros de profundidad		Sedimento
17050	3356	Pozo de 2 metros de profundidad		Sedimento
17051	3341	Pozo de 2 metros de profundidad		Sedimento
17052	3352	afloramiento		rock
17053	4130	arroyo de la vega	0.00 m.	Salmuera
17054	3341	0.02 m. capa superficial debajo costra		Sedimento
17055	3347	Pozo de 2 metros de profundidad		Sedimento
17056	3684	Pozo de 2 metros de profundidad	0.70 m.	Salmuera
17057	3353	Pozo de 2 metros de profundidad	0.80 m.	Salmuera
17058	3347	Pozo de 2 metros de profundidad	0.30 m.	Salmuera
17059	3352	Pozo de 2 metros de profundidad	0.80 m.	Salmuera
17060	3352	Pozo de 2 metros de profundidad	1.00 m.	Salmuera
17061	3350	Pozo de 2 metros de profundidad	0.50 m.	Salmuera
17062	3347	Pozo de 2 metros de profundidad	0.10 m	Salmuera
17063	3356	Pozo de 2 metros de profundidad	0.80 m.	Salmuera
17064	3025	Pozo de 2 metros de profundidad	0.20 m.	Salmuera

MFM	DESCRIPCION	OBSERVACION	TOMADA X	SAMPLE ID	B	Ba
4836	Agua clara	Superficie cor	Danderfer J.C.	4836	1	0.39
4837	Agua turbia	arriba, 0,6 m.	Danderfer J.C.	4837	3	0.07
4838	Agua clara	Superficie cor	Danderfer J.C.	4838	2	0.08
4839	Agua clara	Superficie cor	Danderfer J.C.	4839	1	0.07
4840	Agua turbia a	Al pie del con	Danderfer J.C.	4840	15	0.05
4841	Superficie, 0,6	Abajo, 2,4 m.	Danderfer J.C.	4841	10	0.99
17026	2 m. Arena fria	Superficie cor	Danderfer J.C.	17026	28	4.84
17027	0.60 m. Arcilla	arriba, 0,6 m.	Danderfer J.C.	17027	93	37.91
17028	2,4 m. Arena f	arriba, 0,6 m.	Danderfer J.C.	17028	5	0.93
17029	2 m. Arena fria	Superficie cor	Danderfer J.C.	17029	10	3.03
17030	2 m. Arena fria	Superficie cor	Danderfer J.C.	17030	13	1.66
17031	1 m. Arena vc	Olor azufre	Danderfer J.C.	17031	59	1.50
17032	2 m. Arena fria	Superficie cor	Danderfer J.C.	17032	10	5.47
17033	Agua clara de	basaltos	Danderfer J.C.	17033	4	0.01
17034	Agua clara de	basaltos	Danderfer J.C.	17034	4	0.01
17035	Laguna	arena aluvial	Danderfer J.C.	17035	380	0.07
17036	Agua clara de	arena aluvial	Danderfer J.C.	17036	531	0.08
17037	Agua clara	cono aluvial	Ebisch J.	17037	30	0.07
17038	Agua turbia a	Borde del Sal	Ebisch J.	17038	21	0.10
17039	Agua clara	cono aluvial	Ebisch J.	17039	2	0.06
17040	Agua clara	cono aluvial	Ebisch J.	17040	1	0.07
17041	Agua clara	planicie aluvic	Ebisch J.	17041	16	0.14
17042	Agua clara	borde del Sal	Ebisch J.	17042	524	0.05
17043	Agua clara	planicie aluvic	Ebisch J.	17043	2	0.05
17044	Arena fina cor	Salar, costras	Danderfer J.C.	17044	13	9.86
17045	Travertino, de	Entre Po All	Danderfer J.C.	17045	182	10.79
17046	Arena fina, pa	Borde norte d	Danderfer J.C.	17046	28	3.72
17047	Arena fina, pa	En superficie	Danderfer J.C.	17047	11	9.16
17048	Arena fina, pa	En superficie	Danderfer J.C.	17048	13	7.05
17049	Arena fina pa	Costra de sulf	Danderfer J.C.	17049	13	7.90
17050	Arena fina, gr	Salar, zonac	Danderfer J.C.	17050	100	3.38
17051	Arena muy fin	Salar, zonac	Danderfer J.C.	17051	63	2.16
17052	Azufre exalati	Monticulos de	Danderfer J.C.	17052	0	0
17053	amarillenta-ad	Vega entre co	Danderfer J.C.	17053	1	0.01
17054	sulfatos verd	Debajo de de	Danderfer J.C.	17054	59	2.24
17055	Arena fina, ne	cono aluvial	Danderfer J.C.	17055	46	1.77
17056	turbia, gris cla	Superficie cor	Danderfer J.C.	17056	3	0.06
17057	turbia, gris cla	Salar, costras	Danderfer J.C.	17057	7	0.07
17058	Agua clara	cono aluvial	Danderfer J.C.	17058	255	0.28
17059	turbia, gris cla	Borde norte d	Danderfer J.C.	17059	45	0.04
17060	Agua turbia, p	En superficie	Danderfer J.C.	17060	3	0.13
17061	Agua turbia, p	En superficie	Danderfer J.C.	17061	2	0.07
17062	Agua turbia, p	Costra de sulf	Danderfer J.C.	17062	1	0.07
17063	Agua turbia, g	Salar, zonac	Danderfer J.C.	17063	50	0.04
17064	Agua turbia, g	Salar, zonac	Danderfer J.C.	17064	163	0.11

