TECHNICAL REPORT ON THE CAUCHARI LITHIUM PROJECT

JUJUY PROVINCE, ARGENTINA

REPORT
PREPARED FOR ADVANTAGE LITHIUM CORP.

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SUMMARY

Advantage Lithium Corp. is acquiring an interest in the Cauchari project from Orocobre, who through its 85% owned subsidiary South American Salars (SAS), owns 27,771 ha of mining properties (tenements) over the Cauchari salar. These project hosts brine containing elevated concentrations of lithium and potassium. This report follows on from the NI43-101 report by Houston (2010b) on the initial exploration on the project in 2009 and 2010.

The objective of work carried out since the 2010 report has been to develop an initial brine resource estimate for the project. This technical report documents the activities undertaken, the data collected, interpretation of the data and an inferred resource for the project prepared according to the requirements of National Instrument 43-101 – Standards of Disclosure for Mineral Projects and Form 43-101F1. The report was prepared by primary author Murray Brooker, who is a Qualified Person under the definitions of NI43-101 and independent of Orocobre and its subsidiaries.

Sampling of host sediments and the contained brines in salars is challenging, due to the poorly consolidated nature of the sediments and the fluid character of the brine sample. Consequently there are difficulties in obtaining undisturbed lithological samples and risks of contamination of brine (fluid) samples by fluids used in drilling and contained in adjacent intervals of sediment. With these considerations in mind it is important to take the uttermost care when collecting samples. In the nearby Olaroz project Orocobre and consultant hydrogeologist John Houston developed methodologies to detect sample contamination and to cross check results from one sample source with those from another. The author has, where possible, applied these sampling methodologies which were developed and tested on the Olaroz project.

Location and physiography

The Cauchari project is located in the Puna region of the province of Jujuy (Figure 3.1). The project is at an altitude of 3900 m above sea level, and is located 230 km west of the capital city of Jujuy.

The project sits astride the paved highway passing through the international border with Chile, approximately 80 kilometers by road to the west (Jama Pass). This road continues on to the major mining center of Calama and the port of Mejillones in northern Chile, a major port for the export of mineral commodities and import of mining equipment.

Climate

The climate is typical of a continental, cold, high altitude desert, with resultant scarce vegetation. Solar radiation is intense, especially during the summer months of October through March. The high evaporation rate in the Puna is an important aspect of commercial production, with conventional brine processing requiring solar concentration of Li and K in brine ponds, prior to chemical processing to produce lithium carbonate and potash.

Geological setting

The Puna is an elevated plateau in northern Argentina which has been subject to uplift along thrust fault systems inverting earlier extensional faults. The Puna is also host to numerous large ignimbrites and stratovolcanoes.

During the Pliocene-Pleistocene tectonic deformation took place, as shortening moved east from the Puna. Coincident with this change in tectonic activity climatic fluctuation occurred, with short wetter periods alternating with drier periods.

As a result of both, reduced tectonic activity in the Puna and the predominant arid conditions, reduced erosion led to less sediment accumulation in the isolated basins. However, both surface and groundwater inflows into the basins continued the leaching, dissolution transportation and concentration of minerals. Precipitation of salts and evaporites (halite, gypsum) occurred in the center of basins where evaporation is the only means of water escaping from the hydrological system.

Ordovician sediments lie on the western margins of the salar, with Miocene continental sediments and younger volcanic rocks east of the salar. Clastic deposits of probable Quaternary age fill the salar basin, overlain by fine grained sediments.

Modelling of a gravity and AMT geophysical survey line across the salar suggests the salar is 400 m plus deep, with drilling in adjacent properties to 450 m not intersecting the basement sediments interpreted to form the basement rock beneath the salar. Reverse faults are interpreted on the eastern and western sides of the salar, based on mapping by the Argentine geological survey, Segemar. Multiple faults may accommodate displacement within the salar.

Salar Geology

The Cauchari salar has characteristics of both an immature salar, dominated by clastic sediment, and a mature salar, dominated by halite, in the classification of Houston et.al., 2011. The two major units are divided into a number of sub units, as follows:

- Unit A1 – A sequence of reddish brown silt and clay, with very minor sand
- Unit A2 – A unit of brown and locally black to grey silt and clay in the north of the salar
- Unit A3 – A unit of red brown silt and clay.
- Unit A4 – Red-brown silt and clay with a medium grained sand unit near the top of the unit.
- Unit B1 – A transitional unit with the first appearance of halite with silt and clay
- Unit B2 – A thick halite unit continuing to the base of drilling at 249 m, with at least 12 markers showing discrete silt and clay sedimentary cycles within the halite.

Units A and B host the brine resource, although the brine concentrations in Unit A are generally lower than in Unit B.

Exploration

Five diamond holes were drilled in the salar to depths up to 249 m, but on average 144 m deep. Diamond core samples were sent to the Independent British Geological Survey ("BGS") laboratory, with a total of 147 samples analysed for total porosity (Pt) and 118 for specific yield (Sy). An additional 155 samples were analysed in the company's non-certified Salta laboratory for total porosity measurements. The Sy analyses provided mean values for sands (4%, due to variable halite cementation), silt mixes (5%), clays (2%), halite-sediment mixes (7%) and halite (2% for compact halite to 16% for porous halite), with a thick sequence of halite interpreted to underlie the resource area.

Resource Estimate

Brine sample results and lithological information from the 5 diamond drill holes was used to estimate a resource for the area drilled. Extensive QA/QC evaluation undertaken on the geochemical data and assays from Alex Stewart laboratories indicates the analyses are

acceptable for use in the inferred resource estimate. The Sy (drainable porosity) values from the BGS analysis were used to calculate a weighted Sy value for each drill hole, based on the lithologies and thicknesses of each lithology. These results were compared with value of porosity calculated from the relationship established between porosity geophysical logs and Sy values measured for core samples. The results from the lithology-weighted Sy values and those calculated from porosity logs were averaged and used to calculate an equivalent brine thickness at each diamond hole.

The composite brine sample results as g/l values were multiplied by the equivalent brine thickness (litres contained over a m^2), to produce a kg/m^2 value for each diamond hole. This data was kriged across the salar to produce a set of kg/m^2 concentration maps for Li, K and B. These grids were then clipped with the Orocobre tenements. The sum of the grid values (accounting for the grid cell size) produced the total resource mass, presented in the table below.

Because drilling was carried out to different depths within the properties it was necessary to assign a different thickness to the calculated resource depending on the drilling depth. In the north of the properties a resource thickness of 170 m was used, based on the depth of the shallowest hole (CAU005D) in this area. In the south of the properties a resource thickness of 50 m was used, based on the shallowest hole (CAU004D) in that area.

An inferred resource from the combined northern and southern resource areas contains an estimated 230 million cubic metres of brine at ~380 mg/l Li and 3,700 mg/l K. This is equivalent to 470,000 tonnes of lithium carbonate (~88,000 tonnes lithium metal) and 1.62 million tonnes of potash (KCl - equivalent to ~840,000 tonnes of potassium), using conversion factors of 5.32 and 1.91 for lithium and potassium respectively.

	Brine body parameters				Average resource concentrations		Tonnes contained			
Inferred Resource Area	Area km^2	Average thickness m	Mean specific yield %	Brine volume Million m^3	Lithium mg/l	Potassium mg/l	Lithium metal	Potassium	Lithium carbonate	Potash (KCl)
North 0-170 m	19.69	170	6.1%	204	400	3,800	81,000	780,000	430,000	1,500,000
South 0-50 m	11.35	50	4.6%	26	260	2,500	7,000	60,000	40,000	120,000
Combined	31.04			230	380	3,700	88,000	840,000	470,000	1,620,000

The Cauchari brine has attractive chemistry, with low Mg/Li and high K/Li ratios and is amenable to a similar process to that used at the adjacent Olaroz project.

Exploration target

In addition to the inferred resource defined in 2012 an exploration target was also defined in 2012 to cover the area beneath the resource defined there. The 2012 drilling campaign did not reach the target depth except in hole CAU001D. Consequently there is potential to substantially increase the project resource if the deeper sand unit identified in adjacent properties is intersected in the SAS Cauchari properties.

However, it must be stressed that an exploration target is not a mineral resource. The potential quantity and grade of the exploration target is conceptual in nature and there has been insufficient exploration to define a mineral resource in the volume where the Exploration Target is outlined. It is uncertain if further exploration will result in the determination of a Mineral Resource in this volume.

The original 2012 exploration target was defined only in the eastern tenements. **Consideration of the western properties suggests continuation of the aquifers hosting brine at Olaroz beneath the Archibarca alluvial fan directly into the Cauchari**

tenements. Lithium Americas Corp (LAC) on adjacent properties shows that brine is present beneath the alluvial fan sediments. On that basis an additional exploration target has been defined in addition to that publicly released with the original resource estimate. The exploration targets are outlined in Table 24.2. The exploration target is defined with a range of 0.25 to 5.6 mt of lithium carbonate and 0.9 mt to 19 mt of potash (KCl) for the lower and upper ranges applied for the exploration target, using conversion factors of 5.32 and 1.91 for lithium and potassium respectively. Additional drilling is required to determine what resources (if any) could be defined within the volume of the exploration target.

Extraction assessment

The Cauchari brine has attractive chemistry, with low Mg/Li and high K/Li ratios and may be amenable to the process that is being used to produce lithium at the adjacent Olaroz lithium project. However, process test work has not yet been completed to determine the process that could be used for lithium production from the Cauchari brine.

The Cauchari project is located between the Olaroz project, which is an operating lithium production facility (mine) since 2015, and the pre-development Cauchari project owned by Lithium Americas Corp. A definitive feasibility study has been completed on the Lithium Americas project and the company is in joint venture with major Chilean lithium brine producer, SQM, which is listed on the New York Stock Exchange.

Although the lithium concentration of this project resource is lower than the adjacent Orocobre Olaroz (690 mg/l Li – Houston, 2011) and Lithium Americas Cauchari (600 mg/l, King et. al., 2012) resources drilling intersected potentially economic lithium concentrations as a likely extension of the Lithium Americas resource. The same aquifers hosting lithium brine in the adjacent Olaroz mine and advanced Cauchari pre-development project are likely to extend into the Company's Cauchari project.

Recommendations

The 2011 Cauchari drilling program was affected by the limited time available for drilling as part of the conditional drilling approval, and the early onset of the wet season in January 2012. This resulted in the abandonment of holes CAU003D and CAU004D, with only CAU001D reaching the target depth. CAU006R was drilled as a rotary hole, in order to obtain lithological information at this drill site which would not have been obtained in the available time frame with the diamond drill rig.

It is recommended that five additional deep drill holes (to 400 m plus) are completed in the Cauchari properties as an initial exploration program. Four holes are recommended in the eastern properties, advancing the drilling program undertaken in 2011. A fifth hole is proposed in the western properties, to evaluate the possible extension of brine-bearing aquifers south from Olaroz into these properties. If the result of this hole is positive then additional drilling is recommended in the western properties, with the objective of defining a resource in this area. It is recommended to conduct a new resource estimate with the new drilling information.

Drilling has established that the stratigraphy is dominated by halite in the SAS properties where drilling has been conducted. Intervals of highly porous halite have been observed locally, however the extent of connection between pores and cavities within this halite is uncertain. It is further recommended that:

- Packer testing of intervals of porous halite should be considered, to establish the permeability of such zones relative to more compact halite and clastic sediments. Low flow sampling and pump testing should also be considered for specific intervals

identified as having high porosity in the core, to evaluate the brine chemistry there in detail.

- Long term pump testing should be undertaken at different locations within the salar, to evaluate the productivity of the halite sequence and the sand sequence which is interpreted to underlie it. Test production bores should be constructed at a sufficient diameter to allow installation of a high volume submersible pump. The object is to pump over an extended period of months and evaluate the brine quality and variations, in addition to assessing the possible long term pump rate.
- These holes should be drilled and bores installed by an experienced and reliable contractor and adequately developed before pumping, to clean any drilling-related fluids or muds from the holes. An adequately sized sand pack should be established, to minimize ingress of fine material to the hole.
- Some fast-track lab and pilot plant test work should be conducted in order to verify if the Olaroz process can be applied to the Cauchari project brine.

1 INTRODUCTION

1.1 Authorship and terms of reference

The authors, Murray Brooker and Peter Ehren, was requested by Orocobre Ltd. ("Orocobre") to prepare this report as part of a corporate transaction involving the Cauchari properties of Orocobre 85% subsidiary South American Salars. Both authors are independent of Orocobre Limited and Advantage Lithium Corp. This report includes the resource estimate that was announced by Orocobre in 2012 for the Cauchari properties. At the request of Orocobre this report also includes definition of an exploration target for the Cauchari properties, which is based on observations from drilling in the Olaroz and Cauchari salars.

Murray Brooker was responsible for supervising the 2012 drilling program at Cauchari and the implementation of the quality control system for this work. Day to day supervision was provided by South American Salars management and geologists.

Previous exploration and evaluation data was made available to the authors by Orocobre, consisting of surface pitting brine results, physical sample measurements and geophysics. This report draws on information compiled in the "Technical Report on the Cauchari Project" (Houston, April 2010b), particularly for sources of general geologic and climatic data. The authors have also reviewed other published geological and hydrogeological reports in preparation of this document.

Mr Peter Ehren of Process and Environment Consultancy (PEC) is responsible for sections of the report regarding mineral processing and metallurgical testing expertise and statements in section 12, 15 and 16 of this report. Mr Ehren is a consulting mineral processing engineer with significant experience in brine deposits. Overall review of material prepared by Peter Ehren was undertaken by Mr. Brooker. However, it is acknowledged that Mr. Brooker is not an expert in mineral processing. Mr Brooker has prepared the other sections of the report.

The authors has previous experience with similar brine resource projects in Argentina relevant to the Cauchari project, having provided consulting services to Orocobre on the Olaroz, Salinas Grandes and Cauchari projects in the past, as well as having conducted assessments on a significant number of salt lake projects in Argentina, Chile and other parts of the world. Regarding the Cauchari Project, the authors spent November and December 2011 visiting the project site and reviewing project data, last visiting the drilling site on the 9th of December 2012, with more recent visits in 2014 to 2016.

This report format and content is prepared in accordance with the requirements of National Instrument 43-101 – Standards of Disclosure for Mineral projects. This is as well as Form 43-101F1 – Technical Report and Companion Policy 43-101CP to National Instrument 43-101 Standards of Disclosure for Mineral Projects, of the Canadian Securities Administrators ("NI 43-101").

1.2 Essential differences between brine and hard rock projects

There are essential differences between brine and hard rock base or precious metal projects. Brine is a fluid hosted in an aquifer and thus has the ability to flow and mix with adjacent fluids once pumping of the brine commences. An initial in-situ resource estimate is based on knowledge of the geometry of the aquifer, and the variations in porosity and brine grade within the aquifer. In order to assess the recoverable reserve, further information on the permeability and flow regime in the aquifer and the surrounding area is necessary to be able to predict how the resource will change over the project life. These considerations are

examined more fully in Houston et. al., (2011) and the reader is recommended to refer to this key publication for further explanation of the details of brine deposits.

Section 6 (Geological Setting and Mineralization) discusses characteristics of the brine. Section 7 of this report (Deposit Type) discusses the characteristics of the aquifers hosting mineralized brine. Section 12 (Mineral Processing and Metallurgical Testing) makes reference to important aspects of economic development of a brine project.

Hydrogeology is a specialist discipline which involves the use of a number of specialized terms which are used frequently throughout this document. The reader is referred to the glossary at the end of this report for a definition of terms.

2 RELIANCE ON OTHER EXPERTS

In preparing a technical report of this nature multiple technical disciplines are required. In addition to their own expertise the authors Murray Brooker and Peter Ehren rely on the following experts in preparation of this report.

Legal – independent lawyer, Santiago Saravia Frias for information regarding the legal status of the properties, the property (tenement) agreements, the surveyed limits of properties and permits, and surface property rights in a report dated 8th August 20116. This applies to information in section 3 and related summaries in its entirety. Additional information was provided by SAS personnel Mr Miguel Peral and Mrs Silvia Rodriguez. The independent QPs have not investigated title or mineral rights of the Project and express no legal opinion as to the ownership status of the Cauchari Properties

Environmental – South American Salars representatives Miguel Peral and Silvia Rodriguez for information regarding permits held by the company and the environmental reporting status of the project. This refers to information in section 3 and 19 in its entirety.

3 PROPERTY LOCATION AND DESCRIPTION

3.1 Location

The Cauchari project is located in the Puna region of the province of Jujuy (Figure 3.1). The project is at an altitude of 3900 m above sea level, and is located 230 km west of the capital city of Jujuy.

The project site sits astride the paved highway passing through the international border with Chile, approximately 80 kilometers by road to the west (Jama Pass). This road continues on to the major mining center of Calama and the port of Mejillones in northern Chile, a major port for the export of mineral commodities and import of mining equipment.

There are a number of local villages within 50 kilometers of the project site. These include the village of Olaroz Chico 34 km NNE, Olacapato, 50 km south and Catua 37 km south west. The regional administrative center of Susques (population ~2000) is one hour's drive northeast of the project site.

3.2 Exploration and exploitation licenses

3.2.1 Types of licenses & co-ordinate system

The location of the South American Salars Cauchari tenement licenses is shown in Figure 3.2, with property (tenement) information presented in Table 3.1. Tenement co-ordinates (and all other co-ordinates used in this report) are given in the Argentine coordinate system, which uses the Gauss Krueger Transverse Mercator projection, and the Argentine Posgar 94 datum. The properties are located in Argentine GK Zone 3.

Two tenement types exist in the Argentine mining regulations. **Cateos** (Exploration Permits) are licenses that allow the owner to explore the tenement for a period of time following grant that is proportional to the size of the tenement. The time an Exploration Permit of 1 unit (500 hectares) is granted for is 150 days. For each additional unit (500 hectares) the period is extended by 50 days. The maximum allowed permit size is 20 units (10,000 hectares), granted for a period of 1,100 days. The period begins 30 days after granting of the permit.

A relinquishment must be made after the first 300 days, and a second one, after 700 days being elapsed. The applicant should pay the canon fee, a total of $1,600 Argentine pesos per unit (500 hectares) applied for, submit a minimum working plan to be performed, and hand in an environmental impact assessment.

Minas (Mining/exploitation Permits) are licenses which allow the holder to exploit the tenement subject to regulatory environmental approval. Minas are of unlimited duration, providing the tenement holder meets its obligations under the Mining Code. These include:

- Paying the annual rent (canon) payments;
- Completing a survey of the tenement boundaries;
- Submitting a mining investment plan; and
- Meeting the minimum investment commitment.

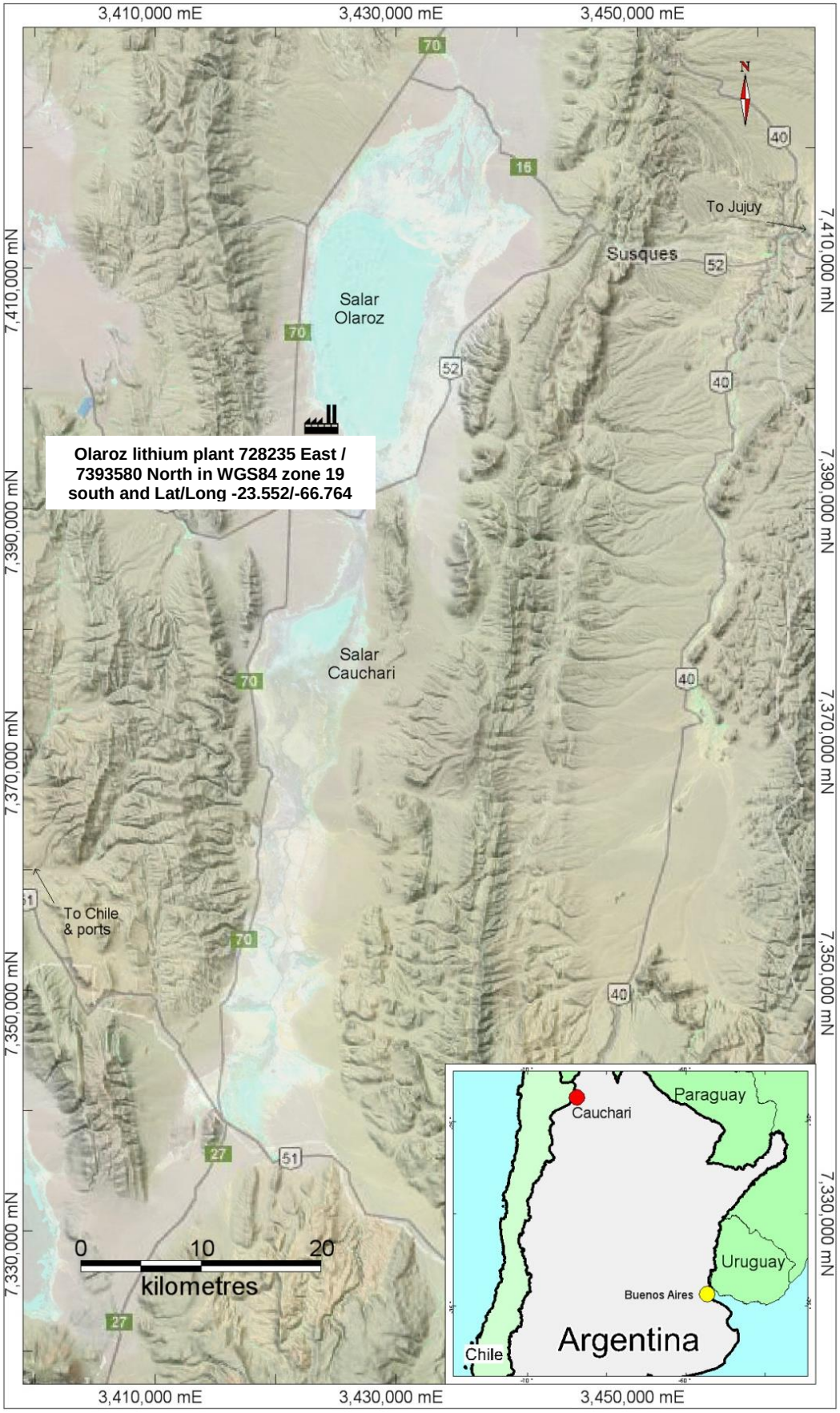


Figure 3.1 Location of the Cauchari and Olaroz salars
Coordinates in zone 3 of the Argentine Gauss Kruger grid system. Olaroz for reference

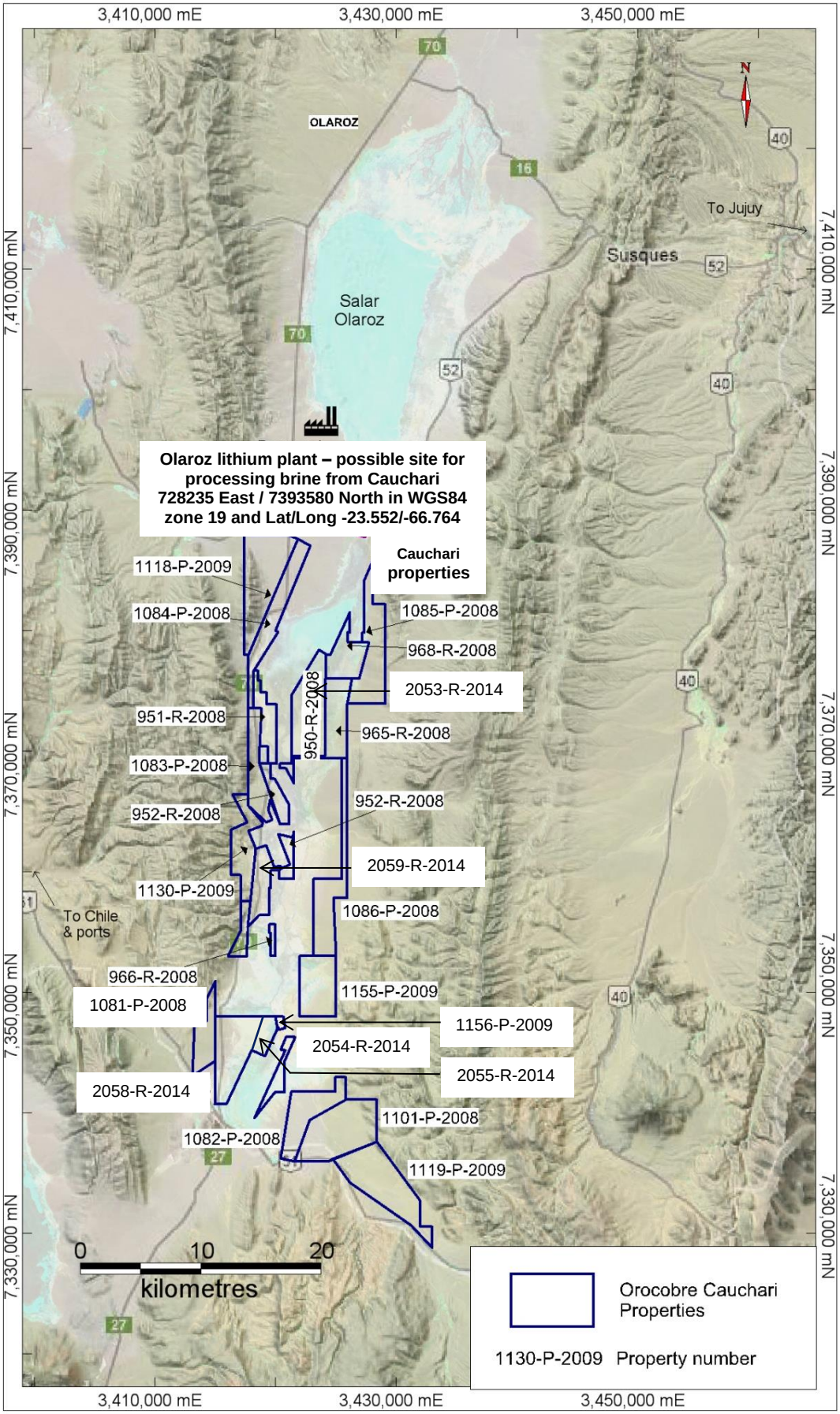


Figure 3.2 Properties held by Orocobre Ltd through South American Salars S.A. (85% Orocobre) Coordinates in zone 3 of the Argentine Gauss Kruger grid system. Olaroz for reference

Expenditure commitments for Minas

The Cauchari properties are now all held as applications for minas.

- The investment commitment is 300 times the annual rent payment, to be spent over a five year period and payable within five years of the filing of a capital investment plan.
- During each of the first two years the amount of the investment shall not be less than 20 % and the rest of the investment (60 %) freely distributed during the remaining three years.
- The annual tenement tax varies according to the mineral commodity. For brines it is $3,200 argentine pesos/year per 100 hectares.

Mining claims (of both types) must be specified for the type of mineral the holder is seeking to explore and exploit. The twice annual canon fees applicable for mining permits are dependent on the class of minerals applied for. Claims cannot be over-staked by new claims specifying different minerals and adding mineral species to a claim file is a relatively straightforward procedure, which may require payment of a different canon fee.

All Cauchari tenements are in the process of being granted as minas/exploitation permits, replacing the Cateos previously held by SAS. Provided that the title holder fulfils the legal requirements, in due time the pertinent exploitation licence/concession should be granted. Independent legal review has confirmed the property obligations have been maintained to keep the properties in good standing.

Expenditure commitments for individual properties are listed in Table 3.1.

3.2.2 The Cauchari tenement package

The Cauchari tenements cover approximately 27,771.5 hectares in the province of Jujuy. These consist of 22 minas which were applied for on behalf of South American Salars. There is an agreement between the vendors of these tenements and South American Salars SA the wholly owned subsidiary of South American Salar Minerals Pty Ltd. The latter is an Australian Registered company 85% owned by Orocobre Ltd and 15% owned by Argentine shareholders S. Rodriguez and M. Peral who applied for all the tenements. The legal report prepared by independent Argentine registered lawyer Mr Santiago Saravia Frias (dated 12 August, 2016) showed that these properties were originally primarily in the name of Silvia Rodriguez, and these properties are in the legal process of being transferred to South American Salars, with the transfers legally registered in favour of SAS.

3.2.3 Surface rights and legal access

A description of the Surface owners on each of the tenements is provided in Table 3.1. All the tenements have surface owners being, depending on the area, the communities of Catua, Termas de Tuzgle de Puesto Sey and/or Los Manantiales de Pastos Chicos.

Pursuant to Argentina legislation, except for a few minerals that belongs to the surface owner, the others belong to the Provinces, which grant exploration and exploitation concession rights to the applicants.

Article 13 of the Argentine Mining Code states that “the exploitation of mines, their exploration, concession and other consequent acts, have the nature of public benefit”. Based on this principle the exploration and mining permits, have primacy over the surface rights provided certain legal requirements are met, basically consisting of due compensation for

damages or the lodging of a surety when the amount of the compensation is not agreed with the surface owner or when the works to be done are urgent. Therefore, the applicant of an exploitation permit, as for the Cauchari project tenements, has the right to access and carry out exploration activities provided that the pertinent environmental impact assessment is approved

3.3 Environmental liabilities

The Cauchari tenements are not subject to any known environmental liabilities. However, there has been ulexite/borax mining and there is active borate mining adjacent to the South American Salars Properties in the north of the salar. The borax mining operations are limited to within three metres of the surface and it is assumed the workings will naturally reclaim when mining is halted, due to wet season inflows.

3.4 Permit status

Exploration and mining activities on cateos and minas are subject to regulatory authority approval of an environmental impact report ("EIR") before the commencements of the activities. The authors are advised by SAS manager Miguel that the company has obtained approvals for its activities both through approvals on the EIRs it has lodged with regulatory authorities and relevant local aboriginal communities, and also through prior approvals on properties it acquired. Subsequent EIR biannual updates have been presented to reflect the ongoing activities.

The authors are informed that the IIA Environmental report has been approved by the UGAMP (Unidad de Gestión Ambiental Minera Provincial – which is the environmental approvals authority in the province of Jujuy). The authors are informed by SAS manager Mr M Peral this document has been presented to the local communities and the document now remains to be signed by the DIA government authority to permit activities to commence on the properties.

3.5 Royalties

The Argentine federal government regulates ownership of mineral resources, although mineral properties are administered by the provinces. In 1993 the Federal Government established a limit of 3% on mining royalties to be paid to the provinces as a percentage of the "pit head" value of extracted minerals. The company is subject to a 3% royalty payable to the Jujuy government based on earnings before income and tax.

The Cauchari properties of South American Salars were 85% owned by Orocobre (through South American Salars), prior to the property transaction and 15% owned by private owners. The author is informed there are no royalties or pending payments related to these tenements other than the royalty to Orocobre as part of the transaction with Advantage Lithium. Advantage Lithium will have a 1% gross royalty to Orocobre as part of the transaction discussed below.

Property	Property Number	Property Area (ha)	Property Type & Expiry	Land owner (communities)	Total Five Year Mining Investment plan (in $US)	Annual Canon (rent) fee $US
Juan Pablo II	2055R 2014	495.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	320,000	1,067
Juan XXIII	2054 R 2014	442.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	320,000	1,067
Papa Francisco I	2053 R 2014	1997.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey and Los Manantiales de Pastos Chicos.	1,280,000	4,267
San Gabriel I	951 R 2008	795.2	Mina - Perpetual	Catua, Termas de Tuzgle de Puesto Sey and Los Manantiales de Pastos Chicos.	512,000	1,707
San Joaquin I	952 R 2008	487.7	Mina - Perpetual	Catua and Termas de Tuzgle de Puesto Sey.	320,000	1,067
San Francisco Sur	965 R 2008	1345.0	Mina - Perpetual	Catua, Termas de Tuzgle de Puesto Sey and Los Manantiales de Pastos Chicos.	896,000	2,987
San Carlos Este	966 R 2008	118.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	128,000	427
Francisco Norte	968 R 2008	700.1	Mina - Perpetual	Pastos Chicos	448,000	1,493
Georgina	1081 P 2008	1247.0	Mina - Perpetual	Catua	832,000	2,773
Olacapatita I	1082 P 2008	1422.0	Mina - Perpetual	The Province of Jujuy has established an encumbrance for solar energy in the whole tenement	960,000	3,200
San Gabriel Sur	1083 P 2008	1450.0	Mina - Perpetual	Catua, Termas de Tuzgle de Puesto Sey and Los Manantiales de Pastos Chicos.	960,000	3,200
SanGabriel Norte	1084 P 2008	1526.7	Mina - Perpetual	Cauta and Los Mantantiales de Pastos Chicos	1,024,000	3,413
San Francisco Este	1085 P 2008	1201.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey and Los Manantiales de Pastos Chicos.	768,000	2,560
Sulfita	1086 P 2008	1717.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	1,152,000	3,840
Olacapatita II	1101 P 2008	2484.0	Mina - Perpetual	The Province of Jujuy has established an encumbrance for solar energy in the whole tenement	1,600,000	5,333
Olacapatita III	1119 P 2009	2493.0	Mina - Perpetual	The Province of Jujuy has established an encumbrance for solar energy in the whole tenement	1,600,000	5,333
San Gerardo	1118 P 2009	2395.8	Mina - Perpetual	Catua, Termas de Tuzgle de Puesto Sey and Los Manantiales de Pastos Chicos.	1,536,000	5,120
San Gerardo II	1130 P 2009	1239.0	Mina - Perpetual	Catua Comunity	832,000	2,773
Antonito I	1155 P 2009	1500.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	960,000	3,200
Solitaria I	1156 P 2009	66.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	64,000	213
Mina San Gabriel X	2059 R 2014	885.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	576,000	1,920
Mina Juan Pablo I	2058 R 2014	1765.0	Mina - Perpetual	Termas de Tuzgle de Puesto Sey	1,152,000	3,840
Total		**27,771.5**			**18,240,000**	**60,800**

Table 3.1 Individual tenements of the Cauchari project showing the areas in hectares. Co-ordinates in Gauss Kruger Zone 3, POSGAR94 datum.

3.6 Issuers (Advantage Lithium) obligations to acquire interest in the properties

The Cauchari project is part of a package of six property groups in which Advantage Lithium has entered into a letter of intent to acquire a 100% interest in five of the properties and up to 75% of Orocobre's Cauchari project (this report). A joint venture will be formed between Advantage Lithium and Orocobre for the Cauchari project and the following conditions must be met.

- Advantage Lithium will acquire an immediate initial 50% interest in the Cauchari project, with the option to increase to a 75% interest, upon incurring exploration expenditure of US$5m over 3 years or completion of a feasibility study in that period.
- Orocobre will retain a 1% gross royalty on the Cauchari properties, and will have rights of first refusal on brine production (and may enter into an offtake agreement in respect of such brine production).
- Advantage Lithium will be the Operator, in the Cauchari lithium brine project.
- For the acquisition to proceed it is an obligation that Advantage Lithium conduct an equity financing to raise gross proceeds of not less than US$15,000,000 to a maximum of US$25,000,000 to maintain and advance the projects.
- Completion of due diligence by Advantage Lithium and execution of a binding transaction documentation.
- Completion of the transaction and issue 40,666,667 Advantage Lithium (AAL) shares to Orocobre (ORE).
- Obtain approval by the TSX Venture Exchange and board and shareholder approval by both companies.

Upon completion of the agreement Orocobre is to own over 31% of Advantage Lithium, with a share lock-up to apply post-closing. Upon closing, Orocobre will own approximately 31.1% of Advantage Lithium (on a fully-diluted basis post capital raising). A pooling agreement will be entered into between Orocobre and the Advantage Lithium insiders, pursuant to which the parties will agree not to sell their shares of Advantage Lithium for specified periods post-closing (subject to customary exceptions).

3.7 Risk factors

A number of normal risk factors are associated with the Cauchari properties (tenements) which are part of the proposed transaction between Orocobre and Advantage Lithium Corp. These risks include, but are not limited to:

- The risk that properties which have not been fully granted will not be granted or parts of them will not be granted, due to conflicts between property applications or due to deficiencies in the applications and the risk that properties will not be renewed by the provincial authorities.
- The risk that final environmental approvals will not be received from the necessary authorities.
- The risk of obtaining all the necessary licences and permits on acceptable terms, in a timely manner or at all.
- The risk of changes in federal or provincial laws and their implementation, impacting activities on the properties.
- The risk of unseasonal flooding of the salar, which could temporarily delay planned exploration.
- The risk the company is unable to meet its obligations for expenditure and maintenance of property licences.
- The risk of activities on adjacent properties having an impact on the Cauchari project.

4 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

4.1 Accessibility, local resources and infrastructure

The Cauchari project is located in the Puna area of northwest Argentina, within the provinces of Salta and Jujuy (Figure 4.1). The project site is reached by paved and unpaved roads from Salta or Jujuy which connect with the highway Route 52 that passes through Salinas Grandes to the international border with Chile, to the northwest (Jama Pass). This highway continues on to the major mining center of Calama and the port of Mejillones in northern Chile.

Access to the project from the City of San Salvador de Jujuy is via Route 9, which heads north-northwest for approximately 60 km, meeting the international highway Route 52 near the town of Purmamarca. Following Route 52 for a further 50 km leads to the eastern side of Salinas Grandes. The road crosses this salar before ascending further and continuing south along the eastern margin of the Olaroz salar. The Cauchari tenements are accessed by gravel tracks heading south from Route 52, where the road crosses the boundary of the Olaroz and Cauchari salars. This is approximately 70 km from the international border. The total driving distance between the City of Jujuy and the project area is approximately 230 km, and takes approximately 4 hours. Both Jujuy and Salta have regular flights to Buenos Aires.

The project is reached from the provincial capital of Salta by driving 27 km WSW from Salta to Campo Quijano, then continuing north ~120 km along Route 51, through Quebrada del Toro, to the town of San Antonio de los Cobres, at an altitude of 3750 m. This route is paved, with the exception of the lower section through Quebrada del Toro and the upper section leading to San Antonio. From San Antonio de los Cobres Route 51 leads west to the south of the Cauchari salar, with route 70 providing access along the western side of the salar to near the international road. The distance from San Antonio is approximately 125 km, with gravel tracks providing access to the project area.

The Puna gas pipeline in northern Argentina crosses to the north of the salar de Olaroz. The company Sales de Jujuy has constructed a spur gas pipeline from this pipeline to the Olaroz project, 20 km north of the Cauchari properties. A railway crosses from northern Argentina into Chile also passes the southern end of the salar, approximately 40 kilometers to the south of the project site, providing potential access to a number of ports in northern Chile.

4.2 Local population centres and accommodation

There are a number of local villages within 50 kilometers of the project site. These include the villages of Olacapato, Catua and Olaroz Chico. The regional administrative center of Susques (population ~2000) is one hour's drive northeast of the project site.

Accommodation was previously provided by a field camp established by Orocobre within several kilometers of drill holes in the north of the tenements. Further accommodation is provided by a number of basic hotels in the town of Susques.

4.3 Physiography

The Altiplano-Puna is an elevated plateau within the central Andes (see Figure 4.2 below). The Puna covers part of the Argentinean provinces of Jujuy, Salta, Catamarca, La Rioja and Tucuman with an average elevation of 3,700 m asl (Morlans, 1995; Kay et. al., 2008).

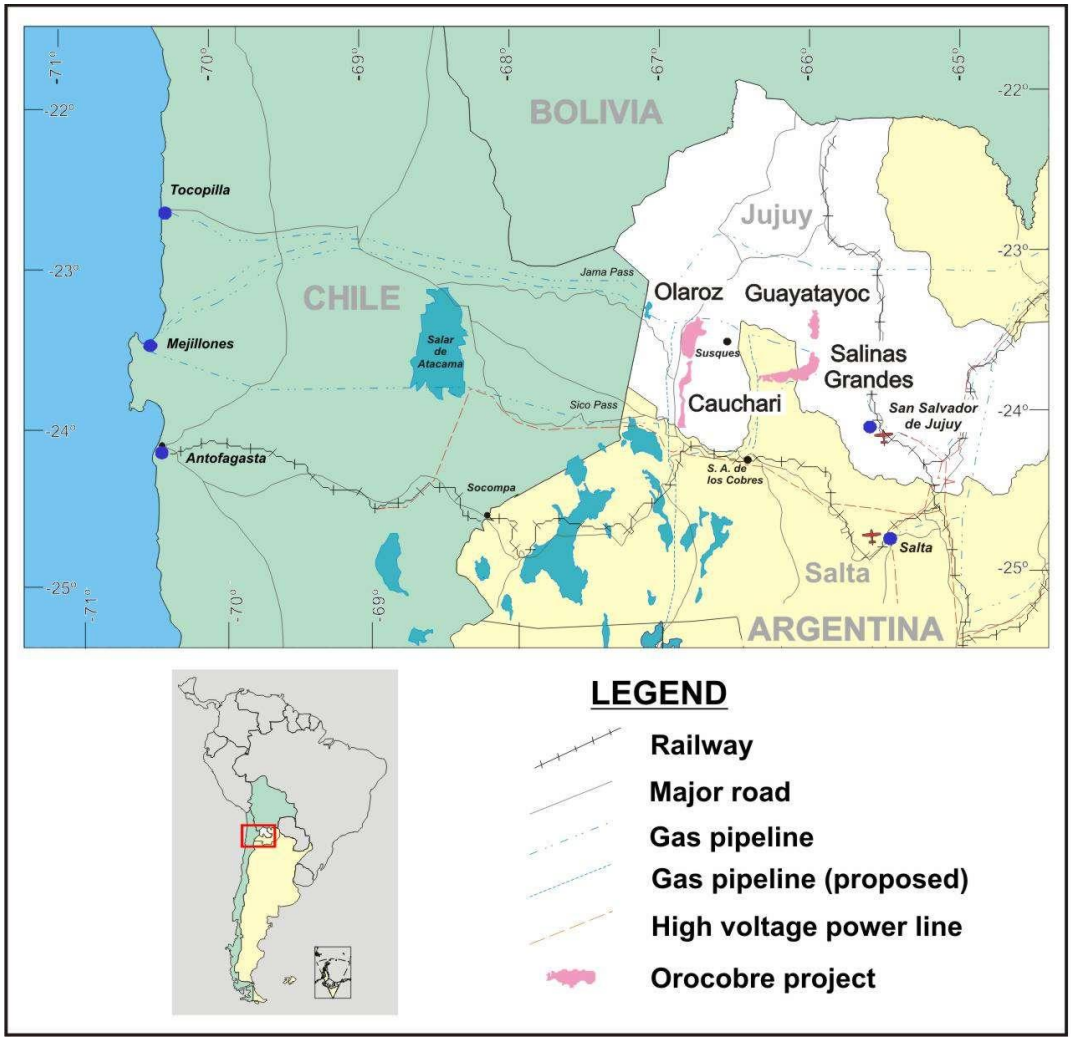


Figure 4.1 Project location, access and infrastructure

The Altiplano-Puna Volcanic Complex (APVC) is located between the Altiplano and Puna regions and is associated with numerous stratovolcanoes and calderas. Investigations have shown that the APVC is underlain by an extensive magma chamber at 4-8 km depth (de Silva et al., 2006).

The physiography of the region is characterized by basins separated by generally north-south trending ranges, with canyons cutting through the Western and Eastern Cordilleras. There are numerous volcanic centers in the Puna, particularly in the Western Cordillera, where volcanic cones are present along the border of Chile and Argentina.

Dry salt lakes (salars) in the Puna are flat areas which fill many of the closed basins (see Figure 4.3 below), which have internal (endorheic) drainage. Inflow to the Argentine salars is from summer rainfall, surface water runoff and groundwater inflows.

The Cauchari project is located in the salar of the same name (see Figure 4.3). The elevation at the surface of the salar is approximately 3900 m asl. The salar is a flat area, cut by some drainage channels, and forms a composite closed basin, with internal (endorheic) drainage, where discharge occurs by evaporation.

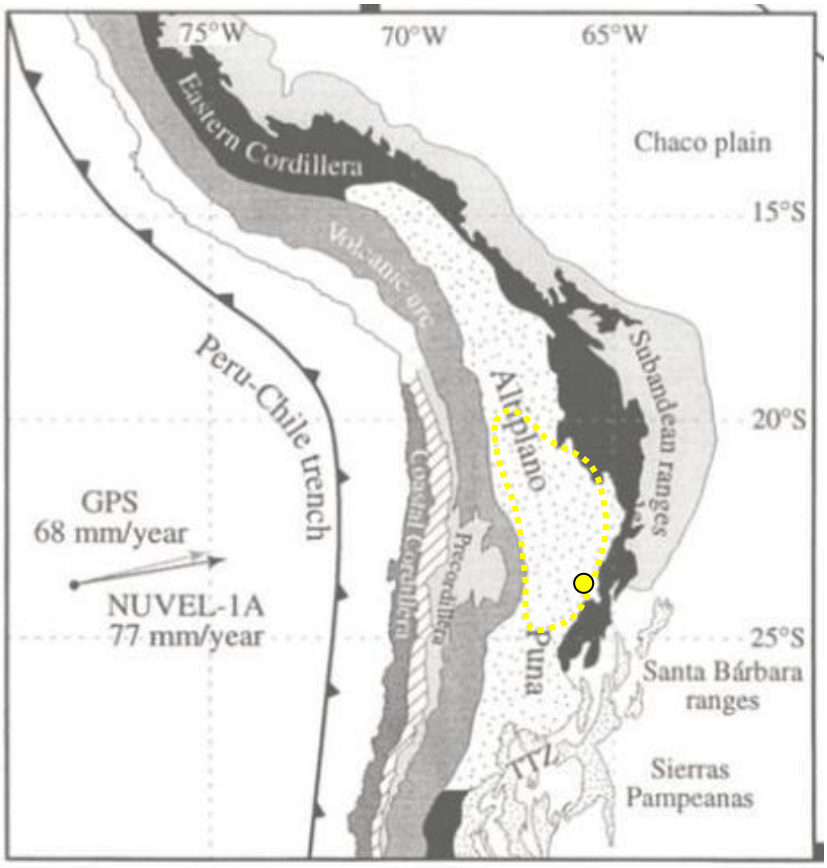


Figure 4.2 Physiographic and morphotectonic features of the Central Andes.
The Altiplano-Puna Volcanic Complex (APVC) is shown in yellow and Cauchari as a yellow dot.

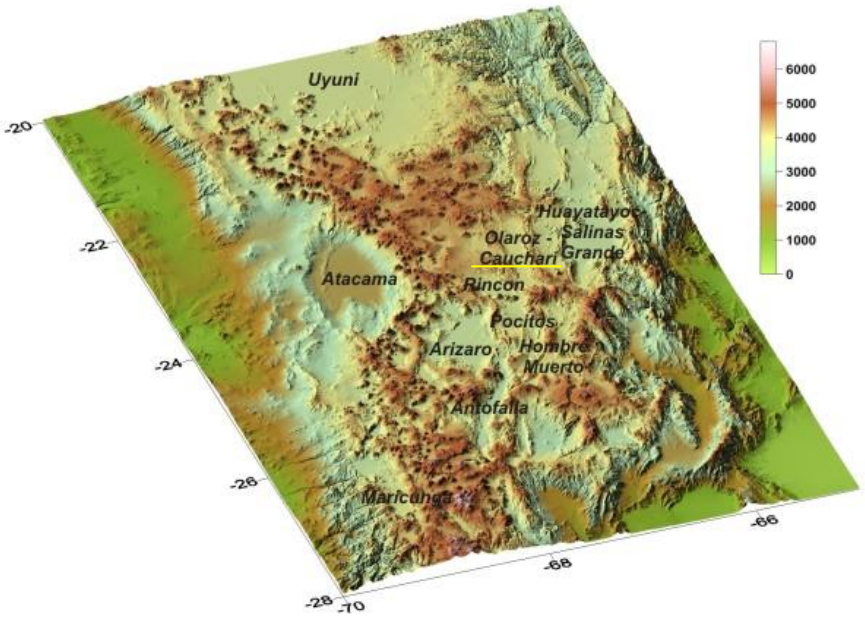


Figure 4.3 Digital elevation model of the Puna showing the location of various salars.
Note the location of Cauchari in the east of the Puna Plateau (from Houston, 2010).

Key physiographic observations regarding the Cauchari salar include:

- The drainage divide between the Cauchari salar to the south and the Olaroz salar to the north is coincident with the international highway linking Argentina to Chile at the Jama pass.
- The large Archibarca alluvial fan is present on the western side of the Cauchari salar. The eastern side of the Cauchari salar hosts smaller alluvial fans entering the basin.
- The Tocomar River enters the south of the Cauchari salar basin, flowing north towards the Cauchari salt pan (high reflectance area in satellite imagery). Hot springs are reported in the vicinity of the river at the southern end of the drainage basin hosting the salar.

Water inflows into the salar include precipitation, runoff from the surrounding ranges and groundwater inflows. Cauchari receives surface drainage inflows from the Tocomar River in the south. The total area of the basin is ~6,000 km^2. Within this area the Cauchari salar (salt covered area) occupies approximately 250 km^2. The drainage basin around the Cauchari and Olaroz salars is shown in Figure 4.4.

4.4 Climate

The climate in the project area is severe, with daily temperature variations that may exceed 25^oC, although the climate allows for year-around operation of wells, ponds and processing plants at this altitude. The climate can be described as typical of a continental, cold, high altitude desert, with resultant scarce vegetation. Solar radiation is intense, especially during the summer months of October through March, leading to high evaporation rates. However, the rainy season between the months of December to March can significantly reduce these evaporation rates. High rainfall periods cause flooding in the salar in years with higher rainfall, which can limit some activities during and following summer when surface water is accumulated in the salar.

Due to the remote location, and low population density there is limited historical climate data available for the area around the project. Approximately 20 km to the north of the Cauchari properties the Olaroz project operates three automated weather stations, which have collected climatic data since approximately 2012. Prior to that more limited information was collected by Orocobre during the exploration phase of the project.

The climatic conditions are attractive for solar evaporation processes, with conditions similar but slightly wetter than the Hombre Muerto Salar, approximately 230 km south of Olaroz, which has been producing lithium for over 20 years. The climatic conditions are expected to be very similar to the Olaroz Salar, 20-30 km north of the Cauchari properties.

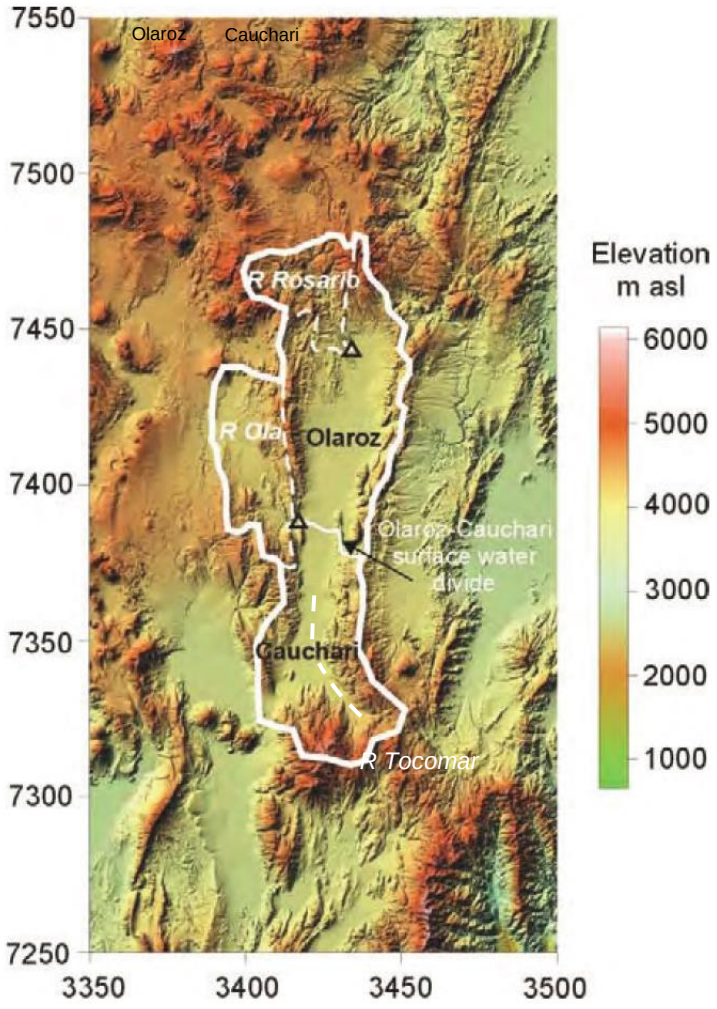


Figure 4.4 The Cauchari and Olaroz drainage basin

4.4.1 Rainfall

The main rainy season is between the months of December to March, when most of the annual rainfall occurs, often in brief convective storms that originate from Amazonia to the northeast. The period between April and November is typically dry. Annual rainfall tends to increase towards the northeast, especially at lower elevations. Significant control on annual rainfall is exerted by ENSO (El Niño-Southern Oscillation) (Houston, 2006a), with significant yearly differences in rainfall linked to ENSO events (Figure 4.3). Note that data is compiled on a calendar year from 1 January to 31 December, which primarily represents the January to March wet season but may capture some information from the subsequent wet season, which may commence in late December.

Information is generally not available on the salar salt surfaces, however, some records are available from Olaroz and 5 weather stations (Table 4.1, below) at small settlements in the adjacent area. These include Susques (50 km northeast), Olacapato (50 km south), La Quaica (210 km north-northeast), Mina Pan de Azucar (140 km north-northeast) and the Hombre Muerto salar (200 km south). At the FMC lithium extraction project in the Salar de Hombre Muerto, a mean annual rainfall of 73.2 mm was recorded between 1992 and 1995.

Based on the historical data, and the location and elevation of the Salar in relation to regional precipitation patterns (Houston, 2011) calculated that a mean long term annual rainfall of 130 mm is probable for the Olaroz Salar, with an average of 156 mm/year over the

2010-2016 period. Considering the proximity of the Cauchari salar to Olaroz, within the same drainage basin, a similar rainfall would be expected.

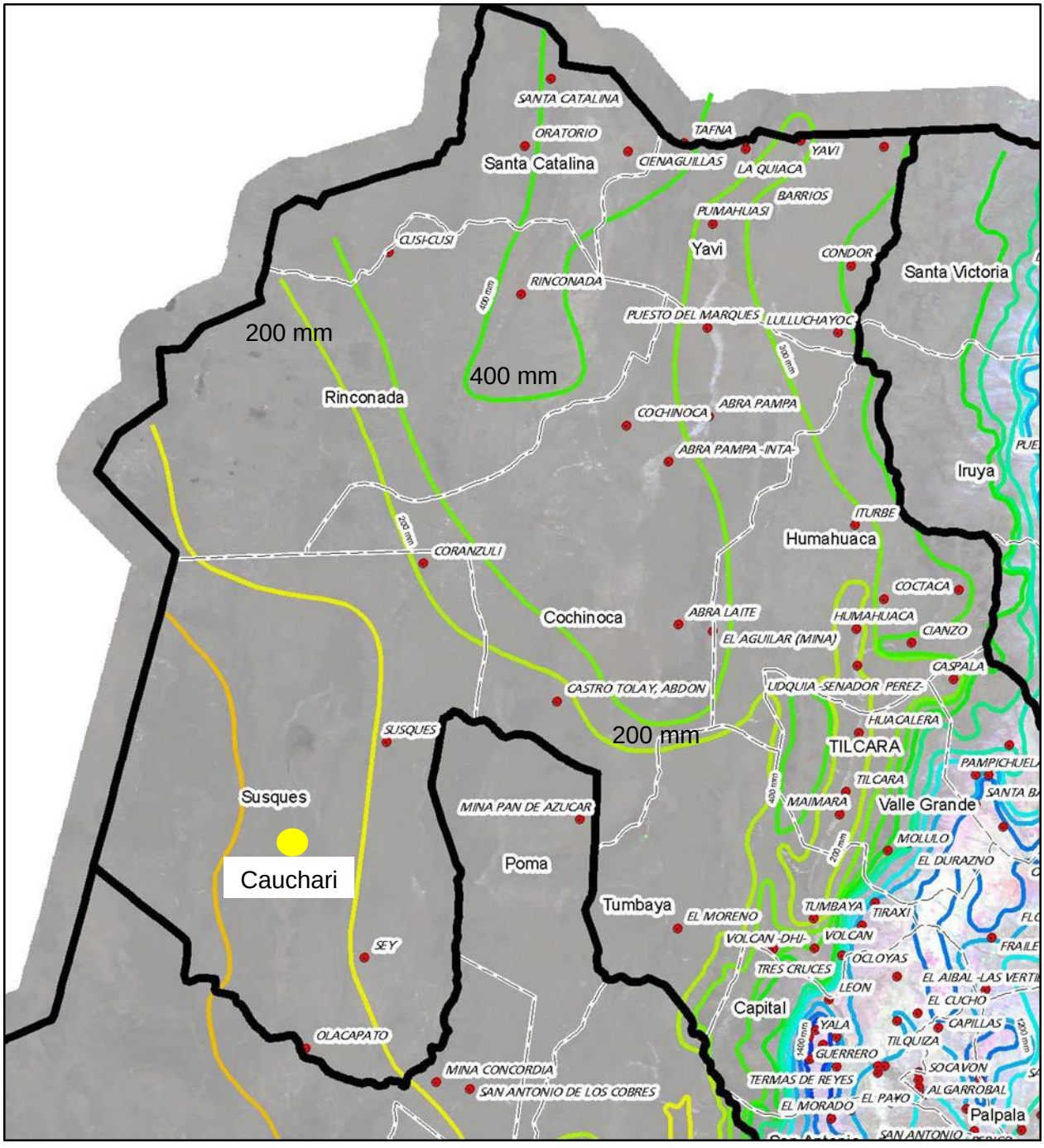


Figure 4.5 Lines of iso precipitation in Jujuy/Northern Salta
The location of the Cauchari project is shown as a yellow dot.

Olaroz project weather station, 30 km north August 2008-September 2009 (3900 m)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total mm
19	15.5	9.4	0	0	0	0	0	0	0	0	5	48.9*
Hombre Muerto salar, 180 km south of project 2008-2009 (4000 m)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total mm
8.7	17.1	25.2	0	0	0	0	0	0	2.4	4.2	17	74.6
Susques, 50 km northeast of project 1982-1990 (3675 m)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total mm
53.3	58.3	30.4	0.6	0	0	0	0	0	0.3	16	29.1	188.1
La Quaica, 210 km north northeast of project 1982-1990 (3442 m)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total mm
80.3	72.6	52.4	11.8	0	0	0	0	0	12.8	35.2	73.9	339
Mina Pan de Azucar, 140 km northeast of project 1982-1990 (3690 m)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total mm
100.6	100	66.4	19.7	0	0	0	0	0	6.7	76.3	87.9	457.6
olacapato, 50 km south of project 1950-1990 (3820 m)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total mm
34	23	4	0	0	0	0	0	0	0	0	10	71
** Incomplete data*												

Table 4.1 Average monthly rainfall

4.4.2 Temperature

Weather stations in the area at similar altitudes show similar temperature fluctuations. Records from the weather station at Susques (50 km north east of Cauchari) and the central Olaroz weather station (20 km north of Cauchari) include temperature (Table 4.2, below) in addition to rainfall. The Olaroz weather station shows average temperatures throughout the year from -2 in July to 14 in January (over the period December 2012 to August 2016, with a maximum over this period of 26 ^{o}C and a minimum of -19 ^{o}C (Figure 4.4).