MFM	Ca	Cr	Cu	Fe	K	Li
4836	241	0.02	0.03	2.5	162	4
4837	187	0.03	0.18	7.5	142	5
4838	252	0.03	0.11	8.2	141	6
4839	26	0.06	0.07	16.0	40	1
4840	396	0.01	0.03	1.7	293	13
4841	1774	0.04	0.03	1.3	724	19
17026	4195	0.14	0.58	25.4	1063	17
17027	275	0.16	5.24	50.1	1372	14
17028	993	0.01	0.32	20.5	399	5
17029	811	0.08	0.80	79.5	328	4
17030	82	0.25	0.64	88.7	299	3
17031	3664	0.01	0.10	8.2	1186	32
17032	64	0.08	0.47	81.1	413	7
17033	41	0.01	0.03	0.2	66	2
17034	40	0.01	0.03	0.2	68	2
17035	109	0.02	0.03	2.1	4636	171
17036	157	0.01	0.03	1.6	6854	261
17037	230	0.01	0.03	0.2	308	8
17038	277	0.01	0.03	0.7	436	17
17039	106	0.01	0.03	0.2	80	2
17040	188	0.01	0.03	1.1	75	2
17041	43	0.01	0.03	0.2	360	9
17042	722	0.01	0.03	1.2	8531	823
17043	19	0.01	0.03	1.3	36	1
17044	693	0.43	1.38	203.0	773	3
17045	2418	0.01	0.70	3.8	2352	89
17046	47054	0.02	0.21	3.1	237	3
17047	628	0.18	0.75	156.2	314	5
17048	999	0.17	0.79	181.7	594	7
17049	2300	0.10	0.33	89.7	544	10
17050	71206	0.04	0.08	1.7	537	17
17051	54999	0.05	0.07	1.8	361	9
17052	0	0	0	0	0	0
17053	93	0.01	0.03	0.2	9	1
17054	63077	0.04	0.22	1.4	448	13
17055	2349	0.01	0.12	7.6	289	6
17056	118	0.01	0.06	11.2	275	11
17057	85	0.01	0.03	0.2	34	2
17058	2054	0.01	0.03	1.0	2499	119
17059	1997	0.01	0.03	0.4	424	25
17060	54	0.01	0.03	0.2	48	2
17061	8	0.01	0.03	1.4	74	1
17062	28	0.01	0.03	0.2	28	1
17063	2276	0.01	0.03	0.4	448	25
17064	2241	0.01	0.03	1.0	2080	89