Olaroz project weather station, August 2008-September 2009 (3900 m)													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mean	12.8	14.1	11.6	10.8	6.9	5.1	4.3	5.3	5.5	9.3	11.5	13.0	9.2
Maximum	22.9	24.1	21.9	21.6	19.1	15.5	13.4	16.8	17.9	21.2	22.6	24.1	20.1
Minimum	2.7	4.1	1.4	-0.8	-5.2	-5.3	-4.9	-6.3	-7.0	-2.7	0.4	1.9	-1.8
Susques Temp, 50 km northeast of project, 1972-1996 (3675 m)													
Mean*	11.3	11.2	10.5	8.1	4.9	3.0	2.5	4.6	6.6	8.9	10.4	11.1	7.8
Other Jujuy and Puna area data													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
La Quiaca	12.3	12.0	12.2	10.0	6.4	3.9	4.1	5.8	8.6	10.4	12.0	12.2	9.2
Abra Laite	11.3	11.2	10.5	8.2	5.1	3.2	2.7	4.7	6.6	8.9	10.4	11.0	7.8
Barrios	11.9	11.7	11.2	9.0	6.1	4.2	3.7	5.7	7.5	9.8	11.1	11.6	8.6
Cangrejillos	11.6	11.5	10.2	7.5	4.0	1.6	1.1	3.3	5.4	7.8	10.1	11.4	7.1
Castro Tolay Abdon	12.4	12.2	11.5	9.1	6.0	4.0	3.4	5.6	7.6	10.0	11.5	12.2	8.8
Abra Pampa	11.8	11.8	11.5	10.6	6.5	4.0	3.9	6.1	8.5	10.5	11.8	12.2	8.0
Susques	10.8	10.6	10.2	8.3	5.0	2.3	2.0	3.8	6.1	9.8	10.3	11.1	7.5
Tres Cruces	10.3	10.2	9.7	8.5	5.4	3.3	3.1	5.1	7.4	9.0	10.5	10.7	7.8
Cieneguillas	10.7	10.7	10.3	8.2	5.3	3.5	2.9	4.8	6.5	8.8	10.0	10.5	7.7
Cochinoca	11.2	11.0	10.5	8.3	5.2	3.4	2.8	4.8	6.7	9.0	10.3	10.9	7.8
Condor	10.0	10.0	9.6	7.5	4.5	2.8	2.1	4.1	5.8	8.0	9.3	9.8	7.0
Coranzuli	9.1	9.1	8.6	6.4	3.3	1.6	0.9	3.0	4.8	6.9	8.3	8.9	5.9

Table 4.2 Average monthly temperature (°C) at the Olaroz weather station (Orocobre data) and other weather stations in northwestern Argentina.

The average annual temperature at the Olaroz project site is approximately 5° C, with daily extremes, depending on the season, of up to 25º C in hot periods and -19º C in cold periods from December 2012 to August 2016. Conditions are expected to be very similar at Cauchari. The coldest months with temperatures below zero correspond to April through November. Details are collated in Table 4.2, above.

4.4.3 Wind

Strong winds are frequent in the Puna, reaching speeds of over 100 km/hr on rare occasions at Olaroz, with an average of 15 km/hour. During summer, the wind is generally pronounced after midday, usually calming during the night. During this season, the winds are warm to cool. During winter wind velocities are generally higher and more frequent. Wind speed data is presented in Table 4.3.

Localidad	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Purmamarca	3.56	3.79	4.28	4.3	5.58	5.04	4.7	3.61	3.99	5.03	4.44	3.86	4.35
Susques	2.37	3.38	4.73	4.62	6.6	4.38	1.68	3.61	4.09	4.44	2.32	2.62	3.74
Olaroz	6.4	7.4	8.7	8.6	10.6	8.4	5.7	7.6	8.1	8.4	6.3	6.6	7.7

Table 4.3 Average monthly wind velocities (km/hr) from areas of northwest Argentina (from Houston, 2011).

4.4.4 Evaporation

No evaporation measurements have been made at Cauchari by South American Salars, however they are expected to be very similar to at the Olaroz project. At Olaroz Class A evaporation pans with both fresh water and with brine have been monitored since 2008. Monthly evaporation data from Olaroz is presented in Table 4.4. Evaporation was noted by Houston (2011) to reach a maximum in October, at the start of the wet season, before increased cloud cover led to a reduction in evaporation. The minimum evaporation rates were during the colder months between May and August. Houston (2011) noted that as the evaporation levels measured at Olaroz are higher than other salars in the region they values reproduced in Table 4.4 should be considered provisional, until additional data is collected.

Houston (2010b) notes that average annual evaporation in the Salar Hombre Muerto was 2,710 mm, calculated for the period 1992-2001 at the El Fenix Camp (FMC) weather station. Evaporation decreases with increasing elevation, and the highest naturally occurring rates are usually associated with the marginal areas of salars where water availability is greatest (Houston, 2006b).

Density g/cc	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1	383	331	356	307	201	213	221	242	332	461	421	433	3,900
1.198	248	173	234	208	133	162	173	180	236	327	276	265	2,614

Table 4.4 Average monthly evaporation in mm - Olaroz salar

Solar radiation is high in the warmer months, with some reduction in the summer months when there is significant cloud cover. The water levels in evaporation pans at Olaroz are monitored daily in conjunction with the solar radiation data recorded by the weather station.

4.5 Operating season

The Olaroz project operates 24 hours a day year around, although climatic conditions are extreme in winter. Rain in the summer season from January to March can limit some

activities, due to local seasonal flooding of the salar. Drilling operations are difficult to carry out in the January to March/April period when there can be temporary flooding of the salar.

4.6 Vegetation

Due to the extreme weather conditions in the region, the predominant vegetation is of the high-altitude xerophytic type adapted to high levels of solar radiation, winds and severe cold. The vegetation is dominated by woody herbs of low height from 0.40 - 1.5 m, grasses, and cushion plants. With high salinity on its surface, the nucleus of the salar is devoid of vegetation.

To date no specific vegetation survey had been carried out in the tenement area. However, it is possible to define a number of vegetation areas, based on their physiography.

4.6.1 Low lying areas in the vicinity of water

These environments are characterized by having vegetation cover of 70-85 %, occupying small areas (1 km maximum) associated with water-logged soils and more or less permanent bodies of water.

4.6.2 Mixed steppes

Different types are recognized, depending on the grass species, which may consist of *Stipa sp.*, *Festuca sp.,* and *Panicum chloroleucum*.

4.6.3 Bushy steppes

Three different types are recognized, depending on the dominant bush species, such as rica-rica (*Acantholippia sp*.), tall tolillar (*Fabiana densa*) and short tolillar (*Fabiana sp*.).

5 HISTORY

5.1 Pre-South American Salars

Salars in the Puna have historically been exploited for salt (halite) and for borates (typically ulexite) within several metres of the salar surface. Previous exploitation of borates has taken place locally in the Cauchari tenements, with extraction of borates recently taking place in properties within several km of the company's tenements. Some tenements have been purchased from historical owners who exploited borates.

Any previous exploration on the properties is likely to have been restricted to shallow pitting, to evaluate the existence of borates. The extent of any past production of borates from the properties is unknown and it is unlikely resources of borates were determined, as the exploitation is generally conducted in an artisanal manner, without a formal long term mine plan. Lithium and potassium were not previously exploited from the properties.

Fabricaciones Militares (an Argentine government agency) carried out sampling of brines from Argentine Puna salars, in 1970. The presence of anomalous Li values was detected at this time, when only salt and borates were exploited from these salars.

Initial evaluation of the mineral potential of salars in Northern Argentina is also documented by Igarzábal (1984) as part of the Instituto de Beneficios de Minerales (INBEMI) investigation carried out by the University of Salta. This investigation involved a geological and geomorphic evaluation with limited sampling of salars in the Puna for Li, K and other elements. The Cauchari salar showed amongst the highest lithium values in this investigation with values of 0.092% Li and 0.52% K. These analyses pre-date the implementation of NI 43-101 and were carried out by an academic laboratory. As previously reported in the April, 2010 Orocobre NI 43-101 report (Houston, 2010b) no assay certificate is available for the information contained in the Igarzábal (1984) report and consequently no reliance can be placed on that data.

5.2 South American Salars exploration at Cauchari

In 2003 initial cateos were applied for by geologist, M Peral, in the south of the Cauchari Salar. Initial reconnaissance sampling in these areas reportedly returned results of up to 400 mg/l Li (M Peral, Personal Communication), which lead to additional sampling in the area by South American Salars (SAS). Reconnaissance sampling of the Cauchari properties began in March 2009, following the wet season, and is reported in Houston, 2010b.

5.3 Ownership prior to South American Salars

As discussed above mining of salt and borates is typical in the Cauchari salar and some of the properties acquired by Mr Miguel Peral and Mrs Silvia Rodriguez (later 15% shareholders in South American Salars) are likely to have been exploited previously for these commodities. Peral and Rodriguez, having recognised the potential for lithium brines, acquired the Cauchari properties by applying for the areas for lithium exploration, subsequently contributing these properties to SAS in return for 15% ownership.

None of the previous properties were acquired by purchasing from existing owners. All the properties were applied for as vacant ground by Peral and Rodrigues in the following order.

6 GEOLOGICAL SETTING AND MINERALIZATION

6.1 Regional geology

The Cauchari salar is located towards the centre of the Puna Plateau in Jujuy. The Puna is an elevated plateau in northern Argentina which has been subject to uplift along thrust systems inverting earlier extensional faults. The Puna is host to numerous large ignimbrites and stratovolcanoes. A summary evolution of the Puna is shown in Figure 6.1, after Houston (2010b)

6.1.1 Jurassic-Cretaceous

The Andes have been part of an Andean type convergent plate margin since the Jurassic period, with both a volcanic arc and associated sedimentary basins developed as a result of eastward dipping subduction. The early island arc is interpreted to have formed on the west coast of South America during the Jurassic (195-130 Ma), progressing eastward during the mid-Cretaceous (125-90 Ma) (Coira et al., 1982).

An extensional tectonic regime existed through the late Cretaceous, generating back-arc rifting and grabens (Salfity & Marquillas, 1994). Marine sediments of Jurassic to Cretaceous age underlie much of the Central Andes.

6.1.2 Late Cretaceous to Eocene

During the late Cretaceous to the Eocene (~78-37 Ma), the volcanic arc migrated east to the position of the current Precordillera (Allmendinger et al, 1997). Significant crustal shortening occurred during the Incaic Phase (44-37 Ma), (Gregory-Wodzicki, 2000) forming a major north-south watershed, contributing to the formation of coarse clastic continental sediments.

Initiation of shortening and uplift in the Eastern Cordillera of Argentina around 38 Ma, contributed to forming a second north-south watershed, with the accumulation of coarse continental sediment throughout the Puna (Allmendinger et al., 1997).

6.1.3 Oligocene to Miocene

Volcanism

By the late Oligocene to early Miocene (20-25 Ma), the volcanic arc switched to its current location in the Western Cordillera. At the same time, significant shortening across the Puna on reverse faults led to the initiation of separated depocentres (Figures 6.2, 6.3, 6.4). Major uplift of the Altiplano-Puna plateau began during the middle to late Miocene (10-15 Ma), perhaps reaching 2500 m by 10 Ma, and 3500 m by 6 Ma (Garzione et al., 2006). Coutand et. al. (2001) interpret the reverse faults as being responsible for increasing the accommodation space in the basins by uplift of mountain ranges marginal to the Puna salar basins. This is confirmed by the seismic section across Olaroz, to the north of Cauchari (Figure 6.2).

Late Miocene volcanism at 5-10 Ma in the Altiplano-Puna Volcanic Complex (APVC) between 21^{o}-24^{o} S (de Silva, 1989), erupted numerous ignimbrite sheets, with associated caldera subsidence, and the formation of andesitic to dacitic stratovolcanoes. This volcanic activity was often constrained by NW-SE trending crustal megafractures, which are particularly well displayed along the Calama-Olacapato-El Toro lineament passing to the south of the Cauchari Salar (Salfity & Marquillas 1994; Chernicoff et al., 2002).

Stratovolcanoes and calderas, with associated ignimbrite sheet eruptions, extend as far south as Cerro Bonete and the Incapillo caldera. De Silva et al., (2006) have shown the APVC is underlain by an extensive magma chamber at 4-8 km depth. Silicic magmas in the volcanoes Ojos de Salado (W of the Antofalla Salar), Tres Cruces and Cerro Bonete are interpreted to reflect crustal melting and melting in the thickening mantle wedge after the passage of the Juan Fernandez ridge.

It has been suggested by many authors (i.e. Gajardo and Carrasco, 2010; Kay et. al., 2008) that Cenozoic volcanism is the source of the lithium and potassium, which is released into salar basins from hot springs leaching volcanic sequences. However, little investigation has been undertaken to determine which phases of volcanism are associated with the elevated lithium levels. Volcanics of Pliocene to Quaternary age are present in the area covered by the tenement package.

Sedimentation

During the early to middle Miocene red bed sedimentation is common throughout the Puna, Altiplano and Chilean Pre-Andean Depression (Jordan & Alonso, 1987). This suggests continental sedimentation was dominant at this time. With thrust faulting, uplift and volcanism intensifying in the mid to late Miocene, sedimentary basins between the thrust sheets became isolated by the thrust bounded mountain ranges. At this stage the basins in the Puna developed internal drainages, bounded by major mountain ranges to the west and east.

Sedimentation in the basins consisted of alluvial fans forming from the uplifting ranges with progressively finer sedimentation and playa sands and mudflat sediments deposited towards the low energy centers of the basins. Alonso et.al., (1991) note there has been extensive evaporite deposition since 15 Ma, with borate deposition occurring for the past 7 to 8 Ma.

Hartley et al., (2005) suggest Northern Argentina has experienced a semi-arid to arid climate since at least 150 Ma as a result of its stable location relative to the Hadley circulation (marine current). Most moisture originating in Amazonia was blocked due to Andean uplift, resulting in increased aridity in the Puna since at least 10-15 Ma.

The high evaporation level in the Puna, together with the reduced precipitation, has led to increased aridity and the deposition of evaporites in many of the Puna basins.

6.1.4 Pliocene-Quaternary

During the Pliocene-Pleistocene tectonic deformation took place as shortening moved east from the Puna into the Santa Barbara fault system. Coincident with this change in tectonic activity climatic fluctuation occurred, with short wetter periods alternating with drier periods.

As a result of both, reduced tectonic activity in the Puna and the predominant arid conditions, reduced erosion led to reduced sediment accumulation in the isolated basins. However, both surface and groundwater inflows into the basins continued the leaching, dissolution transportation and concentration of minerals. Precipitation of salts and evaporites occurred in the center of basins where evaporation is the only means of water escaping from the hydrological system.

Evaporite minerals (halite, gypsum) occur disseminated within clastic sequences in the salar basins and as discrete evaporite beds. In some mature salars such as the Hombre Muerto and Atacama salars thick halite sequences have formed.

Stratovolcanoes and calderas, with associated ignimbrite sheet eruptions, are located in the Altiplano and Puna extending as far south as Cerro Bonete and the Incapillo caldera. The Altiplano-Puna Volcanic Complex (APVC), located between the Altiplano (Bolivia) and Puna (Argentina), is associated with numerous of these stratovolcanoes and calderas. De Silva et al., (2006) have shown the APVC is underlain by an extensive magma chamber at 4-8 km depth.

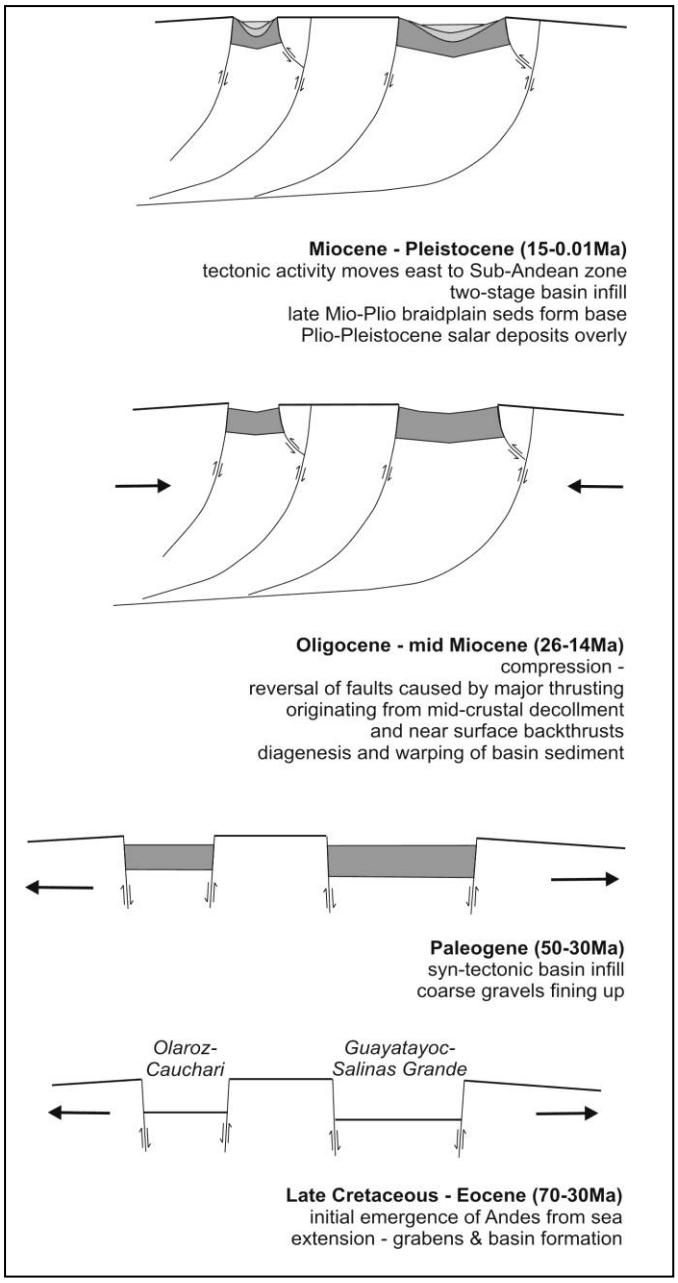


Figure 6.1 Generalized structural evolution of the Puna basins (Houston, 2010)

Silicic magmas in the volcanoes Ojos de Salado (W of the Antofalla Salar), Tres Cruces and Cerro Bonete reflect crustal melting and melting in the thickening mantle wedge after the passage of the Juan Fernandez ridge. Volcanics of Pliocene to Quaternary age are present in the area covered by the tenement package.

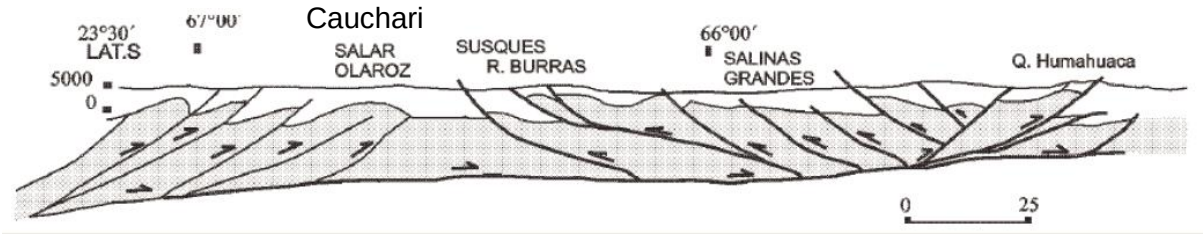


Figure 6.2 Structural cross section from the Chilean border through the Olaroz and Salinas Grandes salars
Note the development of a mid-crustal decollement with an east vergent, thrust fault and associated back thrusts creating the ranges bordering the salars, with Paleogene to Neogene deposits in the salar basins bordered by uplifted Ordovician to Cretaceous bedrock (from Mons, 2005)

6.2 The Cauchari basin local geology

Figure 6.3 shows the local geology in the Cauchari area. The major stratigraphic units, their age and lithological relationships are shown in the accompanying stratigraphic column, Figure 6.4, which outlines correlations between units across the published geological maps that cover the project area.

6.2.1 Geology of the Cauchari basin

The oldest rocks that outcrop in the area are the Ordovician turbidites of the Puna Turbidite Basement and the Ordovician Puna Volcanics. These rocks outcrop in the mountain range on the western side of salar, extending north to the western margin of the Olaroz salar in the mountain range east of the salar.

In the mountain range east of the salar minor occurrences of Ordovician and Silurian sediments and clastic sediments of the Cretaceous Pirgua Subgroup are mapped. Further to the east, towards the salar, units become progressively younger. Outcropping units include the sandstones of the lower Eocene Río Grande Formation (outcropping as a NS belt); the sandstones of the lower Oligocene Vizcachera Formation; and the fluvial deposits of the Miocene Pastos Grandes Group. Units of the Cerro Morado Volcanic Complex outcrop at the southern end of salar.

West of the salar outliers of Oligocene-Miocene Vizcachera Formation and the upper Oligocene Río Grande Formation sandstones overlie Ordovician units.

Pleistocene basalts outcrop in the NNW of the salar, with associated colluvial deposits. An apron of Holocene fluvial deposits surrounds the evaporite deposits of the salar, which occur in the center of the basin.

The major alluvial fans in the Cauchari basin have associated local drainages and consist of:

- The Archibarca fan on the western side in the north of the Cauchari salar, which is the largest of the fans and is located at the junction of the Cauchari and Olaroz basins;
- Four alluvial fans along the eastern side in the central and southern sections of the Cauchari salar; and
- An alluvial fan at the south and southwestern end of the salar.

Drilling has been restricted to the central area of the salar and no drilling has been conducted through the alluvial fans in properties owned by South American Salars, although

on the adjacent tenements Lithium Americas has conducted some drilling on the lower part of the Archibarca alluvial fan.

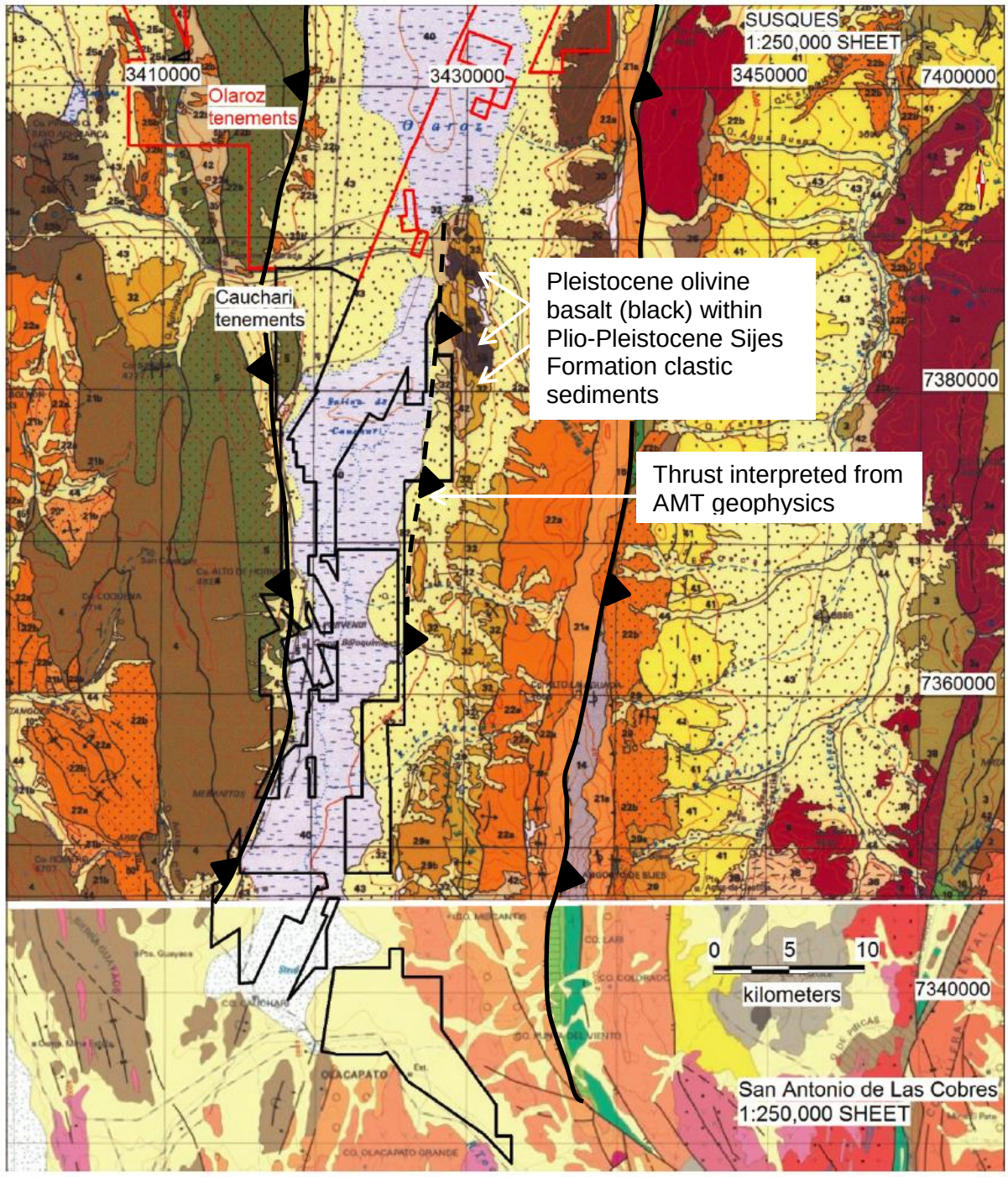


Figure 6.3 Published geology of the Cauchari salar basin and the Cauchari tenements

Age period		Ma	Rock types	Geological environment	Tectonic events	1:250,000 Map Sheet	
						Susques (2366-III)	San Martin (2366d)
Quaternary	Holocene	0.01	Alluvial deposits, salars	Closed basins, salars	Post Quechua deformation	Salar deposits, lacustine, colluvial and alluvial sediments (40-44)	Salar deposits, lacustine, colluvial and alluvial sediments (25c-30)
	Pleistocene	2.6	Alluvial, colluvial, lacustrine, ignimbrites	Closed basins, fan deposits, volcanic centres	NE-SW shortening (from 0.2 Ma) due to strike-slip faulting continuing to present day	Tuzgle ignimbrite (38-39)	Alluvial and glacial deposits (5a, 25b, 26)
Neogene	Pliocene	5.3	Continental sediments +/- ignimbrites	Some volcanic complexes developed in continental sediments	Major volcanic centres and calderas 8-6 Ma	Jama volcanic rocks (36-37). Andesite, dacite lavas, ignimbrites; Atana ignimbrite	Malmar, Uquia and Jujuy Formations. Continental sediments - sandstone, conglomerate +/- mudstone (19, 22-24)
	Miocene		Andesitic to dacitic volcanics	Volcanic complexes in continental sediments		Volcanic complexes (35)	Formations Oran (16 Ma - 0.25 Ma), Callegua, Formation Agua Negra. Continental sandstones, with clay interbeds (19, 20-21)
			Ignimbrites			Coyaguayma & Casabindo dacite Ignimbrites (33 & 34)	
			Continental sediments & tuffs		Start of thrusting, with WNW-ESE directed thrusting from 13-4 Ma	Sijes Formation (32) ~7-6.5 Ma sandstones, mudstones and tuffs	
			Continental sediments, tuffs, volcanic breccias		End of Quechua phase event finished by 9-15 Ma, with associated folding	Chimpa volcanic complex (31) andesites & dacites, lavas/ignimbrites. Pastos Chicos Fm ~10-7 Ma with unnamed tuff 9.5.	
			Dacite domes, pyroclastics, intrusives			Yungara dacite domes (30) & subvolcanics (SE side Olaroz)	
			Rhyolitic, dacitic volcanic complexes, continental sediments			Volcanic complexes (23-29), Cerro Morado, San Pedro, Pairique, Cerro Bayo and Aguiliri, Pucara Formation. Andesite to dacite lavas, domes and ignimbrites. Susques Ignimbrite ~10 Ma	
			Continental sediments			Vichacera Superior (22b). Sandstones and conglomerates, with tuffs & ignimbrites	
		23.8				Vichacera Inferior (22a). Sandstones and interbedded claystones	
Paleogene	Oligocene	33.9	Continental sediments	Red bed sequences	Incaic Phase II - Compression, resulting in folding	Rio Grande Fmn Superior (21b). Red aeolian sandstones	Casa Grande and Rio Grande Formations (18). Continental sandstones, conglomerates, siltstones and claystones
	Eocene					Rio Grande Fmn Inferior (21a). Alternating coarse conglomerates and red sandstones	
		55.8	Continental sediments, locally marine and limey	Local limestone development, local marine sequences		Santa Barbara subgroup (20). Fluvial and aeolian alternating conglomerates and red sandstones	Santa Barbara subgroup. (17)continental limy sandstones, siltstones, claystones
							Balbuena subgroup (16). - see below
BASEMENT - PRETERTIARY UNITS (MARINE)							
Mesozoic	Cretaceous		Continental sediments, locally marine and limey		Peruvian phase - extension and deposition of marine sediments	Balbuena Subgroup (19). Sandstones, calcareous sandstones, limestones, mudstones (Marine).	Balbuena subgroup (16). Continental/marine calcareous sandstones
			Continental sediments			Piruga Subgroup (16). Alluvial and fluvial sandstone & conglomerate	Piruga subgroup (15). Red sandstones, silty claystones and conglomerates
						Granites, syenites, granodiorite (15, 17, 18)	Granites, monzogranite (11-14)
Paleozoic	Carboniferous - Silurian		Marine sediments	Marine platform and turbidite deposits	Isoclinal folding on NW/SE trending axes, extending to early Cretaceous	Upper Paleozoic marine sediments (14)	Machareti and Mandiyuti Groups (10). Sandstones, conglomeratic sandstones, siltsones and diamictites. Silurian Lipeon & Barite Formations (9). claystones and diamictites
						Multiple Paleozoic intrusive suites (6-13)	El Moreno Formation (8). Porphyritic dacite
	Ordovician		Marine sediments	Marine delta and volcanic deposits/domes		Ordovician sandstones (3-5), volcaniclastic sediments & Ordovician turbidites	Guayoc Chico Group (7) & Santa Victoria Groups (6). Marine sandtones, mudstones and limey units
	Cambrian	540		Marine sediments		Meson Group (2). sandstones and mudstones	Meson Group (5). Marine sandstones
	PreCambrian		Schists, slate, phyllite	Metamorphosed turbidites		Puncovis cana Formation (1) tubidites	Puncoviscana Formation (1) tubidites - metamorphosed and intruded by plutons

Figure 6.4 Stratigraphic units in the Cauchari basin and their correlation across different published geological maps

6.2.2 Structural geology of the Cauchari basin

The Cauchari-Olaroz basin is interpreted in government (Segemar) map sheets to be bounded to the east and west by NS trending thrust fault systems, where the rocks bounding the salar are being thrust over the younger rocks within the salar (Figure 6.3). The salar sediments are thought to be at least 400-450 m deep, based on gravity lines conducted by Orocobre and adjacent tenement holder Lithium Americas Corp (LAC – King, 2010, Cauchari resource report) and by drilling conducted by both companies.

Orocobre geophysics (gravity and AMT) and drilling at Olaroz suggested a number of north-south trending faults (Houston, 2011), with down throw towards the centre of the basin. A number of north-south trending faults, stepping down into the salar, were also suggested by LAC (King, 2010a, b) in published graphics based on seismic and gravity surveys across the properties adjacent to the Orocobre Cauchari properties and sedimentological evaluations.

6.3 Mineralization

6.3.1 Sample analyte populations

As previously discussed, brine prospects differ from hard rock base, precious and industrial mineral prospects due to their fluid nature. Therefore, the term 'mineralization' should be considered to include the physical and chemical properties of the fluid, as well as the flow regime controlling fluid flow. The sampling protocol details are outlined in section 9.5. A description of QA/QC procedures is provided in section 10.

Two sets of fluid sample data were obtained during the drilling investigations at Cauchari. A summary of the analytes of interest (Li, K, Mg, B) in fluid samples are presented in Table 6.1, with the two data sets consisting of:

- Samples collected from bailing fluid during diamond drilling (Analysed by Alex Stewart laboratories);
- Fluid samples extracted by centrifuging brine from diamond drilling core samples (analysed by the Independent British Geological Survey laboratory).

Diamond Drilling Bailer Samples						
	B	**K**	**Li**	**Mg**	**Mg/Li**	**SO4/Li**
# Samples	184	184	184	184	184	184
Average mg/l All Samples	579	3,480	362	882	2.8	118.4
Std Dev All Samples	343	2,271	262	679	1.2	139.0
Max All Samples	1,488	8,898	1,064	2,823	7	588
Min All Samples	37	146	14	11	0.2	16.6
Average mg/l excl CAU005D&6R	716	4,525	474	1,144	2.4	61.2

Table 6.1 Summary geochemical data from the geochemical data sets

There appear to be three population types of brine in the samples collected: These consist of:

- A very dilute population (Type 1 - particularly noted in the upper part of CAU005D), on the salar margin
- A moderately concentrated population (Type 3 - corresponding to hole CAU006R), also on the salar margin and
- A concentrated population with a well distributed, relatively high frequency (Type 2) in the central part of the salar.

Figure 6.5 shows the three samples populations.

- Ca appears to be present in the Type 3 population on the salar margin;
- Cl is much higher in the Type 2 population, with density closely following the Cl distribution;
- SO4 is present in the Type 2 and Type 3 populations.

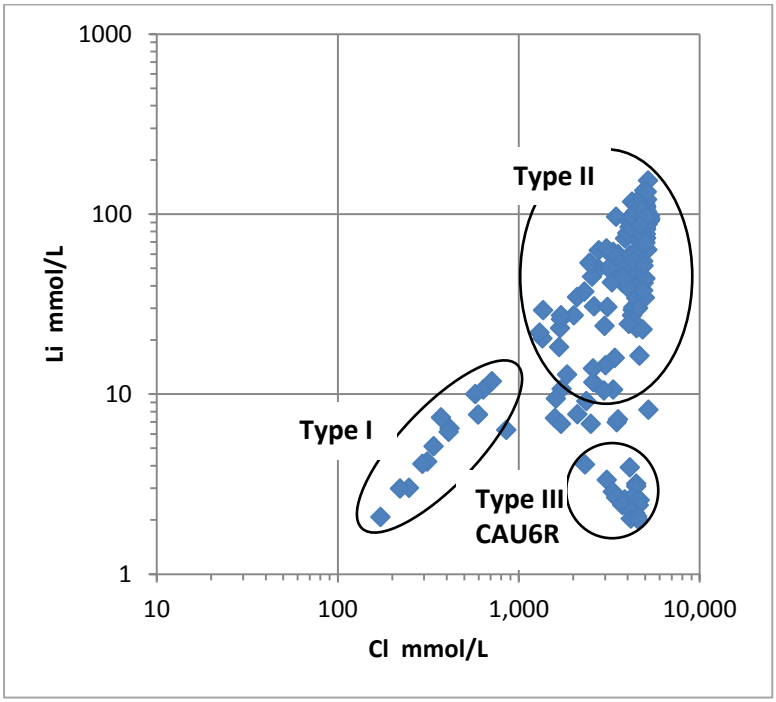


Figure 6.5 Fluid types recognized from ASA sample results

The results for Li, K, B and Mg (Figures 6.6 to 6.7) show there is a broad spread in analytical results, with samples from the diamond drilling not fitting a normal curve. Low concentration Type 1 samples occur in the upper 100 m of hole CAU005D and other drill holes. Results from the rotary hole CAU006R are open hole composite samples and were excluded from the analysis of diamond hole data (but are shown in Figure 6.6).

The lowest concentrations of Li, K, B and Mg are principally associated with holes CAU005D and hole CAU006R (drilled as a rotary hole, with a different sampling methodology). Figure 6.6 shows the results from all six holes, while Figure 6.7 shows only the results from holes CAU001D though 4D. Figure 6.8 shows the results of brine extraction samples analysed by the Independent British Geological Survey laboratory – which is discussed more in following chapters.

It is observed that with holes CAU001D through 4D there is a multi-modal distribution of elements, with Li, K, Mg and B also showing multiple peaks in the frequency distributions. B also appears to show a very high grade population of values above 1300 mg/l.

For individual samples there are considerable differences in analyte concentrations between the bailer sample results taken during diamond drilling and the results extracted from the diamond cores which represent a maximum interval of 20 cm at the base of the interval from which the bailer samples were taken. Precautions were taken to minimize contamination of samples with drilling fluid (see Sections 9 through 10) during the diamond drilling process, although this cannot be ruled out as the cause of some of the variation between bailer samples and brine extraction samples with the same end depth.

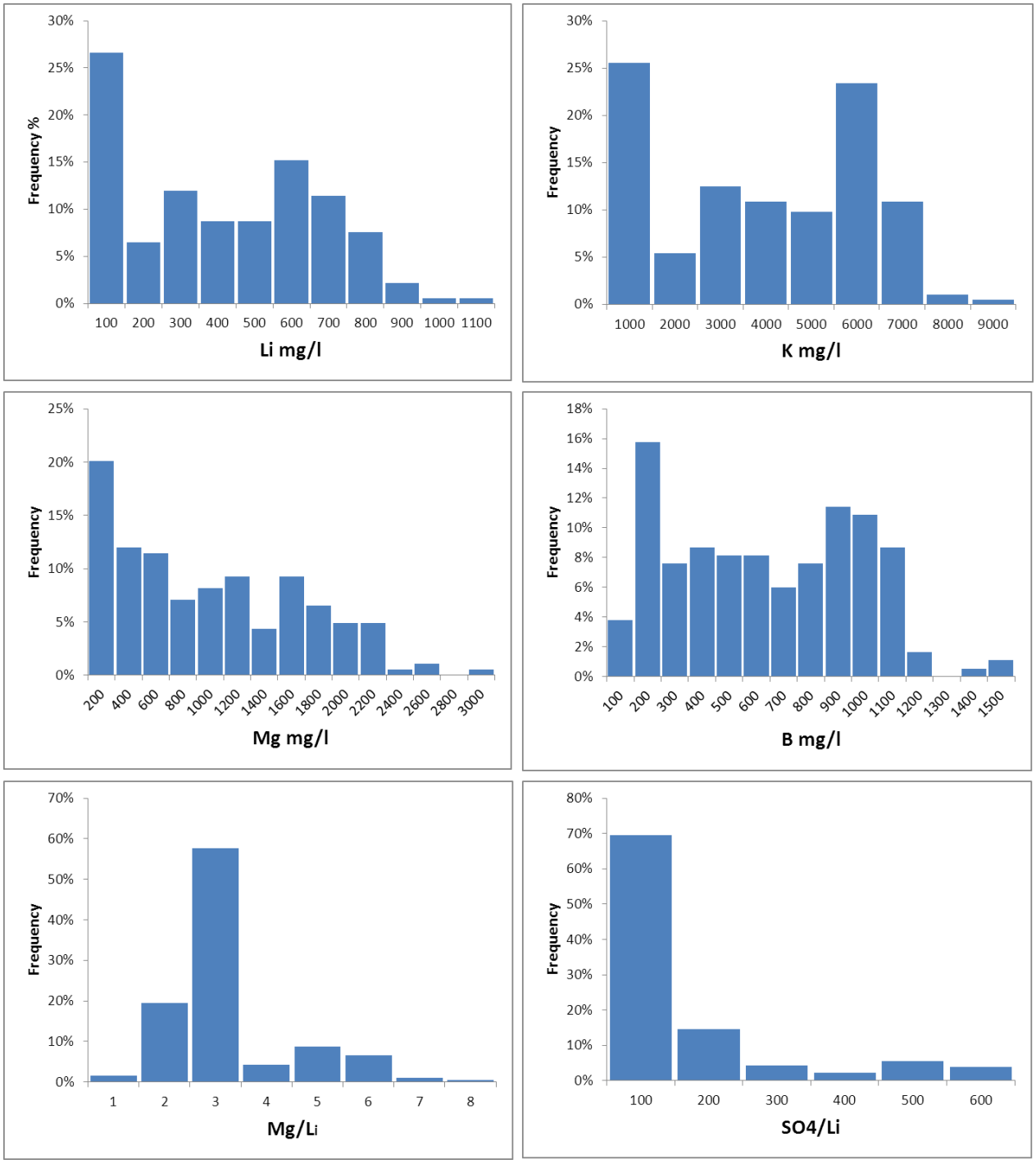


Figure 6.6 Chemistry results for bailed fluid samples from diamond drilling

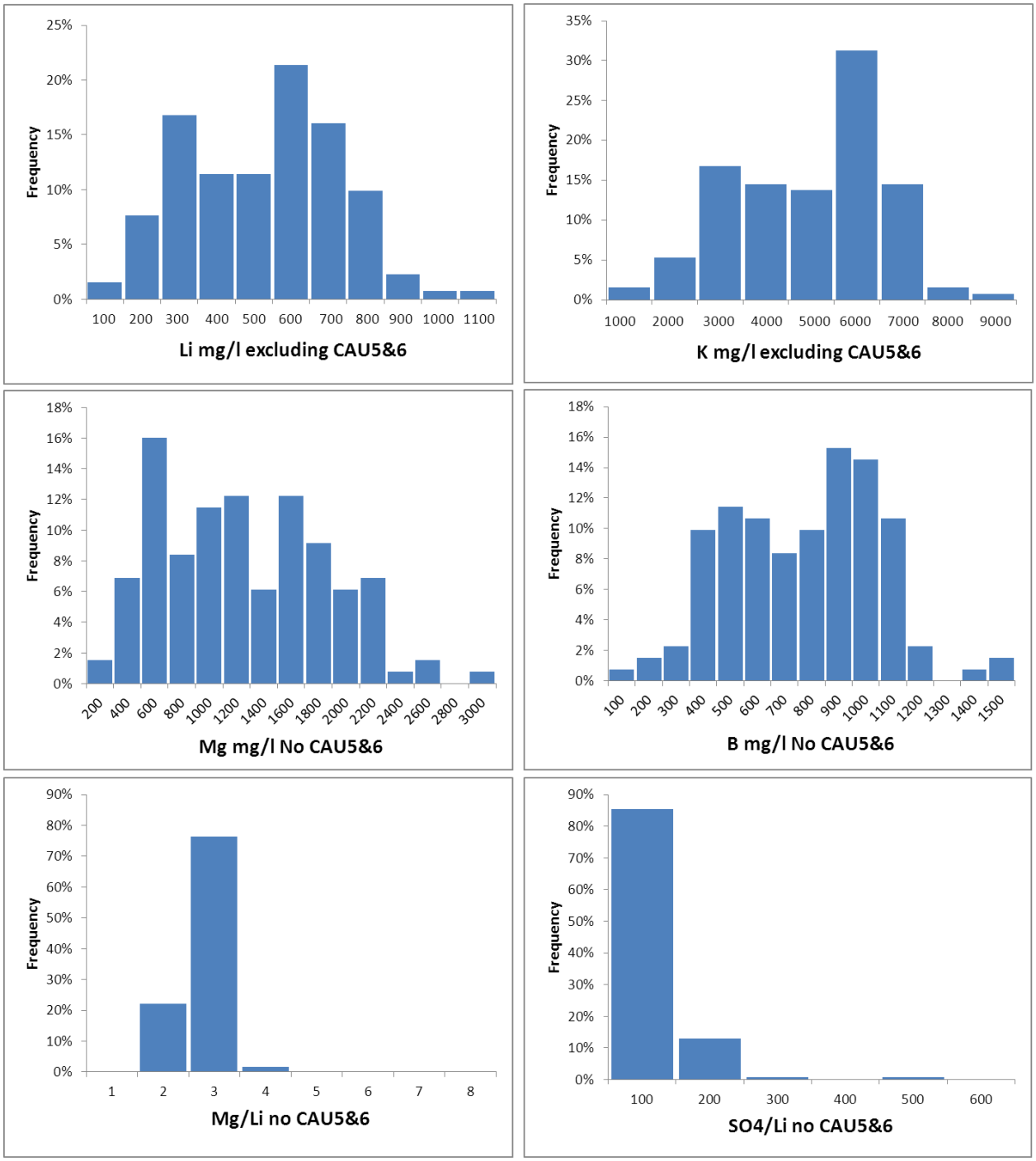


Figure 6.7 Chemistry results from bailed fluid samples, excluding holes CAU005D and CAU006R

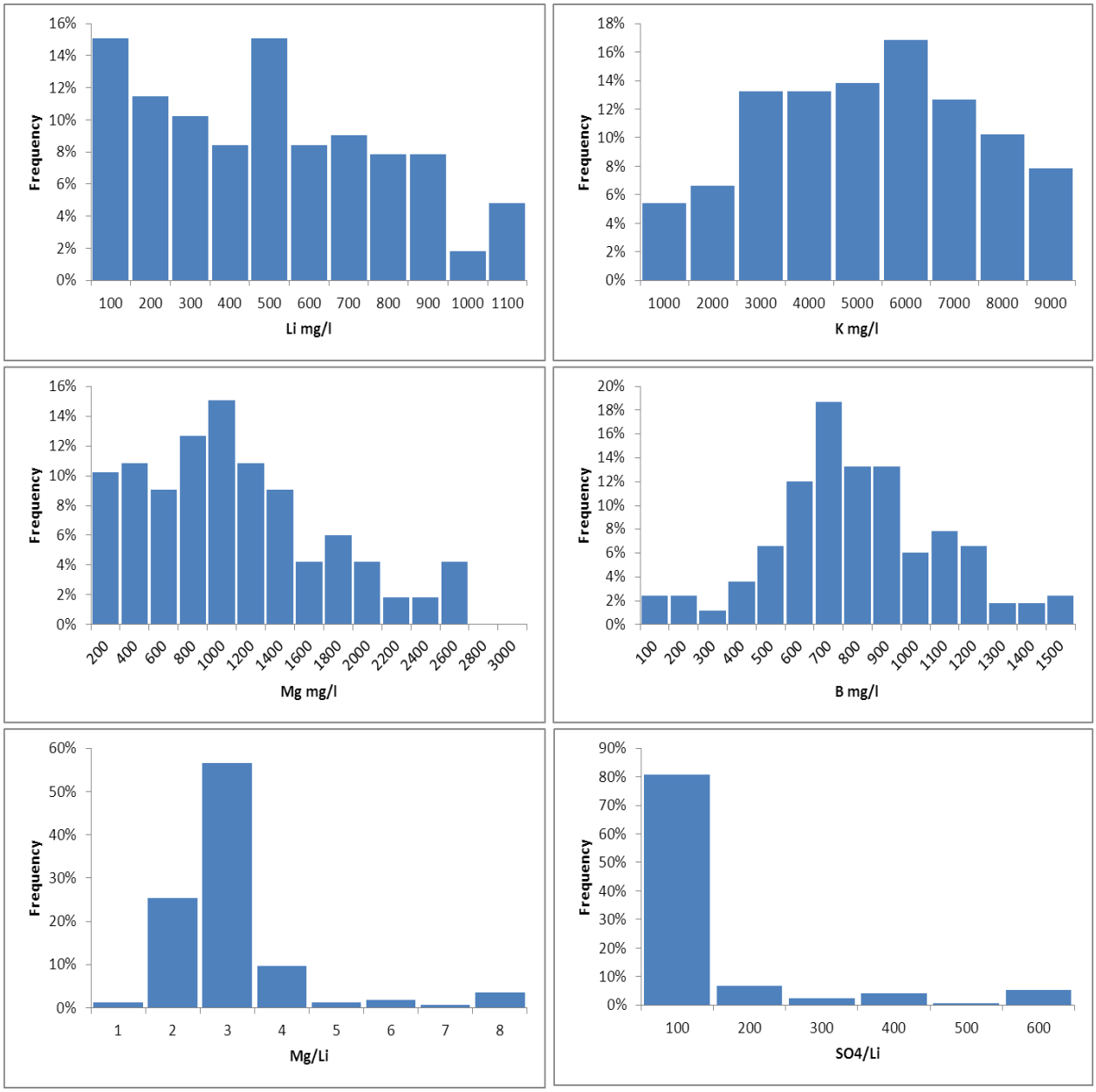


Figure 6.8 BGS core extraction geochemistry from diamond core samples

6.3.2 General fluid characteristics

Evaluation of fluid samples during sampling at Cauchari shows the following major characteristics:

- The pH of the Cauchari brine is generally weakly acid to weakly alkaline, with the brackish water intervals showing higher pH values in excess of 7.5, which are generally associated with lower Li and K values.
- Density shows a general correlation with Li and K concentrations, with concentrations increasing with density. However, above a density of 1.15 g/cc there is a broad range in Li and K concentrations.
- Overall pH decreases with increasing conductivity (Total Dissolved Solids and density).
- Density is closely correlated with elevated electrical conductivity and correlates well with high lithium, potassium and boron values.

- Eh (Oxidation potential) shows a general trend of lower Li values with -Eh values, with Li values of >400 mg/l generally associated with Eh of -20 and higher.

6.3.3 Analyte concentrations by unit and depth

A broad spread of values for analytes within each lithological unit is noted. However, overall Li, K and B values are noted to be lower in Unit A (subunits A1 to A4), where there is a higher proportion of samples with values <200 mg/l Li. Lower density brine/brackish water is noted in Unit A, suggesting recharge from the salar catchment in this upper level of the salar. The Li values increase in Units B, where halite is present. Bailer sampling suggests there are local lower concentration zones within unit B2.

The values of Li, and K, from the bailer sampling during drilling are presented below in Figures 6.9 and 6.10, showing the distribution of these elements as 50 m depth slices**.** Li values show a peak at the top of the halite sequence (Figure 6.11) – corresponding with unit B1 and the top of Unit B2 (at ~ 60 m in CAU001D and 2D). **In this bailer sampling data Li and K show a slow and irregular decrease in values with depth from the top of the halite unit**, whereas B values are more variable.

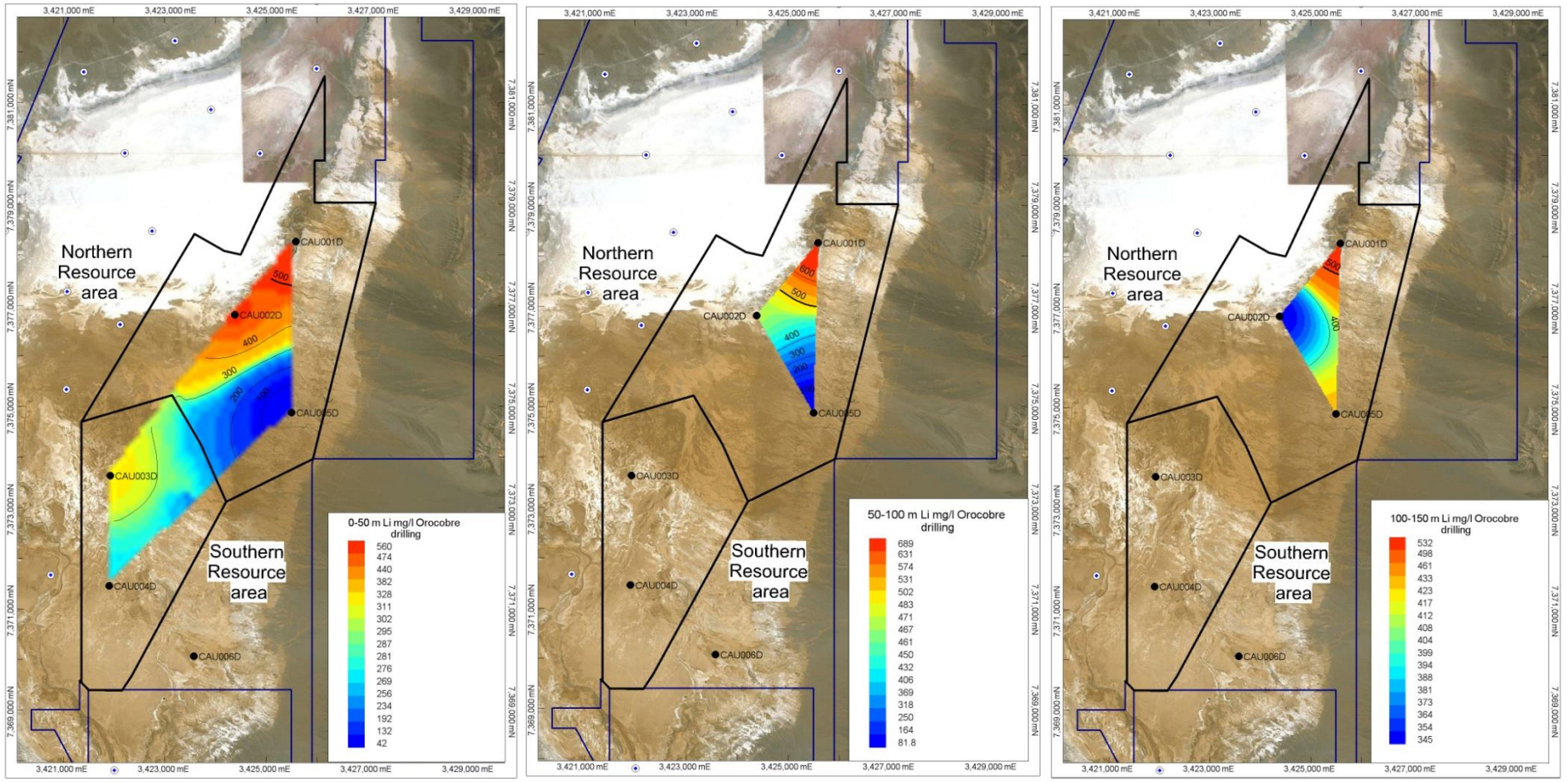


Figure 6.9 Average Li bailer sample concentrations in 50 m slices in diamond holes

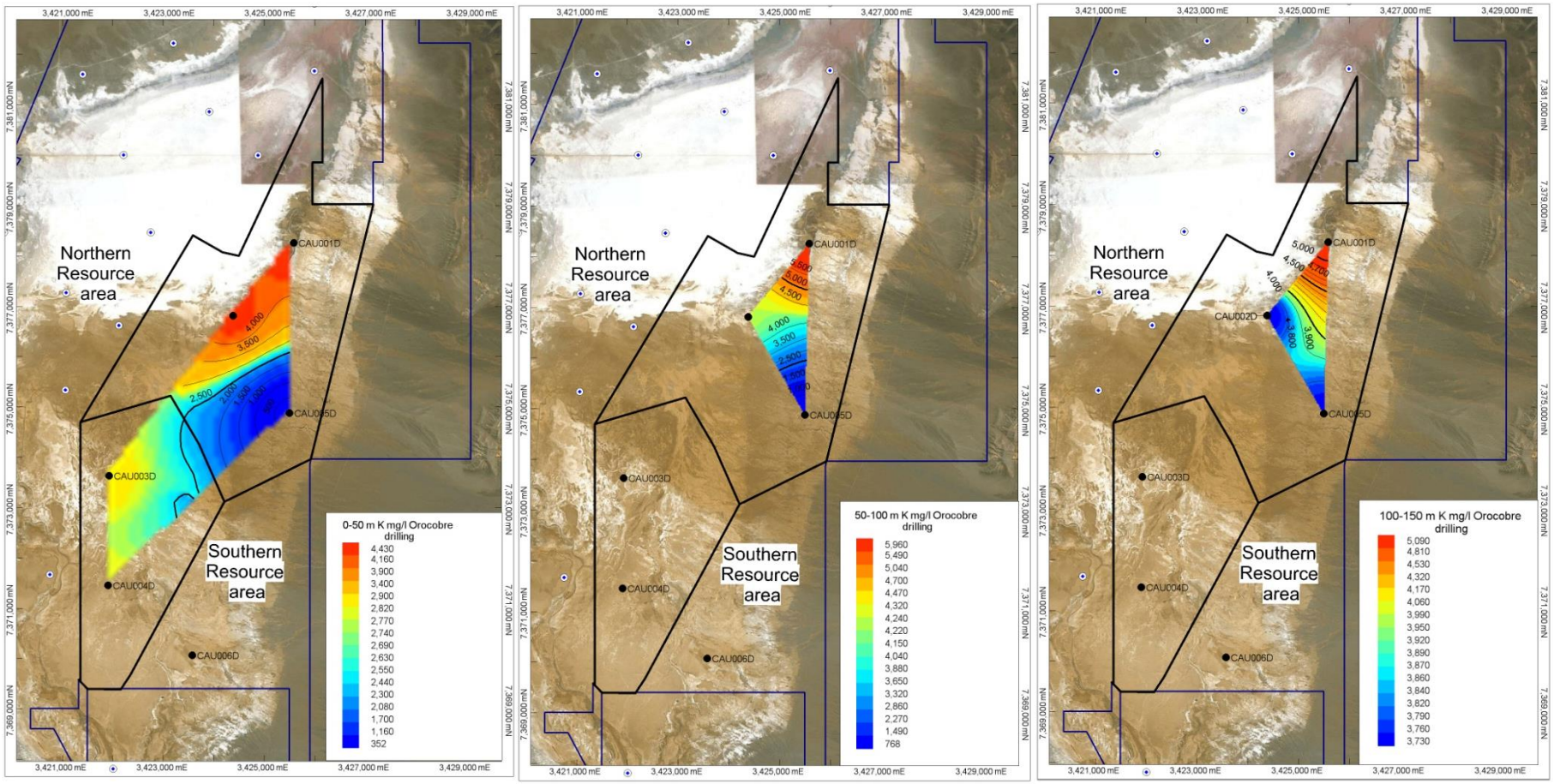


Figure 6.10 Average K bailer sample concentrations in 50 m slices in diamond holes

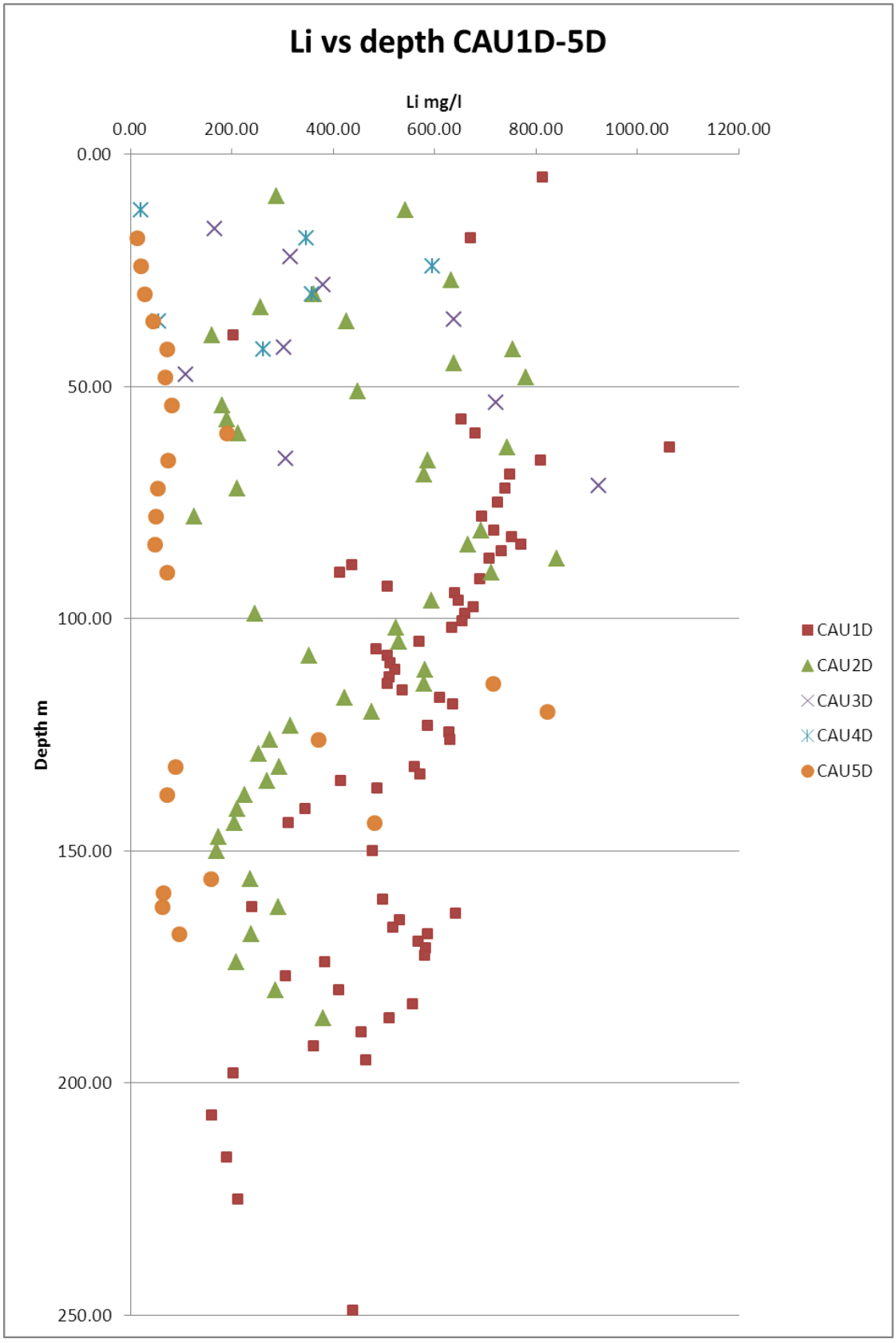


Figure 6.11 Lithium concentrations versus depth for the diamond drilling
The lithium concentrations show a decline with depth and several peaks within this decline, based on the limited deeper drilling in the eastern properties.