MFM	Mg	Mn	Na	Ni	Si	Sr
4836	96	0.50	4784	0.1	71	2.8
4837	76	2.66	5572	0.1	81	1.7
4838	110	0.37	2711	0.2	114	1.0
4839	16	0.15	878	0.1	147	0.3
4840	573	0.10	8683	0.1	46	3.1
4841	218	0.04	10048	0.2	266	28.2
17026	677	2.34	31679	0.1	1405	28.4
17027	184	15.80	24639	1.2	1138	4.4
17028	84	8.56	3075	0.3	550	4.9
17029	421	3.79	1148	1.4	1469	4.8
17030	46	1.00	4718	0.1	650	1.5
17031	774	1.56	52565	0.1	710	20.1
17032	471	2.59	1289	0.3	1565	1.4
17033	45	0.01	1556	0.1	28	0.3
17034	46	0.01	1630	0.1	28	0.3
17035	2854	0.23	106266	0.1	35	1.4
17036	4000	0.24	126370	0.1	32	2.1
17037	159	0.01	3012	0.1	39	1.5
17038	488	0.08	11341	0.1	62	2.7
17039	104	0.10	813	0.1	36	0.7
17040	84	1.21	1230	0.1	31	2.6
17041	31	0.01	6962	0.1	38	0.6
17042	1914	3.24	107045	0.1	18	9.6
17043	7	0.01	454	0.1	19	0.3
17044	250	6.50	2327	1.4	1640	9.0
17045	233	0.36	13881	0.1	1410	139.7
17046	263	1.31	4308	0.1	795	467.4
17047	412	19.50	1171	0.4	1410	6.7
17048	381	13.97	2038	0.1	1410	7.0
17049	1028	27.58	3649	0.6	2207	11.9
17050	798	0.28	69309	0.6	270	911.5
17051	489	1.53	9998	0.5	216	638.8
17052	0	0	0	0	0	0
17053	11	0.01	76	0.1	27	0.3
17054	691	32.28	18312	1.5	100	398.4
17055	137	0.35	7011	0.1	1414	85.4
17056	268	0.34	3782	0.1	69	1.1
17057	49	0.01	634	0.1	30	2.6
17058	2182	0.03	65923	0.1	53	69.6
17059	562	0.02	24357	0.1	27	36.5
17060	25	0.01	1715	0.1	26	1.1
17061	6	0.09	1447	0.1	33	0.3
17062	14	0.01	702	0.1	27	0.6
17063	599	0.02	29542	0.1	28	40.8
17064	1789	0.09	83329	0.1	14	37.6

MFIM	NOMBRE	PROVINCIA	CATEO	lugar	NORTH	EAST	Z	LABOR	NIVEL DEL	TIPO MUEST	DESCRIPCION	OBSERVACION	TOMADA X
17037	PO-L-1-JE	Salta	La Rosa (aledaño)	Salar de Llullaillaco	7255637	2565557		Pozo Agua Salta Observacion	24-00 m.?	Salmuera	Agua clara	cono aluvial	Ebisch J.
17106	001-LL	Jujuy	La Rosa (aledaño)	Llullaillaco	7255633	2562908		pozo de agua		Salmuera	Agua clara		Graña G.

Location	drill hole	total depth	water level	east	north	B	Li	Mg	K	Sr	Na	Ca	SO4
Llullaillaco	PO-L-1	56	23.16	2565557	7255637	236.863	106.845	1846.79	3955.44	2.991	31356.9	346.219	1542

SAMPLE ID	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	Si	Sr
17037	30	0.07	230	< 0.02	< 0.05	< 0.3	308	8	159	< 0.01	3012	< 0.1	39	1.5
17106	5	0.04	85	< 0.02	< 0.05	0.6	117	3	41	0.44	1208	< 0.1	4	1.2

Cl-

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