6.3.4 Brine characterization and evolution

Analysis of the Cauchari brine was undertaken by plotting the average composition (from historical pit data) on a Janecke projection (Figure 6.12). This plot does not show analyte concentrations, but provides an indication of the types of salt expected to crystallize during the solar evaporation process. The Cauchari brine is located just within the Tenardite field as it has a higher SO4/Mg ratio than the Olaroz salar.

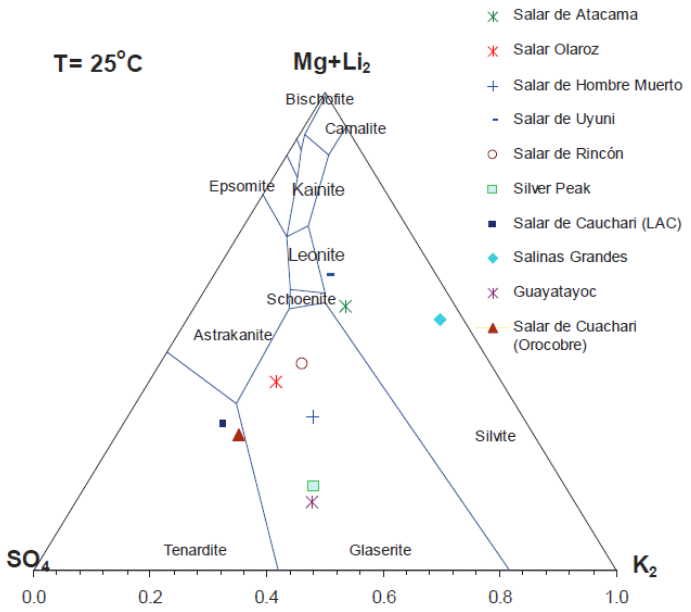


Figure 6.12 The Cauchari average brine concentrations shown on a Janecke phase diagram

Natural brine concentration in the salar involves the fluid passing through evolutionary divides (Hardie and Eugster, 1970; Houston, 2011). The plot of Ca to SO4 (Figure 6.13) indicates the evolution of the brine from a relatively dilute inflow to a CaSO4 rich brine that precipitates gypsum leaving the residual brine depleted in Ca, (Hardy-Eugster pathway VI). The evolutionary pathway is similar to that at Olaroz, with Li remaining in solution and increasing with chloride concentration.

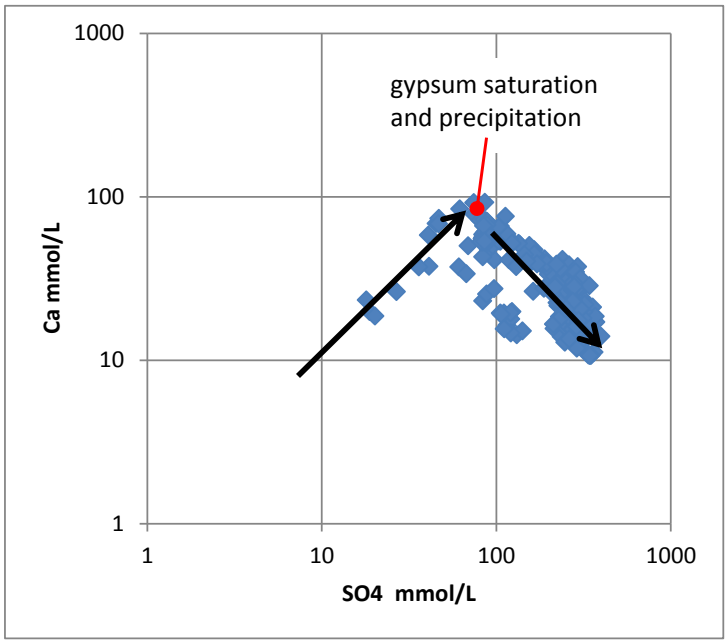


Figure 6.13 Plot of calcium and sulphate from bailer samples, showing gypsum precipitation

The three brine types identified on the Li-Cl plot (Figure 6.5), corresponding to the three populations identified in the frequency graphs (Figures 6.6 and 6.7).

- Type I brines are typically dilute with low Cl (<2000 mmol/L), SO4 (<100 mmol/L), Li (<10 mmol/L), K (<20 mmol/L), Mg (<10 mmol/L), but relatively high Ca (>50 mmol/L).

- Type II brines are concentrated with Cl (2000-5500 mmol/L), SO4 (100-400 mmol/L), Li (10-200 mmol/L), K (20-200 mmol/L), Mg (10-250 mmol/L), but relatively low Ca (10-50 mmol/L).

- Type III brines are also concentrated with Cl (2000-5000 mmol/L), but with relatively low levels of SO4 (<100 mmol/L), Li (<10 mmol/L), K (<200 mmol/L), Mg (<10 mmol/L), although Ca is relatively high (50-70 mmol/L).

With respect to depths and geographical location:

- Type I brines are found in wells CAU005D and 6R (note 6R samples were taken during rotary drilling) above 50 m, on the eastern margin of the salar.

- Type II brines are found in wells CAU001D, 2D, 3D, 4D throughout their full thickness, in the more central part of the salar, and 5D below 50 m, where the brine body is deeper on the eastern margin of the salar.

- Type III brines are found in wells CAU005D and 6R below 50 m on the eastern margin of the salar.

It therefore appears that brackish water entering the eastern and southern part of the salar is found above 50 m in wells 5D and 6R (although it must be taken into account 6R samples are composites from rotary drilling). This eastern/southern fluid (Types I & III) is quite distinct from the central (Type II) fluid which has a generally similar composition to Olaroz brine. The lower part of well 5D probably shows some mixing between the eastern/southern and central fluids and is interpreted to be on the margin of the principal brine body.

The lithium can be concentrated until approximately 0.7% and then be sent to the lithium carbonate plant, where it can also provide feed stock for potassium chloride production. If the brine is concentrated to a higher lithium concentration lithium is lost in lithium sulphate salts. Detailed test work has not been conducted, but initial indications suggest a process similar to that utilized in the nearby Olaroz project could be applied.

At this stage a water balance has not been conducted for the Cauchari salar basin.

7 DEPOSIT TYPE

7.1 Introduction

As discussed in the introduction to this report, lithium brine projects differ significantly from hard rock mining projects, due to their fluid nature. The Cauchari salar can be referred to as a lithium and potassium brine deposit. The important characteristics of the Cauchari deposit are the elements of interest (Li, K, B) in the brine, the brine chemistry and the characteristics of the host aquifer, such as aquifer extent, thickness, internal variations/heterogeneity and the physical aquifer properties, particularly porosity.

Lithium brine projects can be subdivided into two broad 'deposit types', depending on the salar characteristics (Houston et. al., 2011), with sections of this informative paper paraphrased in this following section.

- Mature salars (those containing extensive thicknesses – often hundreds of meters - of halite, such as the Salar de Atacama, and the FMC Hombre Muerto operation) and:
- Immature salars, which are dominated by clastic sediments, with limited thicknesses of halite.

The two different salar types defined by Houston et. al., (2011) reflect the different characteristics of these salars and the brine resources they contain. Individual salars may also contain immature and mature areas within the same salar basin (such as at Hombre Muerto).

Mature salt dominated salars are characterized by having:

- High permeabilities and specific yields (to a maximum of ~ 15% Sy) near surface, with the porosity and permeability in halite units decreasing rapidly with depth.
- In these salars the brine resource is essentially between surface and 50 m below surface, as below this depth there is limited permeability in the salt, due to salt recrystallization and cementation of fractures.

Immature salars conversely have porosity and permeability controlled by individual layers within the salar sequence.

- The porosity and permeability may continue to depths of hundreds of meters in clastic salars (such as at Silver Peak in Nevada, or Olaroz 20 km north of this project).
- However, the porosity and permeability characteristics may be highly variable, due to differences between sand and gravel units and finer grained silts and clays.

The presence of different stratigraphic units in clastic salars typically results in differences in the distribution of the contained brine. It is very important to consider the characteristics of the host aquifer in each salar, together with the geometry and physical properties, particularly porosity.

Based on the typical architecture of the Puna salar basins, the salars typically have a zonation consisting of:

- Coarser grained sediments on the margins of the basin, with successive inner shells of finer grained clastic units.
- Towards the centre of salars chemical sediments show a progress change from carbonate to sulphate and finally chloride evaporites (principally halite).

- The general model for salars consists of an inner nucleus of halite surrounded by marginal deposits of mixed carbonate and sulphate evaporites with fine grained clastic sediments.

Drilling in Cauchari has intersected both clastic sediments and evaporite deposits. At Cauchari there is a layer of clastic sediments (Unit A) overlying a thick sequence of halite. This halite sequence contains clastic interbeds mixed with halite that are generally several metres thick, separating more halite dominated intervals. The Cauchari halite sequence differs from the halite in evaporite sequences of the type found in mature salars such as Salar de Atacama in Chile, which contain very little clastic material (Houston, 2011; pers. Comm).

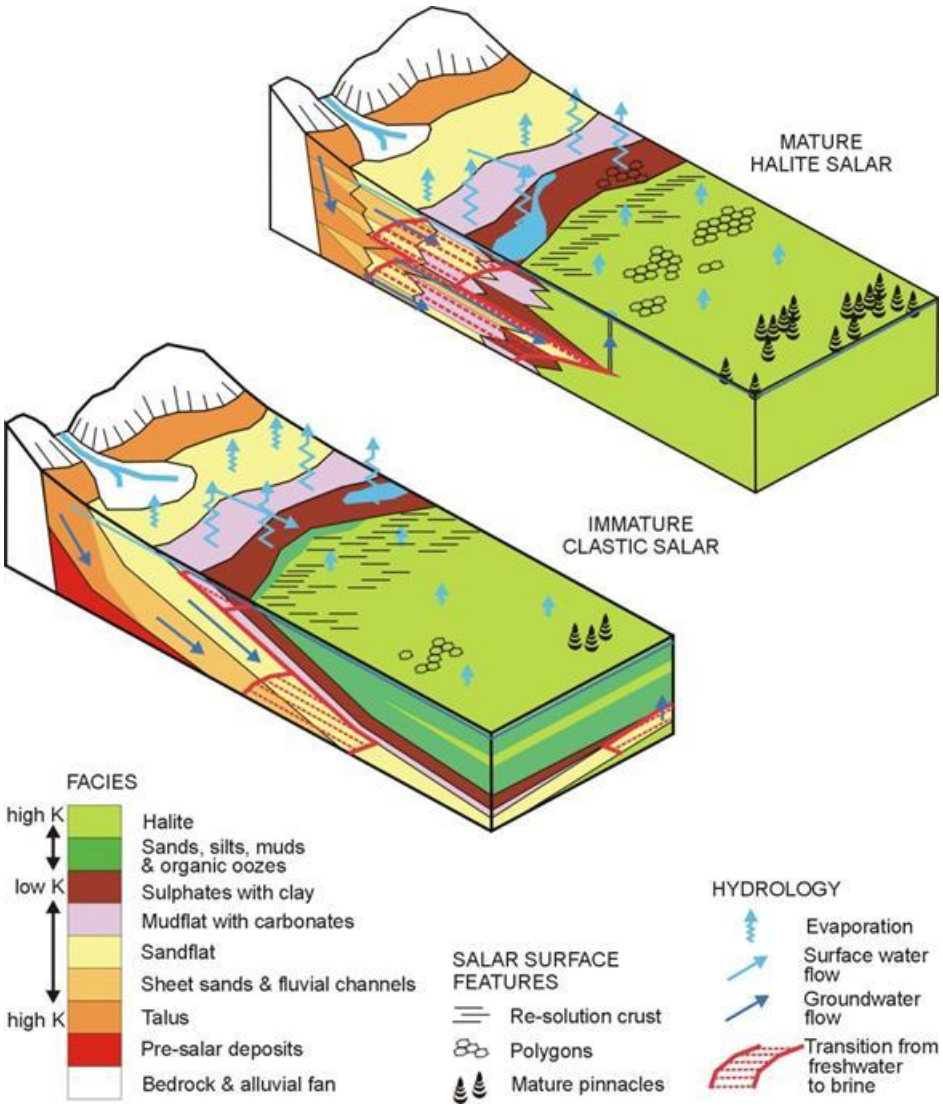


Figure 7.1 Model showing the difference between mature and immature salars (From Houston et. al., 2011)

7.2 The Cauchari salar and associated post-Miocene deposits

Three gravity and AMT geophysical profiles have been completed over the salar (see section 8). This suggests the salar is in excess of 400 m deep in the north, which has been confirmed by drilling by Lithium Americas Corp, adjacent to the South American Salars tenements.

The following Post Miocene major alluvial fans in the Cauchari basin (Figure 7.2) have associated local drainages and consist of:

- The Archibarca fan on the western side in the north of the Cauchari salar, which is the largest of the fans;
- Four alluvial fans along the eastern side in the central and southern sections of the Cauchari salar; and
- An alluvial fan at the south and southwestern end of the salar.

The Archibarca alluvial fan on the west side of the salar covers an area of ~ 125 km^2. Drilling has not been conducted by South American Salars in the fan in the Cauchari tenements, with drilling restricted to the tenements on the eastern side of the salar. The large area of the alluvial fan and potential for sandy to gravelly sediments at depth beneath the alluvial fan suggests this area with significant potential to host brine with lithium.

However, it should be noted there is flow of relatively fresh water through the upper levels of this alluvial fan towards the salar. Drilling by LAC (King 2010 a&b) suggests this alluvial fan has deposited a large volume of sand in the north and western side of the Cauchari salar, largely separating the salar from the Olaroz salar to the north.

7.3 Salar lithostratigraphy

The salar can be divided into the following units based on drilling and geophysical profiling of drill holes.

- Unit A – A sequence of reddish brown silt and clay, with very minor sand and local interbeds of black organic material to grey clay.
- Unit B – The lower halite dominated unit, with silt and clay interbeds.

These dominant units are divided into a number of sub units, as follows:

- Unit A1 – A sequence of reddish brown silt and clay, with very minor sand
- Unit A2 – A unit of brown and locally black to grey silt and clay in the north of the salar
- Unit A3 – A unit of red brown silt and clay.
- Unit A4 – Red-brown silt and clay with a medium grained sand unit near the top of the unit.
- Unit B1 – A transitional unit with the first appearance of halite with silt and clay
- Unit B2 – A thick halite unit continuing to the base of the holes, with at least 12 markers in geophysical logs, showing discrete sedimentary cycles within the halite. In holes CAU005D and CAU006R, further east in the salar, the halite interdigitates with clastic sediments at depth or becomes predominantly clastic, with one major halite interval noted in CAU005D and three noted in CAU006R.

In the adjacent properties Lithium Americas Corp (King 2010 a&b) recognized 5 principal litho-stratigraphic units, consisting of:

- Unit 1. Red silts with minor clay and sand;
- Unit 2. Banded halite beds with clay, silt and minor sand;
- Unit 3. Fine sands with minor silt and salt beds;
- Unit 4. Massive halite and banded halite beds with minor sand; and
- Unit 5. Medium and fine sands.

Comparison with LAC drill hole data suggests the salar sequence may thicken towards the east, although there may be faults influencing the thickness of the salar sediments in the basin. King (2010a&b) and subsequent reports by Lithium Americas Corp (Feasibility Study, July 2012) suggesting that in Cauchari sand underlies a mixed halite unit, although this has not been observed in holes drilled by South American Salars to date – probably because these holes were not drilled deep enough. Sediments underlying halite (interpreted to be on the margins of the halite body in CAU005D and 6R) are predominantly silt and clay.

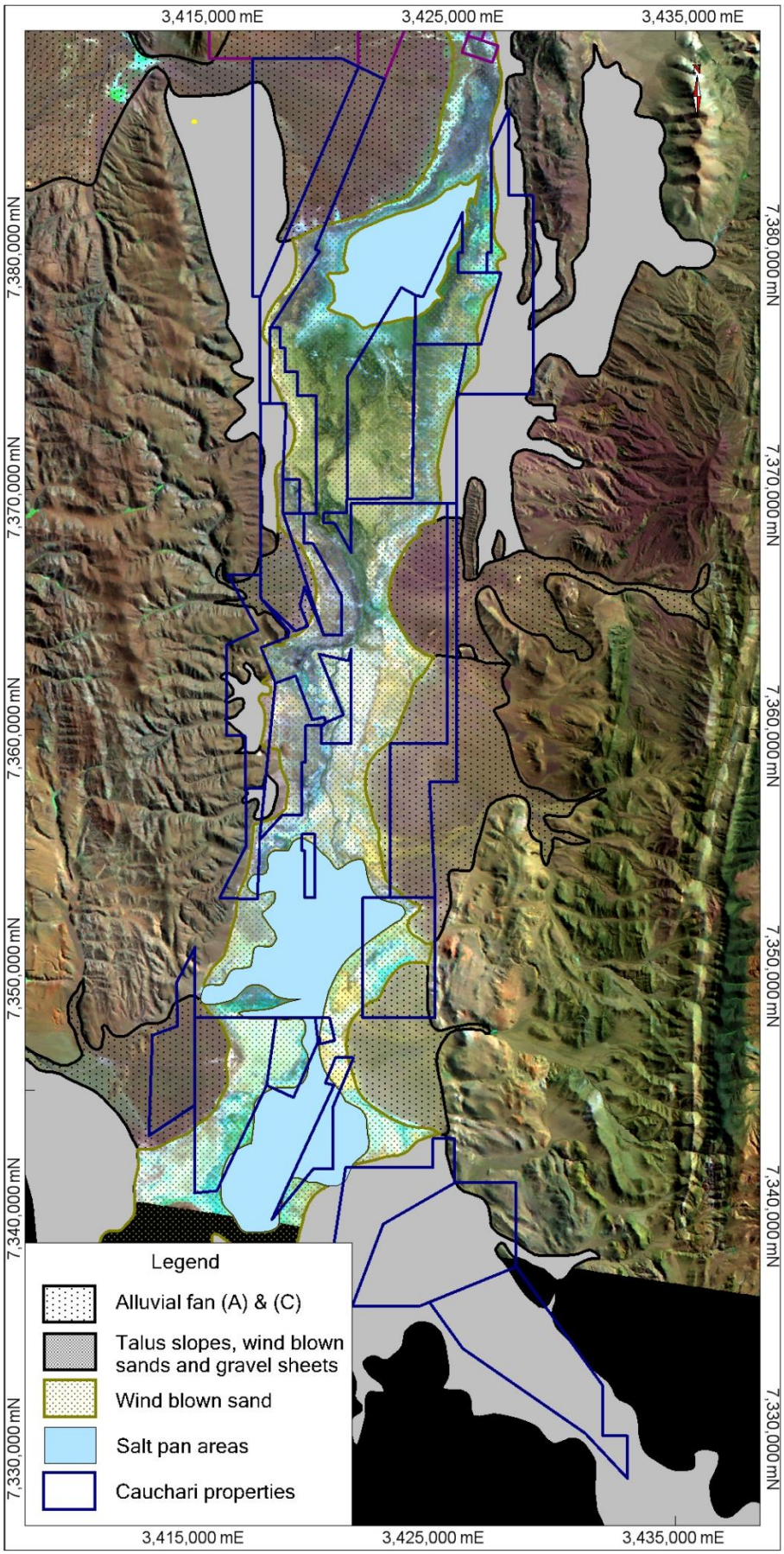


Figure 7.2 Cauchari geomorphology

7.3.1 Unit A1 - Red-brown clay

The salar nucleus (salt pan) is covered by a coating of powdery halite a centimeter or less thick. Beneath this the sequence of red-brown silt and clay. An upper unit with these characteristics was noted in the six holes drilled. The three northern holes, CAU001D, 2D and 5D, show similar unit thicknesses. The dominant halite crust texture in the salar is represented by contractional polygons of various sizes. Neutron and density logs define the base of this unit. The red colour suggests an oxidized, sub-aerial to shallow subaqueous depositional environment for this unit, with periodic additions of sand, probably during flood periods.

The thickness of the unit varies from 11 to 14 m metres thick in the northern holes where it is identified. This unit is interpreted to correlate to units A in the Olaroz salar to the north. Ulexite is noted in this unit as pods ("papas"). Carbonate cement may be present in this unit.

7.3.2 Unit A2 - Brown to locally black silt and clay

Underlying the upper silt/clay sequence there is a unit with local black to grey organic intervals in the northern 4 holes (CAU001D, 2D, 5D and 3D) which suggests this northern area of the salar hosted a lagoon with surrounding plants, which were deposited in the lagoon as organic matter. This unit is absent in the southern holes CAU004D and 6R.

The thickness of the unit (Figure 7.3) varies from 9 to 10 m metres thick in the northern holes where it is identified. This unit may correlate with the Unit B of Houston and Gunn (2011), in Olaroz, which has a thickness of 26 m in the south of the area drilled at Olaroz. Carbonate cement may be present in this unit.

Figure 7.3 Red and black clays representative of Unit A subunits

7.3.3 Unit A3 - Red brown silt and clay

This is a continuation of the upper unit of clay and silt, defined on the basis of the geophysical signature and the extent of the overlying brown to black silt and clay. This unit locally has thin halite beds, such as in CAU002D. In the northern holes the unit varies between 13 and 17 m thick. Carbonate cement may be present in this unit.

A cross section showing correlation between drill holes CAU001D, 2D and 3D is shown as Figure 7.4.

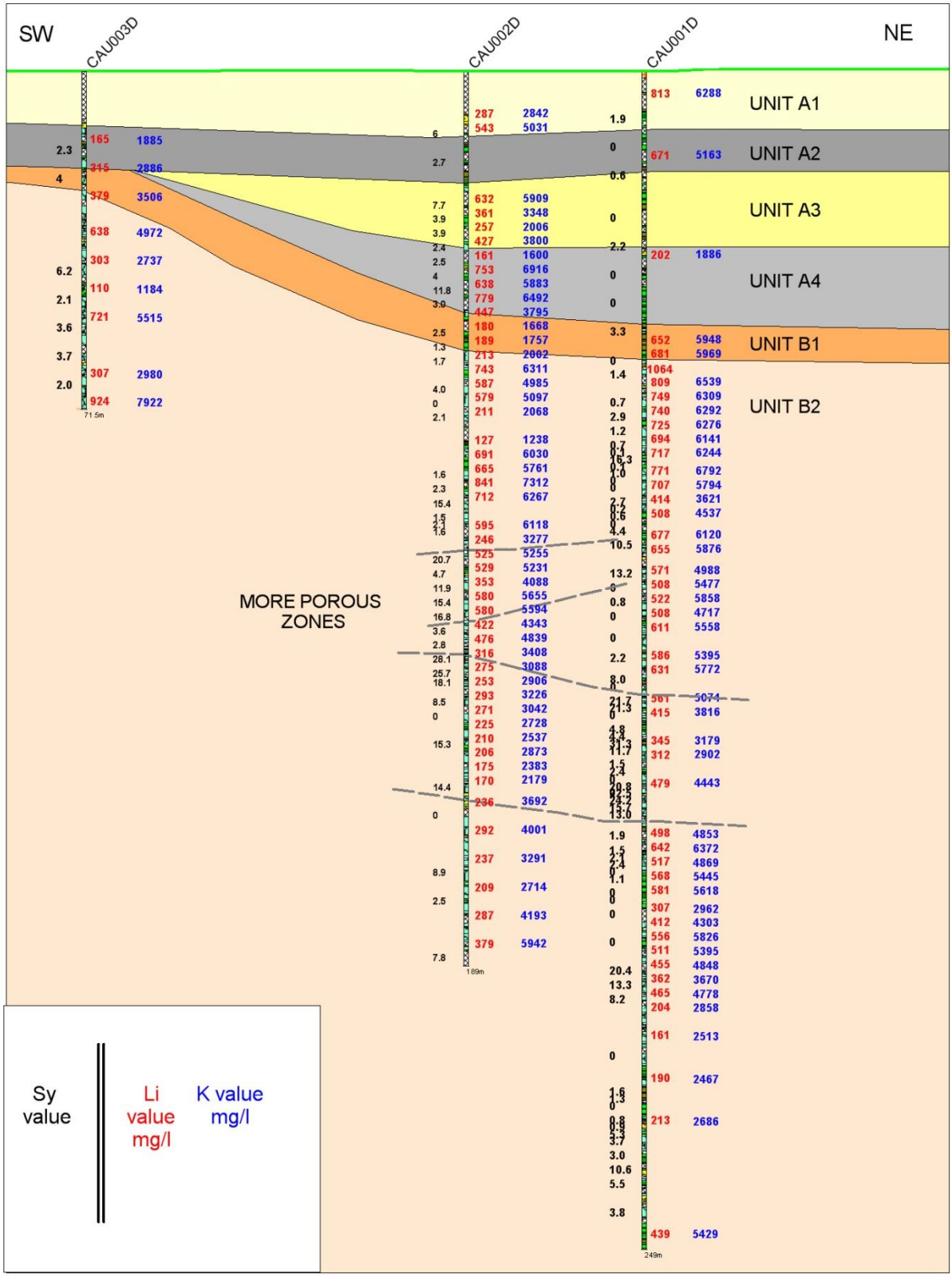


Figure 7.4 NE-SW cross section through Cauchari, showing the geological units

7.3.4 Unit A4 - Red brown silt and clay and sand

This red-brown silt and clay unit has a laterally continuous medium grained sand bed at the top of the unit in holes CAU001D, 2D 5D. This sand may represent a flood event across the

salar. This unit varies between 14 and 18 m thick in the northern holes. This unit may correlate with the Unit C of Houston (2011), which is a well defined sand bed occuring in all wells throughout Olaroz and interdigitating with the Archibarca fan to the south. The lower part of this unit may correlate to the clay dominated units D, E and F in Olaroz (Houston, pers. Comm., 2012). Carbonate cement may be present in this unit.

Units A1 through A4 are interpreted to correspond to Unit 1 of Lithium Americas Corp in the western of the Caucahri salar. Unlike Olaroz to the north, drilling shows there is not a significant halite unit at surface in Cauchari.

7.3.5 Unit B1 - Transition to halite

This red-brown silt and clay unit hosts some halite units, overlying the main halite body and can be distinguished by geophysical profiles as a sub unit, where the initial halite layer appears. This unit is 5-8 m thick in the northern holes and is not distinguished in holes CAU004D and 5R. Contoured unit thicknesses are shown in Figure 7.5.

7.3.6 Unit B2 - Major halite sequence with silt and clay interbeds

This unit is the major halite sequence that extends to the base of CAU001D (and beyond) at 249m. In holes CAU005D and CAU006R, drilled further towards the east, on the margins of the salar, this major halite body is interpreted to be thinner, interbedded with clastic sediments. Consequently the thick halite body intersected in holes CAU001D through CAU004D does not extend to the salar margins at the same thickness. The extent of any faults offsetting the stratigraphy is unclear at this stage on the stratigraphic correlation. However, faults may step down to the east across the salar.

Units B1 and B2 are interpreted to correlate with Unit G of Houston (2011) in Olaroz, with the same markers within the halite sequence identified in Cauchari as in Olaroz. Houston and Gunn (2011) suggested that active subsidence was occurring in the north and west of Olaroz during deposition. Halite is intersected at shallower depths in the south of the Cauchari salar, consistent with a deepening of the top of Unit G to the north, towards Olaroz. However, the sequence of halite intersected at Cauchari is much thicker than that intersected at Olaroz.

Unit 2 (defined by LAC – King, 2010) in the western part of the Cauchari salar, with halite and minor interbedded silt, clay and lesser sand is thought to correlate to Unit B (South American Salars properties) in the east of Cauchari. Units 3 and 5 of LAC (fine and medium sands) are thought not to have been intersected in drilling in the east of Cauchari and may be deeper than the 249 m drilled. However, it is possible that the equivalent unit to LAC Units 3 and 5 starts at 214 m in hole CAU001D, below which the halite unit breaks into a number of halite units with interbedded sands.

The Cauchari North Audiomagneto Telluric (AMT) geophysical line measured EW across the salar (see Figure 8.7) suggests the high conductivity zone (interpreted as brine) extends to the borders and probable base of the salar sequence (thought to be deeper than the base of the AMT survey).

Cauchari is a structurally controlled basin interpreted to be bounded by reverse faults, on the eastern and western margins of the basin. The Miocene to recent basin fill is of an unknown thickness, but exceeds 450 m, based on drilling by LAC (King, 2010 a&b DDH07/PE10) in the central part of the basin.

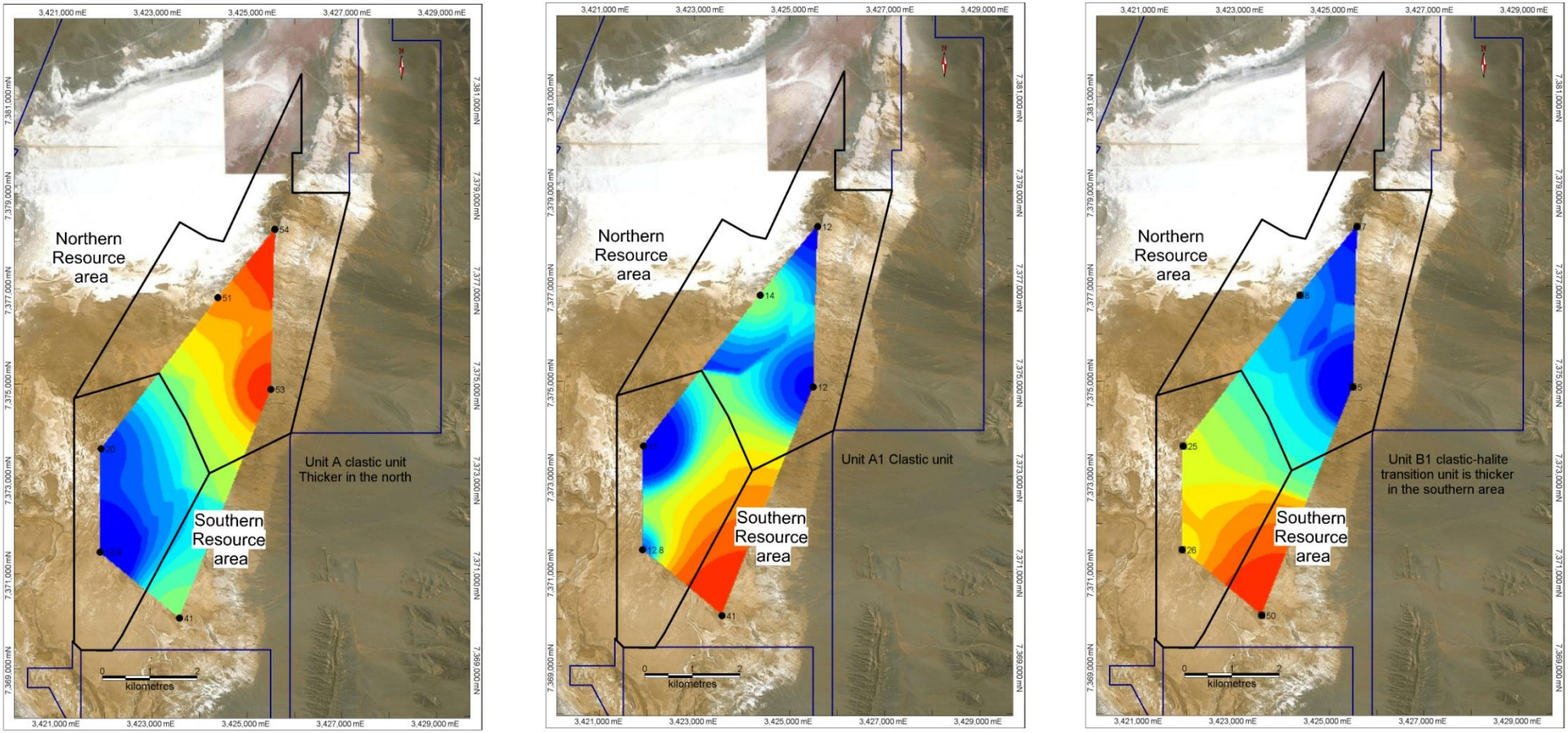


Figure 7.5 Contoured thicknesses of units A, A1 (upper A subunit) and B1 (transition to halite)

Faults stepping down to the east across the Cauchari salar may explain the greater depth to halite in holes CAU001D, 2D and 5D, which display a very similar depth for the Unit A/B contact. Similarly CAU003D and 4D show a similar depth to the unit A/B contact, which is closer to surface where these holes are located, further west in the salar. The A/B contact in CAU006R is intermediate in depth between the two groups of samples discussed above.

Houston (2011) interprets that the Olaroz salar to the north filled slowly with medium to coarse grained alluvial fans beginning in the Miocene. The sedimentation is interpreted to have become progressively finer grained with braidplain, sandflat, playa and fluvial architectures. Houston interprets that as the climate became more arid during the Pliocene evaporite deposits first appeared, with the thick halite unit intersected in the deeper Olaroz drilling probably of Pleistocene age. The deeper halite deposits at Olaroz probably correlate with the thick halite deposits intersected in drilling at Cauchari. Both compact crystalline halite (Figure 7.6) and porous halite (Figure 7.7) are present within the thick halite sequence.

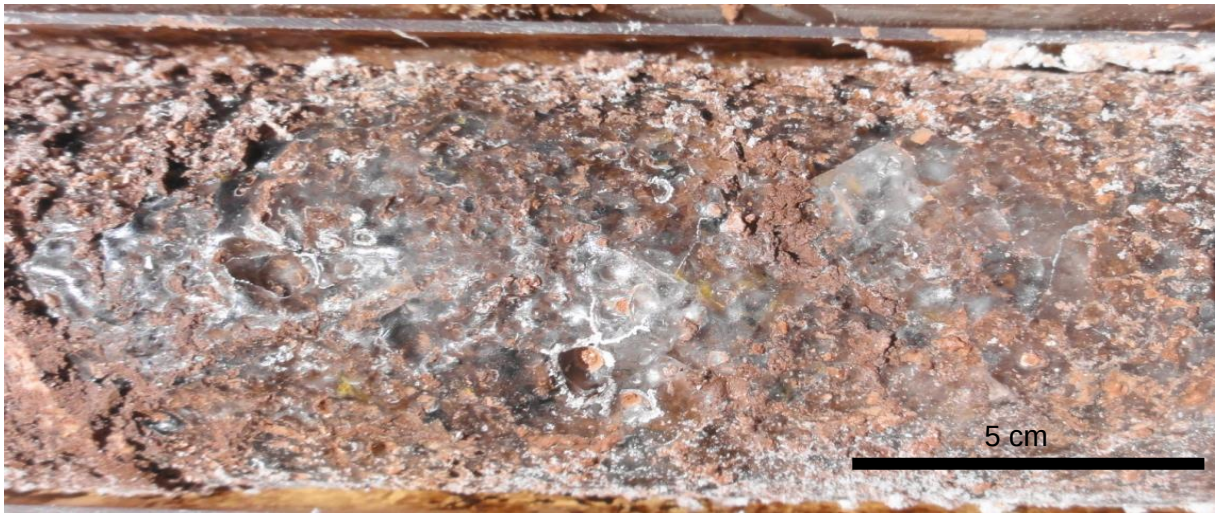


Figure 7.6 Compact textured halite

Figure 7.7 Porous halite in unit B2 with possible primary subaerial to shallow water porosity

7.4 Basin development over time

The Cauchari salar is interpreted to have formed under generally low energy depositional conditions, with periodic influxes of sediments and wind-blown sedimentary input. The salar sequence developed in a relatively dry environment.

Unit A is interpreted to have been deposited in a quiescent lacustrine environment, under probable fresh to saline water conditions. Intervals of brackish fluid are present within this sequence, and these are thought to be connected to recharge zones on the flanks of the salar basin. Clay units within this sequence probably form confining layers to local channel aquifers that are more calcic, with a higher pH, and lower density fluids within Unit A. The black clays within Unit A may represent a wetter period, when more organic material accumulated within the salar basin.

Unit B at Cauchari is interpreted as an arid climatic period, which can be correlated with the halite units in the deepest drilling within Olaroz (Unit G – Houston and Gunn, 2011). Sediment is likely to have been sourced from alluvial fans developed to the east and west of the salar.

7.5 Lithostratigraphic unit porosity and permeability

The Cauchari basin consists of multiple aquifers and confining layers, with Unit A generally representing less permeable lithologies. The high clay content Unit A acts as a major confining layer in the salar. Beds may interdigitate and vary locally in thickness, depending on the conditions at the time of deposition and variations within the basin.

7.5.1 Porosity

Porosity measurements have been made on core samples taken from different units in the salar. Measurements of total porosity were made in the Salta office of South American Salars, with measurements of total porosity and specific yield made at the Independent British Geological Survey sedimentological laboratory in the United Kingdom. Further details of procedures for measurements are provided in Section 10.

Because lithological units generally contain halite and mixtures of sand, silt and clay, the porosity measurements can be quite variable from sample to sample in the same unit. For this reason the porosity measurements were grouped based on the dominant grain type (halite, sand, clay or silt mixtures).

The average and standard deviation values for total porosity (Pt) and specific yield (Sy) are summarized in Table 7.1 below. It is observed that clay units have the highest Pt but lowest Sy values, as moisture is present in microscopic pores which do not readily release water. Sand on the other hand has a lower Pt (lower overall pore volume) but generally higher Sy than clay. However, when halite is deposited together with sand this reduces the total porosity and Sy. Halite deposited with sand has been noted in Unit B at Cauchari, but the extent of potential halite cement is unknown. The average of the Sy samples (148 Pt samples from the Salta laboratory, 147 Pt samples analysed by the BGS), from the combined lithologies, is shown in Table 7.1. Note that an averaged Sy value for porous and very porous halite was used in determining an overall Sy value for resource estimation.

		Salta Lab		BGS Lab				Olaroz BGS Data			
# Samples Pt/Pt/Sy	Lithology	Pt %	St Dev %	Pt %	St Dev %	Average Sy%	Std Dev %	Average Pt %	Std Dev	Average Sy	Std Dev %
10/18/12	Clay dominant	36%	12%	37%	5%	2%	2%	44%	6%	2%	2%
29/19/19	Silt and mixes	30%	10%	20%	10%	5%	4%	38%	11%	6%	4%
10/4/3	Sand dominant	22%	14%	14%	7%	4%	3%	32%	8%	13%	7%
25/22/16	Halite sediment mixes	22%	9%	12%	10%	7%	7%	29%	10%	4%	2%
43/39/29	Compact halite	4%	3%	3%	1%	2%	1%				
18/34/28	Porous halite	10%	7%	14%	8%	9%	8%				
13/11/11	V porous halite	20%	18%	23%	5%	16%	7%				

Table 7.1 Average BGS total porosity and specific yield values by lithology type

8 EXPLORATION

Exploration carried out to date consists of the following stages:

- Surface pit sampling,
- Surface geophysics (reported in the April 30 2010 NI43-101 report) – with a geophysical interpretation provided in this chapter, and
- A diamond drilling program (see Section 9) and down hole logging of drill holes.

8.1 Pit sampling

Brine samples from shallow (<2 m deep) pits were collected from March to May 2009, with a total of 134 brine samples taken from 105 pits. The distribution of Li, K and B within the tenement areas (Figure 8.1) shows these are generally highest closest to the centre of the salar drainage system, with low concentrations around the edges of the salar.

As noted by Houston (2010b) the sampling was undertaken soon after the end of the wet season and it is possible that some of the samples around the edge of the salar were influenced by the seasonal influx of fresher water into the salar. The average results from the pit sampling are shown in table 8.1. The low average values reflect the predominant location of samples around the edge of the salar.

	Li	K	B	Mg/Li
N	107	108	107	
Mean	191	1596	244	2.38
Standard deviation	364	2460	271	
Maximum	2194	12303	1,202	
Minimum	0.01	11.80	5.56	

Table 8.1 Pit sample analytical results (mg/l) from the 2010 NI43101 report (Houston, 2010b)

8.2 Geophysical exploration

The following geophysical description is reproduced from Houston (2010b), with minor modifications reflecting more recent interpretation since the 2010 report.

Orocobre Ltd contracted Wellfield Service Ltda to undertake a gravity and audio-magnetotelluric (AMT) survey. Three lines were conducted, with one east-west line across the central properties in Cauchari, a further east-west line in the south and another northwest aligned line along the Tocomar River in the south of the basin. The objective of the gravity survey was to obtain first order estimates of the geometry and depth of the basin, and if possible, to establish the main sedimentary sequences within the basin. The objective for the AMT surveys was to define the limits of the brine body hosted in the basin sediments, and to define the brine-fresh water interface.

The location of the geophysical survey line is shown in Figure 8.2. All coordinates and elevations are referred to Zone 3 of the Argentine Gauss Krueger transverse Mercator grid system, with the Posgar 94 datum.

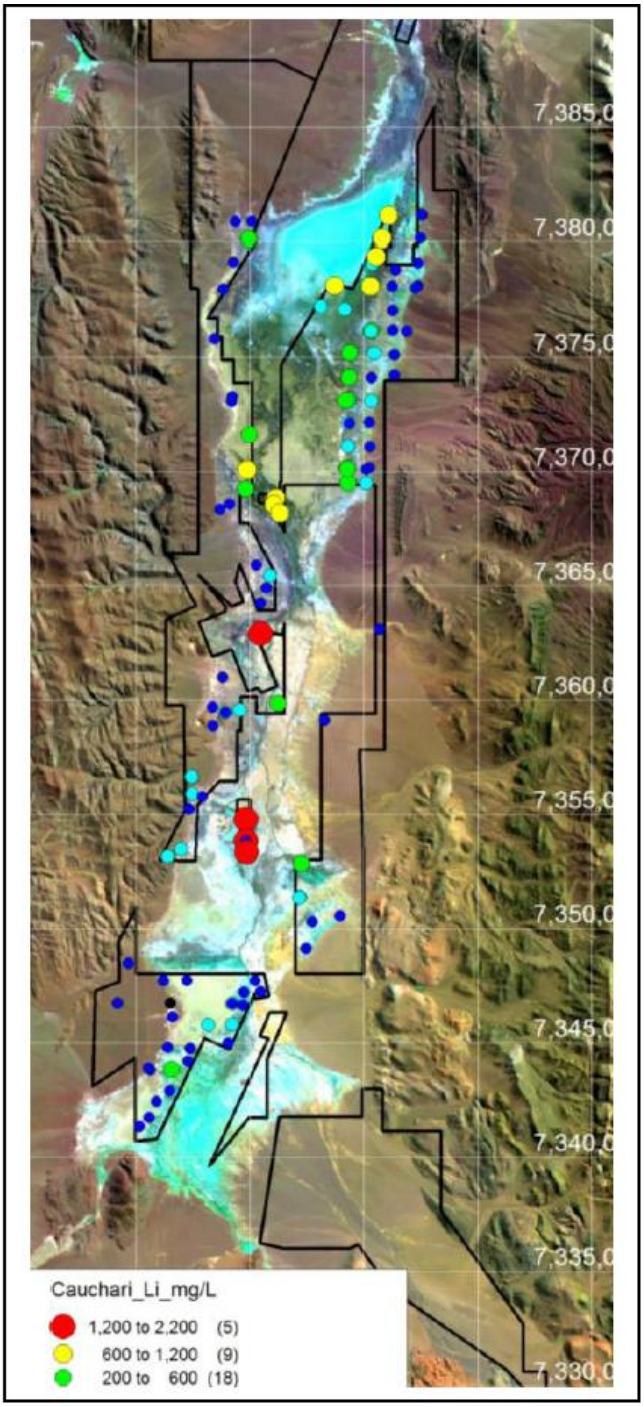


Figure 8.1 Location and values of the 2010 pit samples within the tenement applications at that time

8.3 Gravity

Gravity techniques measure the local value of acceleration which, after correction, can be used to detect variations in the gravitational field on the earth's surface which may then be attributed to the density distribution in the subsurface. As different rock types have different densities, it is possible to infer the likely subsurface structure and lithology, although various combinations of thickness and density can produce the same measured density; resulting in multiple possible models for layers in the salar (referred to as non-unique solutions to the gravity data).

8.3.1 Data acquisition

Data was acquired at gravity stations spaced at 200 m, coupled with high precision GPS survey data. A Scintrex CG-5 gravimeter (the most up-to-date equipment available) was used, and measurements were taken over an average 15 minute period in order to minimise seismic noise. A base station was established with readings taken at the beginning and end of each day's activities in order to establish and subsequently eliminate from the data the effects of instrument drift and barometric pressure changes. The daily base stations were referred to the absolute gravity point PF-90N, close to Salta, where a relative gravity of 2149.136 mGal was obtained. Since this point is distant from Cauchari, intermediate stations were used to transfer the absolute gravity to Pastos Chicos where a relative gravity base station was established with a value of 1425.313 mGall.

To measure the position and elevation of the stations, a differential GPS was used with post-processing (Trimble 5700) of the data. This methodology allows centimeter accuracies, with observation times comparable to or less than the corresponding gravity observation. The gravity station position data was recorded using a mobile GPS (Rover). Another GPS (Fixed) at the fixed base station recorded data simultaneously, to correct the Rover GPS. The Fixed and Rover GPS units were located within a radius of 10 to 20 km of each other. Both data sets were post-processed to obtain a vertical accuracy of 1 cm.

8.3.2 Data processing

In order to arrive at the complete Bouguer anomaly which can be used to interpret the subsurface the following corrections to the acquired data must be made:

- Tidal correction.
- Drift, instrumental height and ellipsoid corrections.
- Free air, latitude, Bouguer and topographic corrections.

The tidal correction compensates for variations in gravity caused by the sun and moon. Using TIDES software, the acceleration due to gravity for these effects can be determined corresponding to the location and time of measurements. The data acquired in the survey were translated to UTC time to facilitate data handling. The exported data were converted from µGal to mGal and used to correct the acquired data.

Instrument drift was calculated from the difference in gravity measured at the base station. This difference was then linearly distributed with respect to time of each reading and used to correct the acquired data.

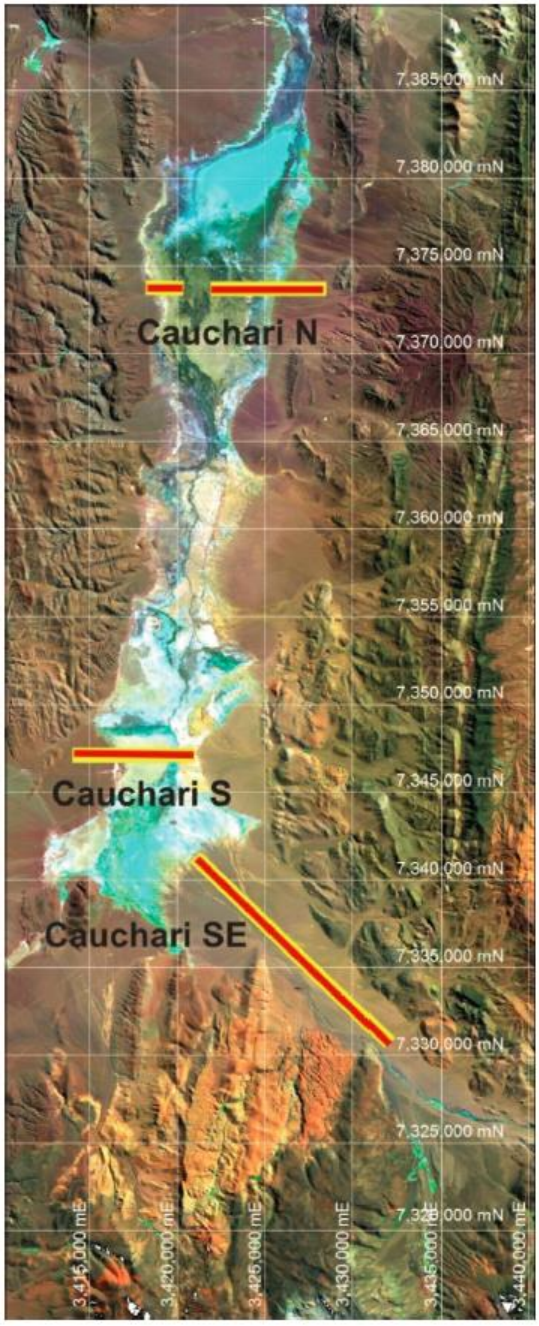


Figure 8.2 Location of the Cauchari gravity (yellow) and AMT (red) line

Each reading was corrected for the height of the instrument using the following formula:

$r_h = r_t + 0.308596\ h_i$

where r_h is the corrected instrument height, r_t is the tidal correction, and h_i is the observed instrument height.

The formula employed to correct variations in gravity associated with the ellipsoidal shape of the earth corresponds to the 1980 model:

$g_l = 978032.7\ [\ 1 + 0.0053024\ \sin^2(l) - 0.0000058\ \sin^2(2l)\ ]$

where g_l is the theoretical gravity in milligals and l is latitude

The free air anomaly is calculated as:

$$g_{free\ air} = -0.3086\ (\Delta h)$$

where $g_{free\ air}$ is the correction factor and Δh refers to the difference in altitude of the station with respect to the base.

Figure 8.3 Gravimeter base station

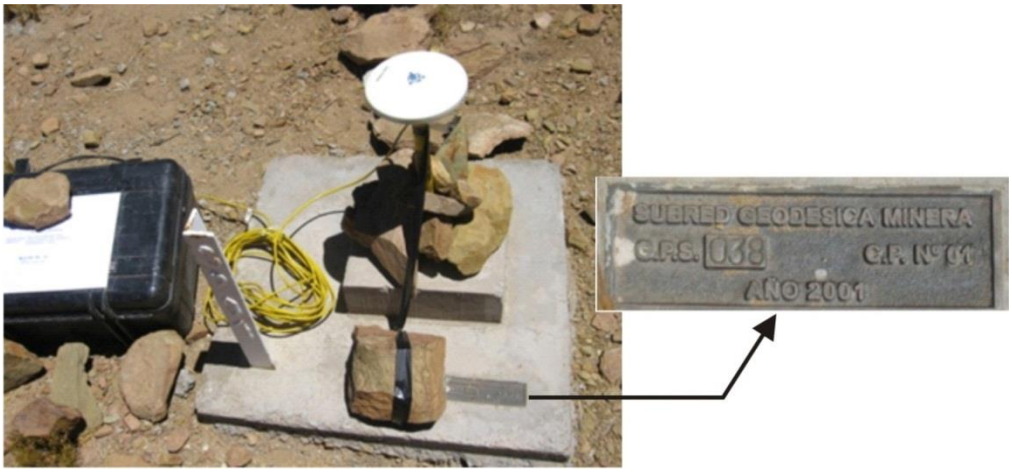


Figure 8.4 GPS base station

To eliminate the effect of the rock masses between the reference level and observation station, the Bouguer correction was employed.

$$g_{CB} = 0.04191(\Delta h)\ \rho$$

where g_{CB} is the correction factor, the value Δh refers to the difference in altitude between the observation point and the base station, and ρ is the mean rock mass density in the area calculated using the graphical Nettleton method to be 2.07 gm cm^{-3}.

The topographic correction is used to compensate the effects of the relief in the gravity measurements. It takes into account the topography at different levels of accuracy and importance, according to its distance from the gravimetric station to correct. Centered areas are considered at the station with radii of 100 m, 2.5 km and 150 km respectively.

The result of applying all corrections is the Bouguer anomaly.

8.3.3 Gravity data modelling

The Bouguer anomaly can be modeled to represent the subsurface geology. However, any model is non-unique and it is essential to take into account the known geology and rock density. At the time of the gravity survey and subsequent processing no local rock density measurements were available and only preliminary two and three layer models were developed, representing salar and probable Quaternary deposits overlying bedrock. Subsequent to the surveying, drilling was carried out in October to December 2011. Density measurements were made afterwards on 18 samples of drill core. This information (Table 8.2) was used to remodel the 2D gravity line across the central part of the salar with these measurements in 2016 and data from drilling to improve the gravity model. This interpretation is provided in Figure 8.5.

Salar Unit	Density used in modelling (g/cc)	Density measured from Cauchari samples (g/cc)
Salar deposits	1.6	
Clastic sediments	1.8	1.8
Compact halite		1.7
Porous halite		1.4
Basement 2	2.6	
Basement 1	2.7	

Table 8.2 Bulk rock density values used in the gravity interpretation

The Bouguer anomaly was inverted to produce a series of possible 2D stratified models. The results were modeled for a two-layer system, since not enough geological or drilling data existed at the time to support more complex interpretations. Boundary conditions are not well established at this stage and it is recommended that further geophysical data is collected to improve the interpretation.

The gravity model suggests that the basinal structure that occurs in the Salar de Olaroz to the north extends south in Cauchari but with reduced width which on the Cauchari north line is approximately 9 kms.

The fitted model extends the asymmetric nature of the Salar de Cauchari towards the south (Figure 8.5), although the maximum basin depth increases to around 450 m + along the eastern boundary in the southern gravity line. The 2014 drilling by Sales de Jujuy on the Olaroz project (reported by Orocobre on 23 October 2014) and the drilling by South American Salars and LAC supports this interpretation.

8.4 Audio magnetotelluric

8.4.1 Data acquisition

AMT measures temporary variations in the electromagnetic field caused by electrical storms (high frequencies >1 Hz), and the interaction between the solar wind and the terrestrial magnetic field (low frequencies <1 Hz), which allows variations in the electrical subsurface to depths of 2 km or more.

The electrical properties of the subsurface depend on Archie's Law: $R_t = a R_w / P^m$ where R_t is the measured total resistivity, R_w is the resistivity of the fluid in the rock pores and P is

the rock porosity, a and m are constants. Hence, it is possible to infer the subsurface variations in fluid resistivity and porosity, although it is important to note that once again the problem of a non-unique solution always exists.

Data at 250 m spaced stations was acquired using Phoenix Geophysics equipment within a range of 10,000-1 Hz, using up to 7 GPS synchronized receptors. The equipment includes a V8 receptor with 3 electrical channels and 3 magnetic channels which also serves as a radio controller of auxiliary RXU-3E acquisition units. Three magnetic coils of different size and hence frequency were used at each station, and non-polarizable electrodes that improve signal to noise ratios. The natural geomagnetic signal during the acquisition period remained low (the Planetary A Index was <= 5 for 95% of the acquisition time) requiring 18-20 hours of recording at each station.

All stations were surveyed in using differential GPS to allow for subsequent topographic corrections.

AMT requires a Remote Station, far from the surveyed area, in a low level noise location to act as a baseline for the acquired data.

8.4.2 Data processing and modelling

Processing of the AMT data requires the following stages:

- Filtering and impedance inversion of each station
- 1D inversion for each station
- Development of a resistivity pseudosection
- 2D profile inversion (including topographic 3D net)

The WinGlink software package was used for filtering, inversion and development of the pseudosection and eventually the 2D model output.

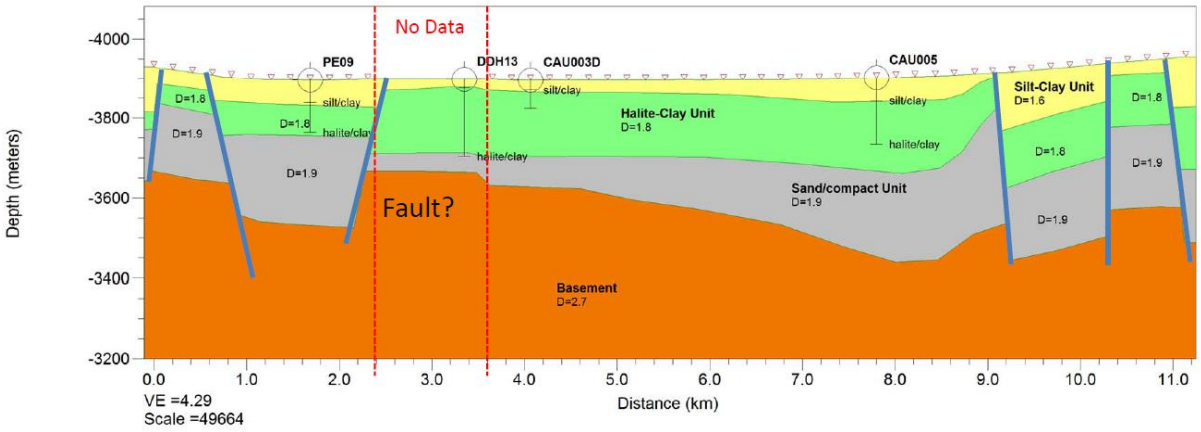


Figure 8.5 Revised interpretation of the Cauchari north gravity line, looking to the north and showing South American Salars and LAC drill holes

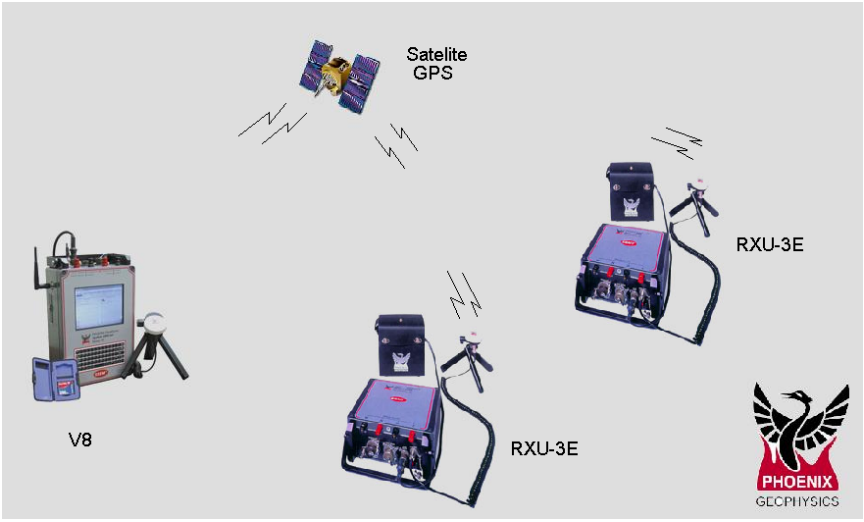


Figure 8.6 Schematic of AMT equipment arrangement

8.4.3 Model output and interpretation

The 2D model results for the section at Cauchari are presented below in Figures 8.7 and 8.8.

In the Cauchari north AMT line the darkest blue on the AMT line is interpreted to represent brine, which extends across the salar between bounding reverse faults which thrust older sediments and unsaturated units over the salar sediments on the margins of the salar basin. This interpretation is supported by TEM (King, 2010b) and electrical soundings (Vazques, 2011) conducted by LAC in the adjacent tenements.

In the Cauchari south AMT line the brine body is narrower than in the Cauchari north line. Unsaturated sediments are interpreted to overlie fresh to brackish water to the east and the west of the main brine body. The eastern part of the brine body might reflect a fault crossing the eastern end of this section, with upthrow of the eastern part of this line (the eastern part of the brine body). The smaller lateral extent and increasing depth of the brine body observed in the southern AMT line is probably representative of the southern part of the Cauchari salar, away from the northern salt pan.

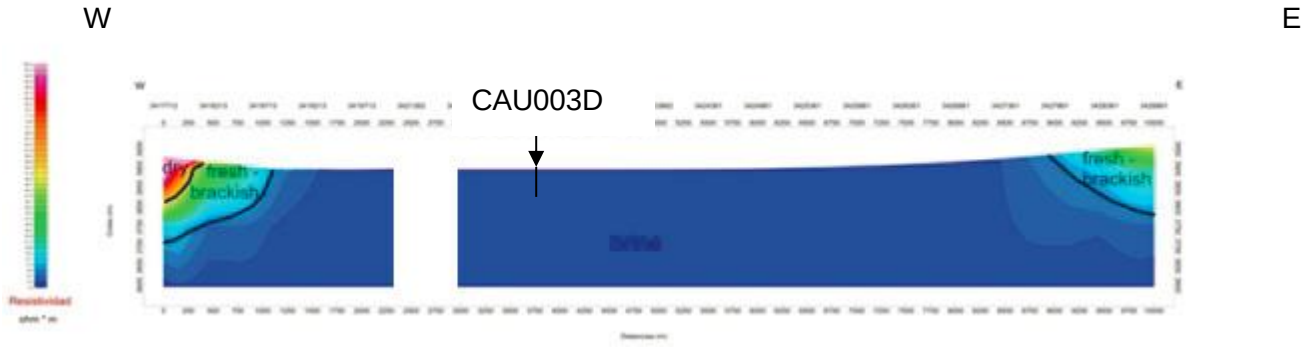


Figure 8.7 Resistivity profile for Cauchari north AMT line

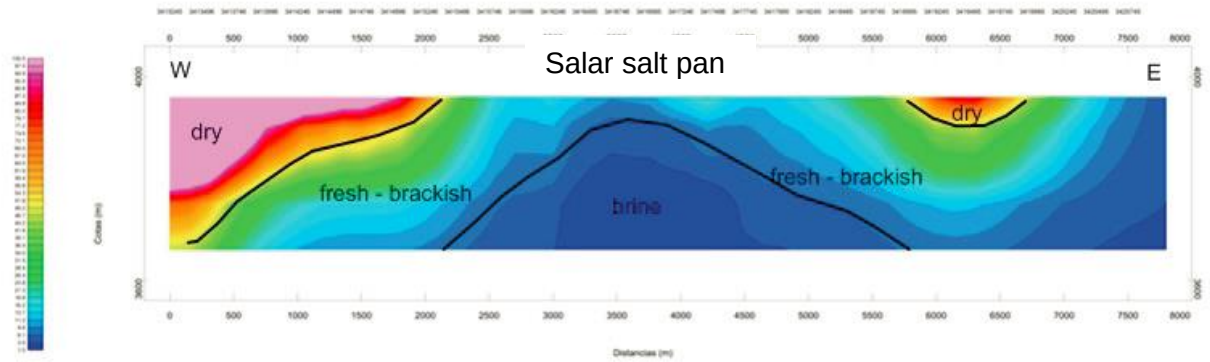


Figure 8.8 Resistivity profile for the Cauchari south AMT profile
This profile shows the brine body is deeper and less broad further south in the Cauchari salar

8.5 Geophysics on adjacent properties

In the properties adjacent to the South American Salars tenements the company LAC has undertaken several geophysics programs that stop at the tenement boundaries and hence provide important information regarding the broader geological and hydrogeological conditions of the salar. LAC has conducted:

- A program of seismic evaluation in 2009 (Figure 8.9), with 12 seismic lines through the LAC tenements, with lines predominantly oriented EW (King 2010 a&b). The resolution depth is quoted as 500 to 600 metres.
- LAC subsequently carried out two gravity lines in the north of the salar, adjacent to the South American Salars tenements.
- A program of 5 TEM electrical geophysical lines surveying over LAC tenements around the margins of the salar, which LAC (King 2010b) suggest may provide information to approximately 100 m depth.
- Electrical soundings over the Archibarca fan, to map the hydrogeological profile.

LAC interpretation of the NS oriented seismic lines interpreted a number of faults trending approximately NS through the salar, which are expected to trend into the South American Salars tenements (Figure 8.9). LAC interpretation of seismic line 7 shows an extensive sequence of halite, overlain by sand and clay, extends south towards Orocobre properties (950-R-2008 and 968-R-2008). LAC interpretation of seismic line 1 suggested the halite unit thins to the south from line 7. However, South American Salars drill holes CAU001D through CAU005D shows the sequence of halite is thick (>100 m) and extensive in the eastern South American Salars properties (950-R-2008 and 968-R-2008), overlain by clay and silt from the salar surface to depths up to ~ 60 m.

LAC TEM line 1 and lines of electrical soundings (Figure 8.9) appear consistent with the Orocobre Cauchari north AMT line, which is interpreted to show brine underlying the width of the salar, extending to the bounding reverse faults on the basin margin. In LAC line 10 electrical soundings, on the eastern margin of the salar and adjacent to the South American Salars properties, Vazques (2011) interprets brine at approximately 60 m, which is consistent with drilling in South American Salars hole CAU002D.

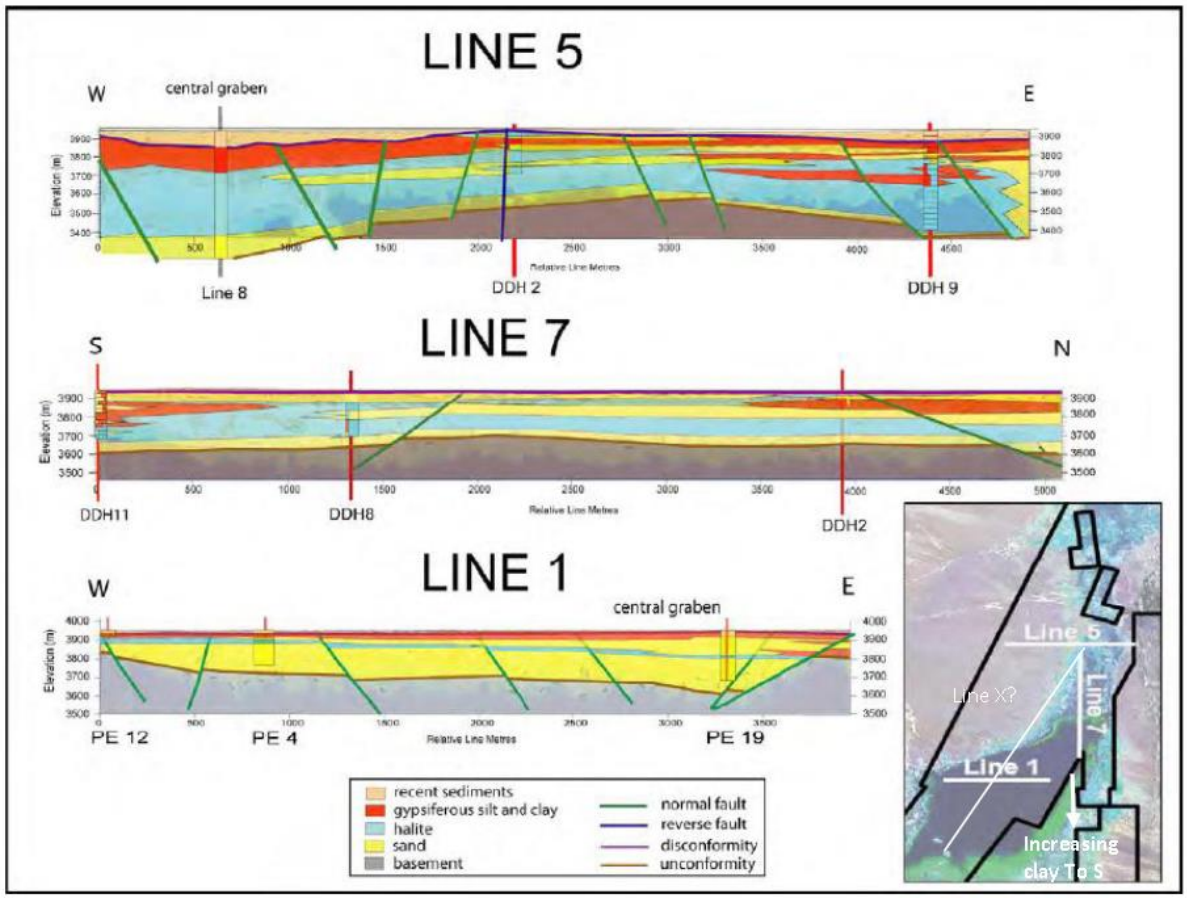


Figure 8.9 The location of LAC seismic lines adjacent to the western and eastern South American Salars tenements

9 DRILLING AND RELATED ACTIVITIES

Drilling was designed to recover high quality samples for porosity testing and geological interpretation. Triple tube core drilling was selected to collect the best possible samples, as sonic drilling equipment was unavailable for this project. Collection of quality brine samples for analysis was also a priority in the program. Brine samples were collected by sampling with a bailer, using techniques developed by Orocobre for resource drilling at the Salar de Olaroz project. Bailer sampling was supplemented by the extraction of brine from core samples, a technique also developed for resource drilling at the Olaroz project. The details of brine sampling are provided in the following section on sampling methods and approaches.

South American Salars S.A contracted Falcon Drilling S.A. to undertake drilling at the Cauchari project. The company had drilling experience in the Argentine Puna and undertook the initial drilling on the Olaroz salar in 2008.

For this project Falcon provided a Longyear 38 trailer mounted drilling rig, which was transported between drilling sites by an excavator. Drilling was undertaken principally using HQ (96 mm external diameter) diamond drill rods. However, NQ (76 mm external diameter) drilling rods were used when there were insufficient HQ rods and casing to continue a hole at that diameter.

A number of raised access roads were constructed over the salar surface, using gravel excavated from gravel deposits and alluvial material from drainage channels on the eastern margin of, and upslope of, the salar salt pan. Excavation of material was approved under the conditions of an environmental approval to the company for drilling on the project.

9.1 Drilling density

A total of 5 diamond holes and one rotary hole were drilled in the South American Salars tenements (Table 9.1), with an average spacing of 3.3 km between holes. The area of the salar within the tenements used for the inferred resource is 31.04 km^2 (refer to Section 13). For the resource zone this corresponds to a density of 6.2 km^2 per drill hole (CAU006R is excluded from the resource area).

9.2 Diamond drilling and testing program

Sampling of both the host sediments and the contained brines in salars is challenging, due to the poorly consolidated nature of the sediments and the fluid character of the sample. Consequently there are difficulties in obtaining undisturbed lithological samples and risks of contamination of brine (fluid) samples by fluids used in drilling and from brine contained in adjacent intervals. Bearing this in mind it is important to take the uttermost care in collecting samples. In the Olaroz project Orocobre and consultant hydrogeologist John Houston developed methodologies to detect sample contamination and to cross check results from one sample source with those from another. The authors have, where possible, applied the sampling methodologies developed and tested on the Olaroz project.

9.2.1 Core drilling

South American Salars undertook a diamond drilling program with Falcon Drilling between October 2011 and December 2011, before the program was terminated due to rain. The 5 vertical HQ and NQ diamond core holes were drilled for a total of 721 m, of HQ and NQ. Hole CAU006R was drilled to 150 m as a vertical rotary hole. Drill hole collar locations were determined by handheld GPS measurements. Drill hole locations are shown in Figure 9.1.

Diamond drill holes were planned to depths of 200 to 250 m. However, problems related to poor quality drill casing provided by the contractor and the arrival of the wet season led to the termination of the program and abandonment of holes CAU003D and CAU004D, without reaching the planned target depths. A summary of the drilling details are provided in Table 9.1 below.

Diamond drilling was carried out with Lexan (plastic) tubes in the core barrel in place of a split triple tube drilling system. Where possible drilling was carried out “dry” that is without injecting water, with the in-situ formation water providing the necessary lubrication for drilling. Water was however, used during the installation of casing and flushing of sediment from the hole.

The drilling fluid consisted of brackish water to brine with additives to aid drilling in the unconsolidated sediments. The drilling fluid was sourced from a pit providing brackish water near the access track upslope of the salar salt pan. Pits at drill sites in the salar dug to 3 m were dry or yielded insufficient inflows to provide water for drilling.

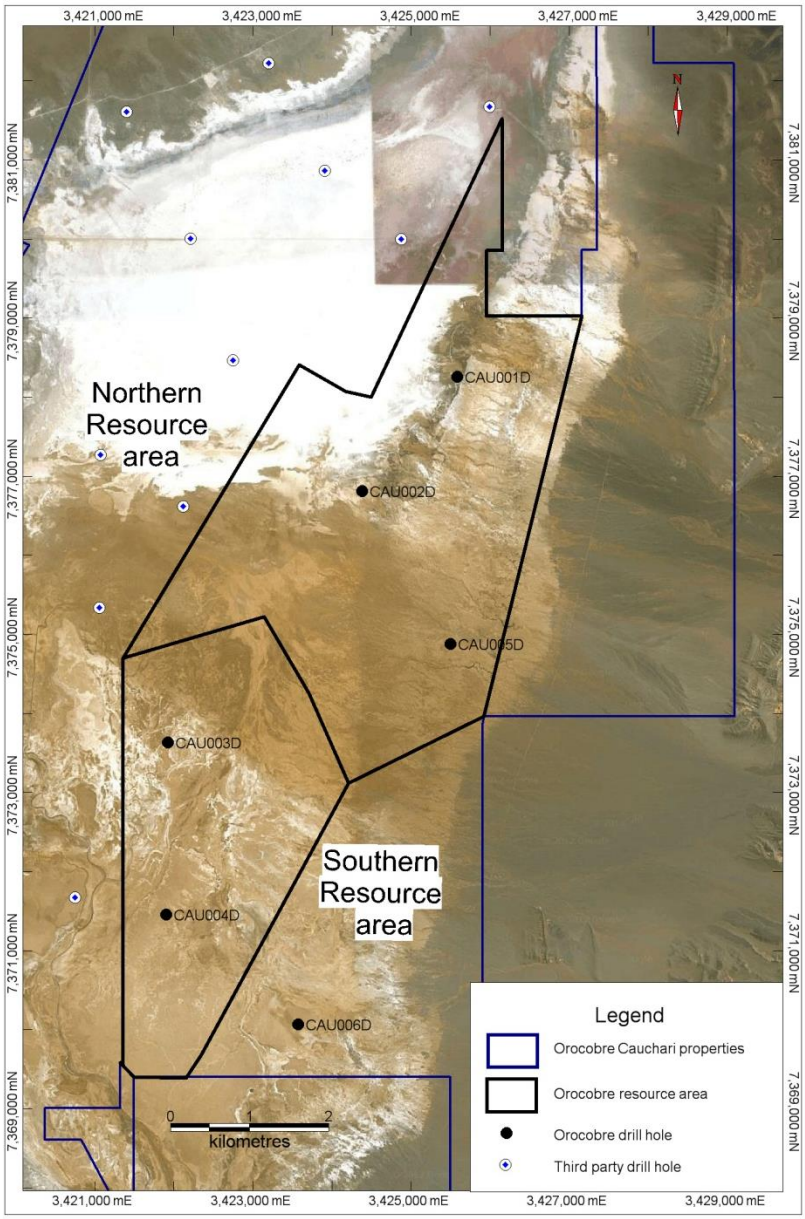


Figure 9.1 Diamond hole locations and third party hole locations

Hole	Easting_GK3	Northing_GK3	Z_Altitude	Azimuth	Dip	Total Depth m	Source
CAU001D	3425595	7378254	3940	0	-90	249	HandHeld GPS
CAU002D	3424384	7376813	3940	0	-90	189	HandHeld GPS
CAU003D	3421872	7373648	3940	0	-90	72	HandHeld GPS
CAU004D	3421905	7371451	3940	0	-90	47	HandHeld GPS
CAU005D	3425501	7374878	3940	0	-90	168	HandHeld GPS
CAU006D	3423532	7370126	3940	0	-90	150	HandHeld GPS

Table 9.1: Coordinates, dip and azimuth of project drill holes

To evaluate whether samples taken showed any evidence of contamination from the drilling fluid used for casing installing, fluorescein, an organic tracer dye, was added to the drilling fluid used during casing installation (and occasionally drilling). Recognition of this bright red dye in samples provided evidence of contamination from drilling brine. As a check on the results of brine samples, collected with bailers during drilling, samples were also obtained by extracting brine contained in drill cores. Brine from the drill core pore spaces was extracted and analysed by the Independent British Geological Survey laboratory and compared with the bailed samples (see Section 10).

9.2.2 Interpretation of drilling results – Geological logging

Core recoveries were variable during drilling, with an overall core recovery of 76%. The core recovery is generally better in clay, silt and halite which, while undergoing some dissolution during drilling, generally remained as coherent sticks of core. Less consolidated salar units, such as sand, showed poorer recoveries. Sand caused some jamming of the inner core tube within the core barrel. This often required the rods to be retrieved from the hole to clean the core barrel.

On site SAS geologists undertook a brief geological description of the core. This was followed by detailed geological logging of the drill core, where the lexan tubes were split open and the lithologies described in depth. Geological units encountered include sand, silt, clay and halite with some ulexite (borate), with significant intervals recorded as no recovery/lost core.

HoleID	Drilled m	Recovered m	Lost m	% Recovery
CAU001D	249	188.3	60.7	75.6%
CAU002D	186	128.4	57.6	69.0%
CAU003D	71.5	57.5	14.1	80.3%
CAU004D	46.5	35.8	10.8	76.9%
CAU005D	168	137.9	30.1	82.1%
Total overall	721	547.8	173.2	76.0%

Table 9.2 Diamond drilling hole depths and recoveries
Note these holes include intervals drilled by tricone

9.2.3 Interpretation of drilling results – Geophysical logging

Natural gamma, gamma-gamma, neutron and sonic geophysical logs were run in the diamond holes by Wellfield Services Limitada, a specialized geophysical logging contractor. Geophysical logs were measured in five of the six Cauchari drill holes (CAU004D did not have any casing to allow logging – see below)

The geophysical logs were run within the steel casing of drill holes, prior to removal of the casing. In the poorly consolidated salar sediments it is necessary to log holes within casing, to prevent collapse within the holes. The steel casing does not prevent effective geophysical logging with the tools used. Electronic data is recorded continuously; with centimetre spaced measurements taken down hole.

Natural gamma logs measure the gamma rays emitted from the formation surrounding the geophysical logging tool. Gamma rays are emitted by minerals containing potassium, thorium and uranium, consequently they generally have a higher response with clay minerals. Possible volcanic tuffs have been recognized in the Cauchari core.

Neutron logs are tools which measure hydrogen ions in the formation at different distances from the logging tool, of which two are used with a different spacing. This results in different penetration distances from the logging tool, measuring what is referred to as “near” and “far” data. As the hydrogen ion concentration is principally determined by the water content of the pores these logs provide very useful continuous information on water content. These logs are used to generate a porosity log, which can be related to laboratory porosity data, and “calibrated” to show porosity throughout drill holes.

Density logs emit and receive gamma rays and are used to measure the bulk density of rocks and pore spaces. This logging tool can be used for lithological identification on this basis, as the bulk density depends on minerals in the sediments and the porosity.

The geophysical logs together with geological logs of the recovered material provide the basis of the geological interpretation of the subsurface and an evaluation of porosity, prior to detailed laboratory porosity testing. Based on the geophysical log data a density and porosity measure have been calculated automatically. However, it should be noted these measures shown in the geophysical logs are not calibrated and correlation with actual laboratory porosity and density measurements is required to adjust these measures to reflect the real total porosity.

9.2.4 Well head installation

Monitoring wells were installed within the holes drilled, with the exception of hole CAU001D, which developed a weak artesian flow. Drilling suggested this artesian zone is in the lower part of the hole and it was decided not to install a monitoring well in this hole. Holes were capped with threaded caps to control access to the wells.

9.3 Porosity sample program design and sampling

Lithological samples were recovered by drilling HQ or NQ core. When cores were recovered to surface the lexan tube was pumped from the core barrel using water and a plug separating tube and water. Upon release from the core barrel tight fitting caps were applied to both ends of the Lexan tube. The tube was then cleaned, dried and labeled. The samples for porosity testing consisted of a 20 cm section of core for porosity testing and brine extraction by the Independent British Geological Survey laboratory in the United Kingdom and an adjacent 10 cm section of core for testing of total porosity in the Company’s own Salta office. The BGS laboratory is temperature-controlled and offer services compliant with the requirements of BS EN ISO 9001 quality standards. The company’s Salta laboratory is not a certified laboratory and was used only for total porosity measurements.

These samples were cut from the deeper end of the Lexan tube, capped tightly and wrapped with duct tape, to minimize the possibility of brine leakage from samples. The deeper end of the core is less likely to be contaminated by water used to pump out the core barrel or during

drilling and is less likely to be modified by drilling as it has a shorter residence time in the Lexan tube.

Of the porosity samples taken:

- A total of 176 samples were analysed by the Independent British Geological Survey (BGS) laboratory for total porosity and specific yield from 5 core holes drilled in 2011. Of these a total of 160 were in condition to be tested (13 of these were subsequently discarded, as samples appeared to have partially dried prior to analysis).
- A total of 164 samples from 5 core holes were analysed for total porosity in the Company's own Salta office laboratory.
- The samples analysed by the BGS had an average spacing of 4 m.
- The samples analysed in the Company's own Salta laboratory also had an average spacing of 4 m.

9.4 Fluid sampling program design and methodology

Fluid (brine or brackish water) sampling was undertaken by sampling diamond holes with a bailer during drilling and by extraction of brine from pores within core samples subsequent to drilling, to compare the sampling methods and results as follows:

9.4.1 Diamond hole bailer sampling

During diamond drilling sampling was undertaken with a steel bailer in the diamond drill holes. Samples were taken every 3 metres. The frequency of sampling was decreased to 1.5 m metres in CAU001D, to obtain additional information on variations in brine concentration.

Once the rods were drilled 3 or 6 metres to take a sample, the casing was reamed into position 3 meters above the base of the hole. The drill rods were then lifted 1.5 metres, so that the bailer reached the back of the drill bit and did not stir up sediment from the lower 1.5 m of the hole into the sample. At times, due to hole conditions, it was necessary to vary the position of the casing with respect to the end of the hole. Fluid sampling during the drilling process was carried out using a steel single valve bailer with a capacity of 30 litres.

9.4.2 Diamond core brine extraction

The second sampling methodology with the diamond drilling involved the use of a centrifuge by the Independent British Geological Survey (BGS) laboratory to separate brine from the host porous sediment samples cut from the base of the Lexan tubes. The details of the sample preparation and analysis are provided in Section 10. Samples were collected at the base of intervals that correspond to bailed brine samples, in order to evaluate the correlation between samples.

9.4.3 Monitoring well installation

It was originally planned to install monitoring wells in drill holes, to enable low flow sampling as an additional means of checking the results of bailed samples and brine from core extraction. Monitoring wells were installed in holes CAU002D, CAU003D, CAU004D and CAU005D. A monitoring well was not installed in CAU001D, due to weak artesian flows originating from deep in this hole.

9.5 Fluid sampling protocols

As discussed above fluid samples were collected by bailer. Prior to bottling, the bailed sample was transferred to a bucket, which had been rinsed with the same brine as the sample. When necessary fine sediment was allowed to settle in the bucket before the fluid sample was transferred from the bucket to two virgin, unpreserved 1 litre plastic bottles. The bottles were rinsed with the fluid, and then filled, with additional fluid added to bring the fluid level to the top of the bottle removing any airspace. Bottles were labeled with the hole and sample depth with permanent marker pens, and labels were covered with transparent tape, to prevent labels being smudged or removed. Samples with fluorescein contamination were noted at this point and except in specific circumstances these were not sent for laboratory analysis, due to the interpreted sample contamination.

A volume of the same fluid as the bottled sample was used to measure the physical parameters. These included density (with a picnometer), temperature, pH, Eh and in some samples dissolved oxygen. Details of field parameters were recorded on paper tags, which were stuck to the bottle with transparent tape when completed with sample information.

The bottles were capped and transferred to the field camp, where they were stored in an office out of direct sunlight. Where samples were turbid with suspended material they were filtered to produce a 150 ml sample of filtered water for the laboratory. Before being sent to the laboratory the 150 ml bottles of fluid were sealed with tape and labeled with a unique sample ticket number from a printed book of sample tickets. The hole number, depth, date of collection, and physical parameters of each sample number were recorded on the respective pages of the sample ticket book and in a spreadsheet control of samples. Photographs were taken of the original 1 litre sample bottles and the 150 ml bottles of filtered water, to document the relationship of sample numbers, drill holes and depths.

Samples for analysis were transported to the Company's Salta office, from which they were sent by Courier to the Alex Stewart (Assayers) Argentina (ASA) laboratory in Mendoza. The unused sample was stored at the camp for future reference. Laboratory standards, uncertified standards and duplicate samples were inserted in the sample batches prior to sending to the laboratory.

Primary fluid samples from diamond drilling bailer sampling were submitted to Alex Stewart laboratories in Mendoza. In addition, standards and duplicates were sent with the diamond hole samples.

9.6 Drill hole brine sampling supervision

Sample collection at Cauchari was conducted by SAS geologists, who also conducted the on-site geological logging of the drill cores. Brine samples were collected from the sample bailer in a 10 litre bucket. Measurements of the brine were made immediately following the sampling, for pH, Electrical Conductivity (EC), Temperature, Total Dissolved solids, dissolved oxygen (as mg/l and %) and density.

9.7 Sample security

The 150 ml samples were transported by company vehicle to the company office in Salta. From the company's Salta office the samples were sent by courier to the Alex Stewart laboratory in Mendoza. A sample list, analytical instructions and details of the person submitting the samples was sent to the laboratory by email.

The reference of the sample tag number to the drill hole and depth was maintained in the project database and in hard copy documentation. Photographs of sample batches were taken as an additional sample control.

10 SAMPLE PREPARATION, ANALYSES AND SECURITY

10.1 Porosity samples

10.1.1 Core sample collection, handling and transportation

Lexan core samples 10 cm long were taken from the base of lexan tubes every 3 metres for processing in the Company's* (South American Salars) Salta porosity laboratory. This not a certified laboratory, and was only used for total porosity measurements. All chemical assays of brines were completed by the independent Alex Stuart laboratory in Mendoza, Argentina and checked with another independent chemical laboratory. An additional 20 cm long lexan tube was taken immediately above the 10 cm tube every 3 m during drilling. These sections of lexan core were cut immediately following recovery of the core from the core barrel. The 20 cm cores were fitted with tightly fitting caps, sealed with tape and labeled for shipment to the BGS laboratory.

The lexan tubes were packed inside PVC tubes with respective lengths of 10 or 20 cm, to prevent damage and exposure to sunlight during transportation. The PVC outer tubes had tightly fitting PVC caps labeled in permanent pen. A register of samples was compiled at the camp site to control transportation of samples to the Company's Salta office.

Samples were sent from the Company's Salta office to the Independent British Geological Survey by DHL international courier service, with up to 10 cores per box. The PVC core tubes containing the samples were placed upright in boxes and shredded paper or polystyrene balls were used to fill the boxes and prevent samples moving during transportation. Cores from holes were spread over several shipments to the BGS to guard against the possibility of major sample loss from any one hole.

10.1.2 Total porosity analysis in Salta

Lexan Cores were received in the Company's Salta office and checked against the list of samples sent from the field office. Samples were then removed from the PVC casing and weighed accurately, before extraction from the lexan tube. The sample volume was added to a weighed aluminium baking tray and dried in an oven at 45^{o}C for a period of up to 216 hours. During the drying process weights were monitored and recorded approximately every 12 hours. As the sample volume is known, together with the weight difference over the drying period the total moisture content is used to calculate the sample total porosity.

The oven was maintained at a temperature of 45 degrees, as temperatures over 60^{o}C can convert gypsum to anhydrite, with a corresponding loss of water which would incorrectly influence the calculation of total porosity. There is the possibility that salts will precipitate during the drying process. A calculation methodology for salt precipitation was developed by J. Houston for cores during work undertaken at Olaroz. This methodology was used to calculate a corrected precipitation as well as uncorrected total porosity. However, thin sections of cores to evaluate salt precipitation would be required to validate that the correction used at Olaroz is directly applicable at Cauchari. Thin sections at Olaroz (Houston, 2011) suggested that no significant precipitation occurred following sampling.

The samples were broken into groups based on their lithological descriptions (Figure 10.1). It was noted that there is often a significant amount of clay interbedded with halite, giving the halite a red colour and dirty appearance. The clay content of some halite cores results in some relatively high Pt values for these cores. Halite described as compact (which can contain some fine clastic sediment) shows lower Pt values than weakly and moderate to highly porous halite, the latter category being difficult to characterize with the methodology used, due to the significant cavities present in the halite. Sand samples (Figure 10.1) show a

bimodal distribution, with the lower porosity samples containing significant halite cement, compared to the higher porosity samples.

Samples analysed in the Company's Salta laboratory show the highest total porosities (Pt) for clay, with lower total porosities for silt, clay or silt with halite and for sand. Halite units with a compact texture show a spread in Pt values from 0 to 12%. Halite with moderate to high porosity shows Pt values up to 42% (Shown on a scale of 0 to 1 in Figure 10.4).

10.1.3 Core sample analysis at the BGS laboratory – Wallingford UK

~~S~~ome of the halite cores with porous textures may have been damaged during transportation, due to the brittle nature of this core. Since excessive core handling will modify the physical structure of the core and affect porosity and drainage measurements, it was important to keep core handling to a minimum.

Once the cores were received at Independent British Geological Survey laboratory in Wallingford the core samples were opened and checked against an accompanying manifest. A quick visual inspection was made by the geologist/hydrogeologist undertaking the lithological logging (see section below for a description of sampling) prior to any detailed lithological logging and photography of the core. Samples were encapsulated in semi-rigid Lexan core liners which themselves were contained in thicker more rigid PVC tubing.

Sample cores (typically of 20cm length) were received with taped, sealed end-caps. Three core samples of approximately 6cm length were cut with a diamond trim saw. Two of these were then resealed in modified end caps before being sub-sampled using specially designed cutting rings seated on 35mm id (38mm od) lexan core sleeves. Two duplicate samples were trimmed using a diamond trim-saw to typically 5cm long and photographed. The samples were then resealed with silicone rubber end caps prior to testing.

Material from the remaining core (length 6cm) was removed and pore water from the centre of the core was extracted by centrifuge. Material from the outer parts of the core was discarded to avoid pore water contamination from drilling fluids.

Samples for hydraulic testing (moisture content drying, porosity and specific yield measurements) were tested in the Aquifer Properties Laboratories at BGS, Wallingford. Samples for pore fluid chemical analysis were analysed at the BGS, Nottingham laboratories.

Samples were analysed with a regular sample spacing, where core recovery permitted. In a number of cases two analyses were carried out on units of coarse sand, to evaluate variability in this lithology.

Sample lithological description followed methods used for BS5930 Engineering Geology standards by one of BGS's geologists. The aim of the sample lithological logging was to characterize variations in lithology and, where possible, to identify any lithological boundaries within the core. Lithologies were coded as 1. halite, 2. sand, 3. silt and mixed lithologies and 4. clay.

Moisture Content (drying) determination

One set of sample plugs was tested for moisture content drying as undertaken on-site in Argentina but using conventional ovens at 60^{o}C in the BGS lab. One other set of plugs were dried in preparation for other testing. Samples were weighed at daily intervals at the start of the process and weekly intervals thereafter until weights did not vary by more than 0.02g.

Calculations are performed to express moisture content as a percentage of sample original wet weight and its dried weight after taking account of the weight of the lexan tube.

Porosity by liquid resaturation

Effective porosity (not measured at Cauchari), bulk density and grain density are measured using a liquid resaturation method based on the Archimedes principle. A sample to be tested (plug or rock fragment) is dried, weighed and then placed in a resaturation jar. The jar is emptied then flooded with saturant. If samples are dry then propanol can be used as it is relatively inert with respect to the core and in particular reduces the potential for swelling clays to modify the porosity during testing.

Where wet, the samples were resaturated with simulated formation brine. The sample is allowed to saturate for at least 24 hr. The saturated sample is then weighed, firstly immersed in the saturant and then, still saturated, in air. For each sample, a record is made of dry weight (w), saturated weight in air (S1) and saturated weight immersed in saturant (S2). The density of the saturant (ρ_f) is also noted using a hygrometer or calibrated density bottle. From these values, sample dry bulk density (ρ_b), grain density (ρ_g) and effective porosity (ϕ) can be calculated as follows:

$$\rho_b = (w\rho_f)/(S_1\text{-}S_2)$$
$$\rho_g = (w\rho_f)/(w\text{-}S_2)$$
$$\phi = (S_1\text{-w})/(S_1\text{-}S_2)$$

For halite samples the solubility in isopropanol (IPA, Propan-2-ol) is used. A solubility of approximately 0.01% w/w is low (solubility in pure water is 3600 times greater). There is more significant potential for measurement inaccuracy due to sample friability and handling.

An estimate of halite precipitation in pores entails measuring the weight of solid (largely NaCl) extracted in a portion of the IPA at the end of the test after evaporating the solvent. A dissolution correction could then be applied.

The effective errors on the porosity measurements of consolidated samples are approximately ±0.5 porosity %. For encapsulated semi-and un-consolidated samples this is more likely to be ±2.0 porosity % which is due to uncertainties about fluid stored in the annulus between the solid sample and sleeve. Sample results are shown in Figure 10.2.

Specific yield determination

Specific yield is measured using a centrifugation technique. There are various methods available to determine specific yield in the laboratory, however, the centrifugation technique allows relatively rapid determination of this parameter and can be considered a standard technique. The same samples used in the porosity and permeability measurements can be tested.

In this method samples are saturated with simulated formation brine and weighed (w1). They are then placed in a low-speed refrigerated centrifuge (MSE Harrier 18/80) with swing out rotor cups and centrifuged at c. 1200 rpm for two hours (this takes into account the particular centrifuge rotor dimensions). They are then removed from the centrifuge and weighed for a second time (w2).

A centrifuge speed is selected to produce a suction on the samples equivalent to 3430 mm H_2O. This suction is chosen as it had previously been used by Lovelock (1972) and Lawrence (1977) and taken to be characteristic of gravitational drainage. Most samples are spun for 2 hours although samples have been tested for varying durations up to 14 hours in

order to investigate the effect of time and repeated sample handling. Lovelock (1972) and Lawrence (1977) have shown that, for example, for a wide range of sandstones, drainage was complete after 2 hours. This has also been found to be the case for subsequent tests on other samples. Results are presented in Figure 10.3. A comparison of sample Pt measurements to literature values is shown in Figure 10.4.

Specific yield is then calculated as follows

$$S_y = (w_1 - w_2) / AL$$

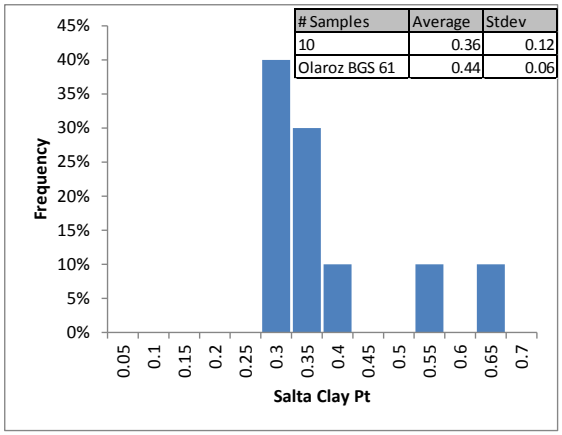
Where A is sample area and L is sample length.

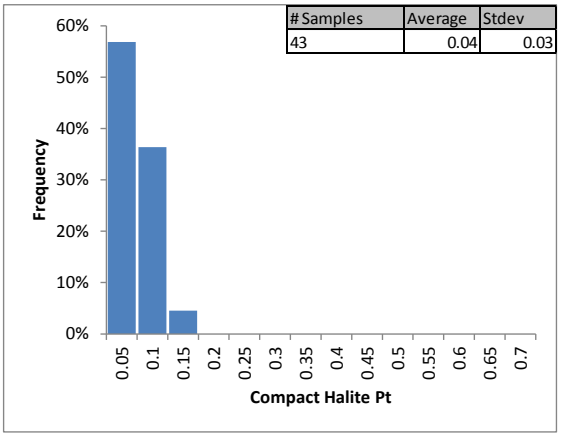
10.1.4 Porosity QA/QC procedures

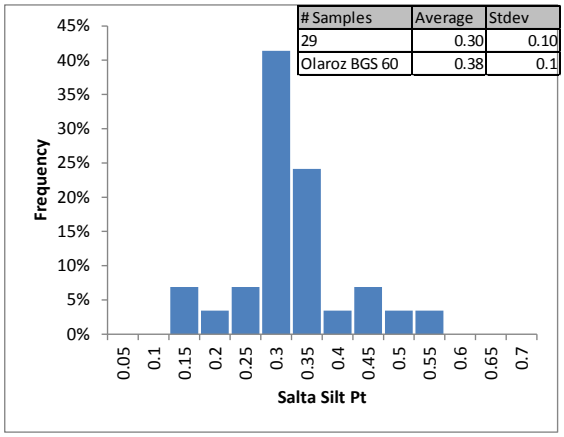
Values of total porosity from samples analysed by the BGS and those analysed in the Company's Salta laboratory were plotted to assess differences between the two laboratories.

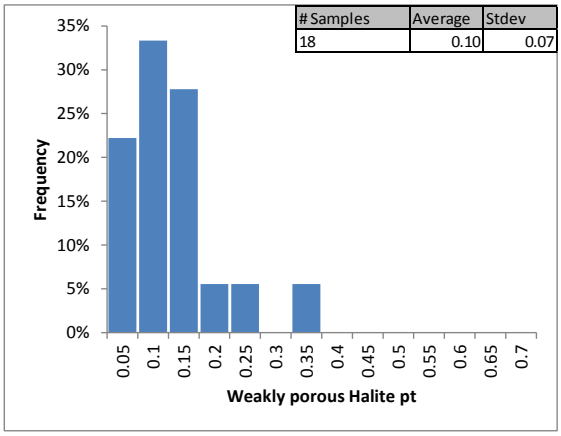
The difference between the results may reflect a number of factors including the differences in sample size used for the analyses, the difference in the sample location (by up to 30 cm) and corresponding differences in lithology and analytical errors. When Pt values from the Company's Salta laboratory and the independent BGS laboratory are plotted as a scatter plot (Figure 10.5, with samples showing significant differences in lithology removed from the comparison), these show a broadly 1:1 relationship, with a broad scatter and a slight tendency for BGS Pt values to be higher for compact halite samples and lower for clay samples. Overall the spread is likely to reflect differences in lithology between samples on a scale of up to 30 cm.

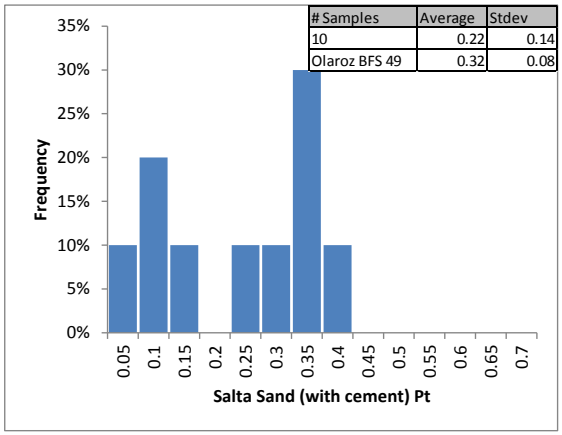
Repeatability of laboratory measurements at the BGS was assessed by conducting two tests on samples of coarse sand, shown in Table 10.1.

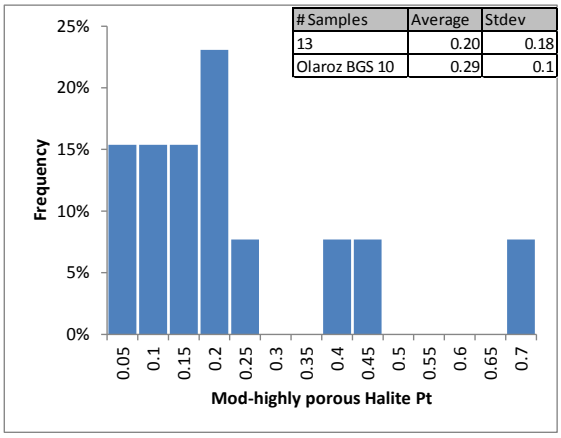












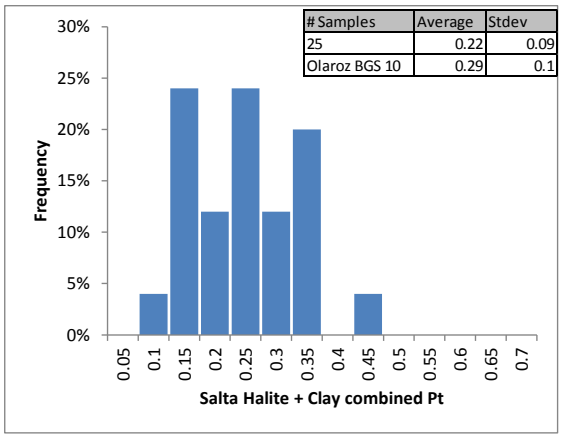
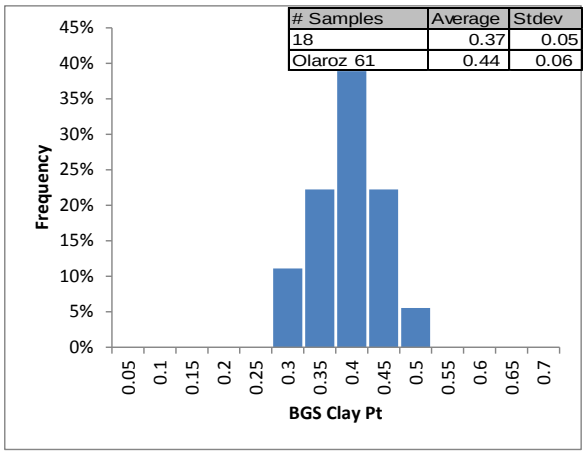
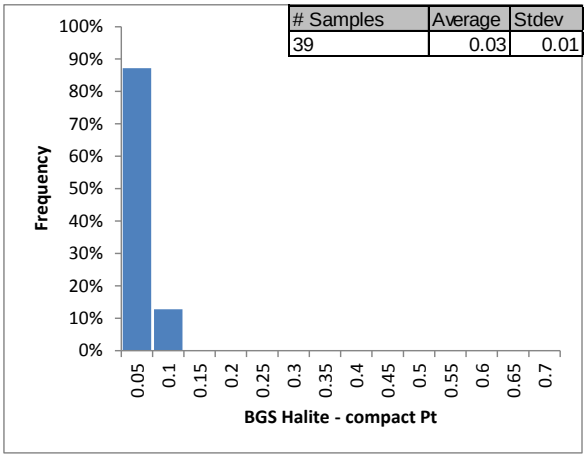
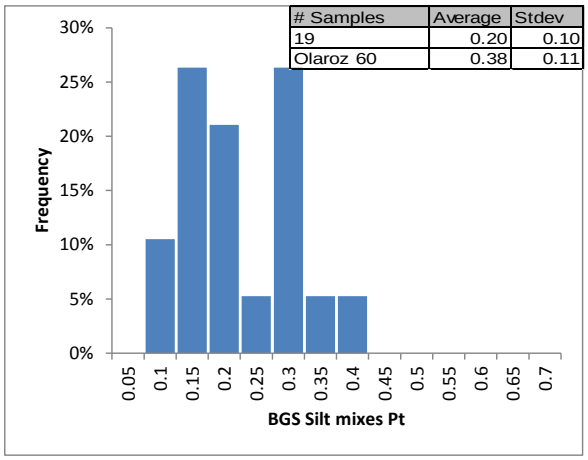
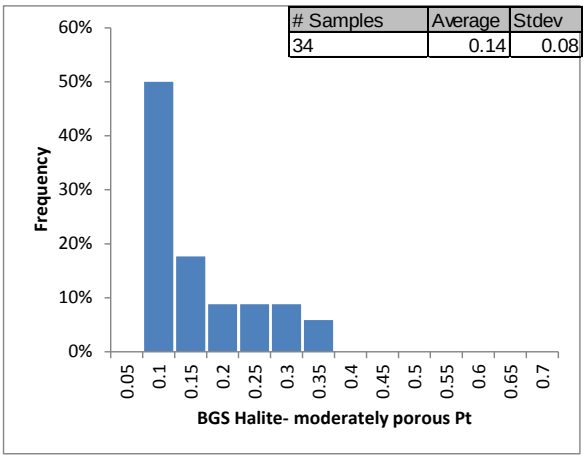


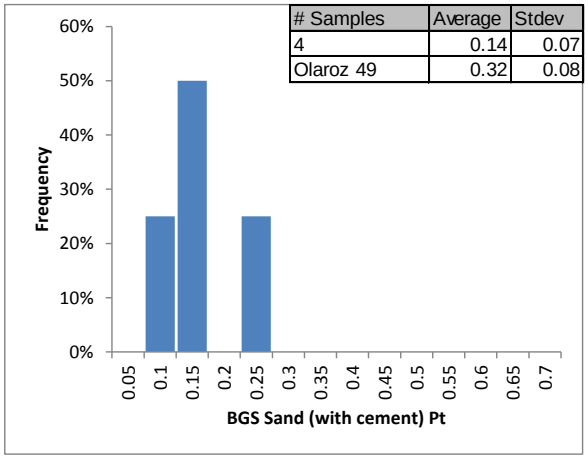
Figure 10.1 Cauchari total porosity measurements (Pt) – Company's Salta Laboratory

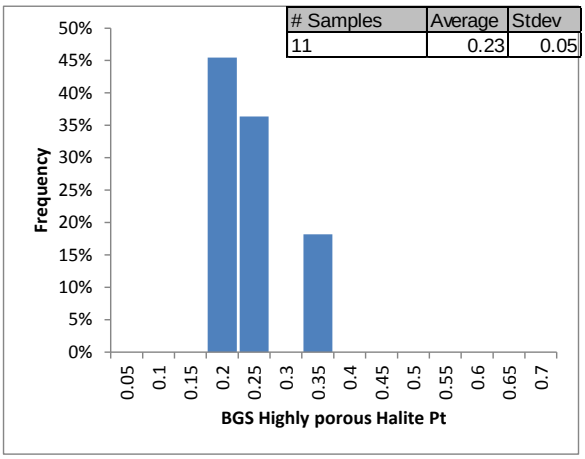












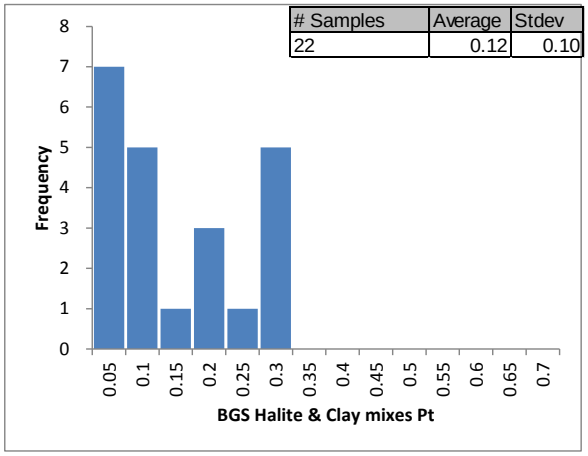


Figure 10.2 Cauchari BGS total porosity measurements

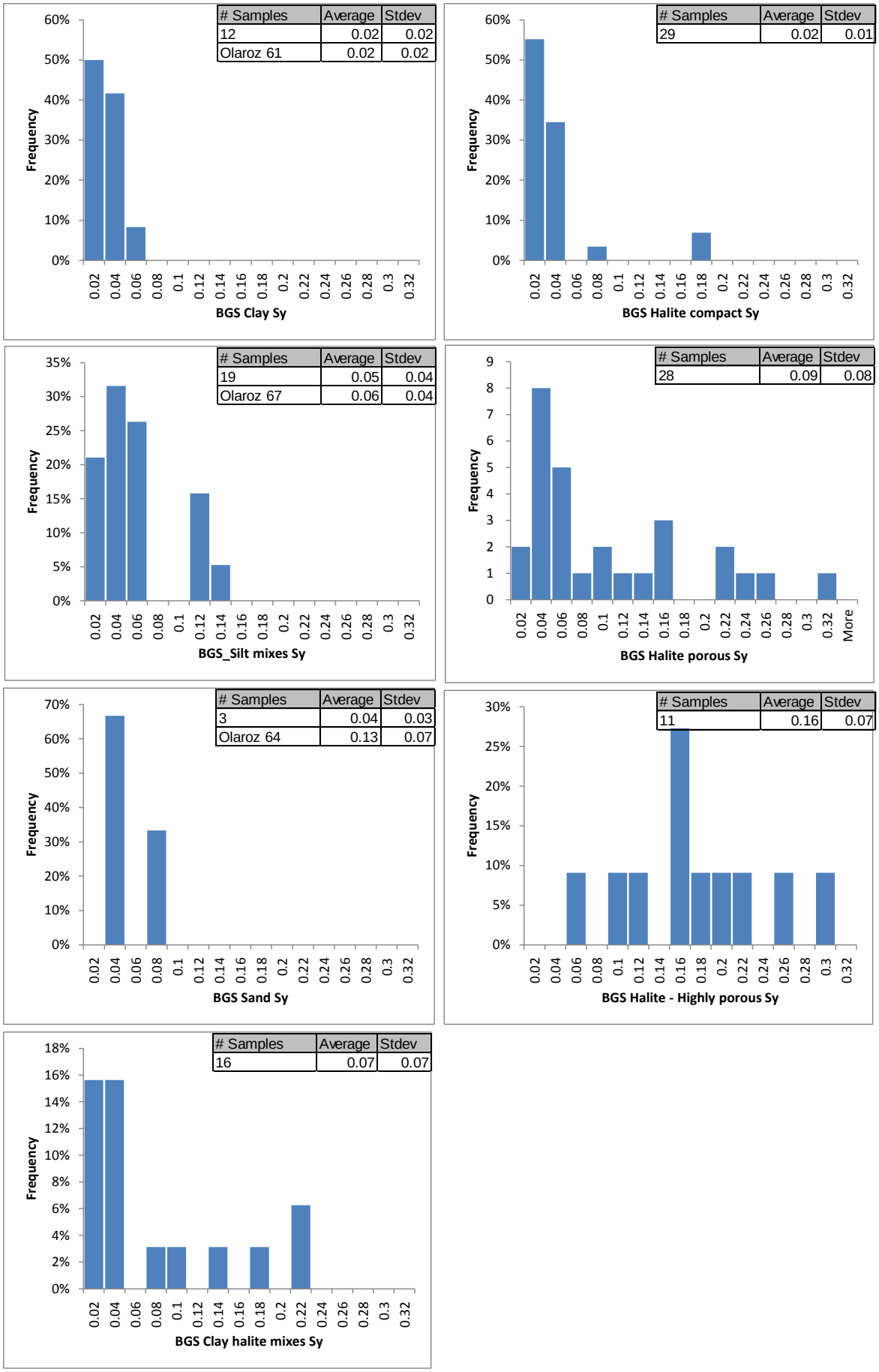


Figure 10.3 Cauchari BGS specific yield measurements

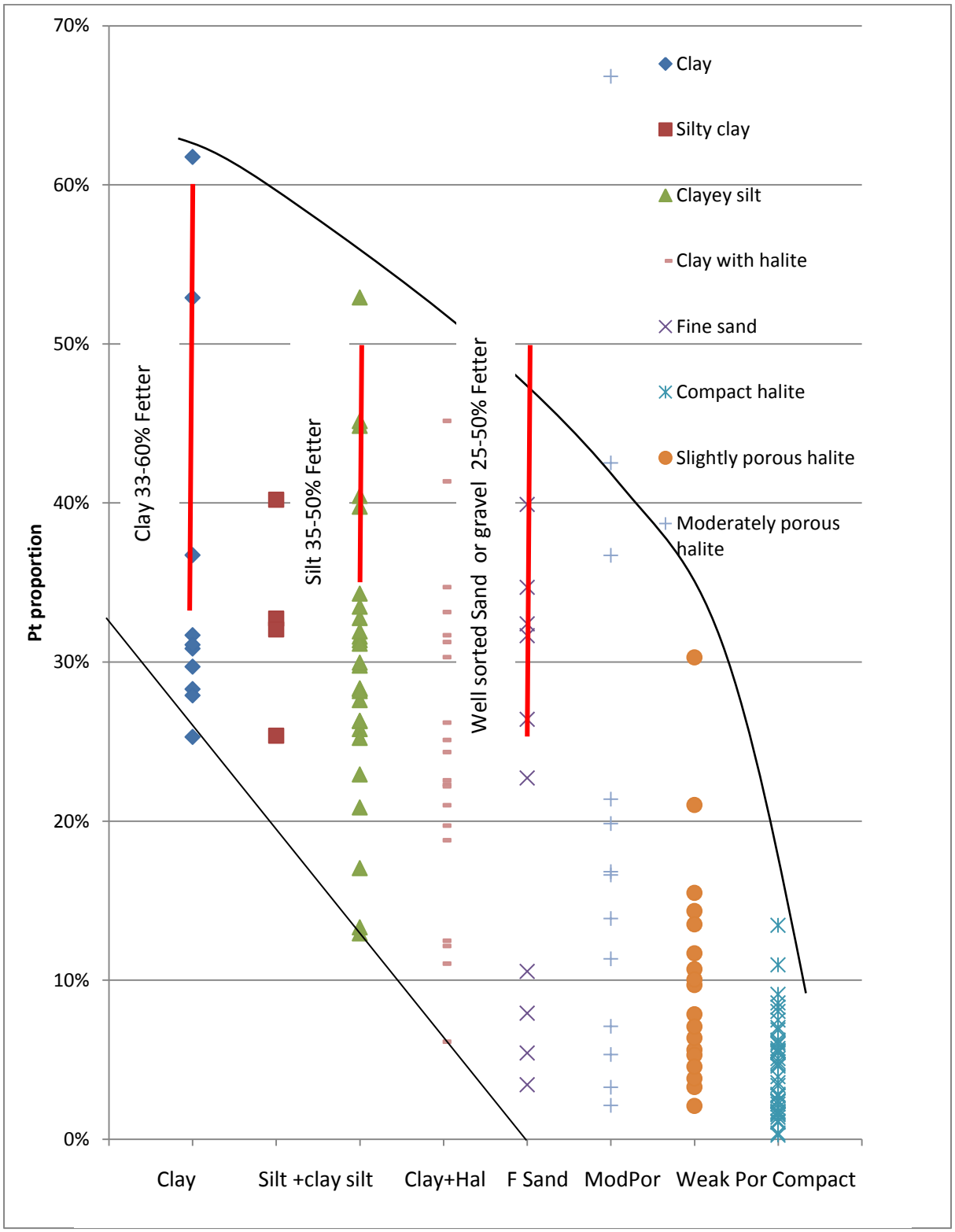


Figure 10.4 BGS total porosity data by lithology type, compared with literature values
Note that the silt mixes can contain both clay and sand, hence the broad range of this lithology type. Reference values used are from Fetter (1994)

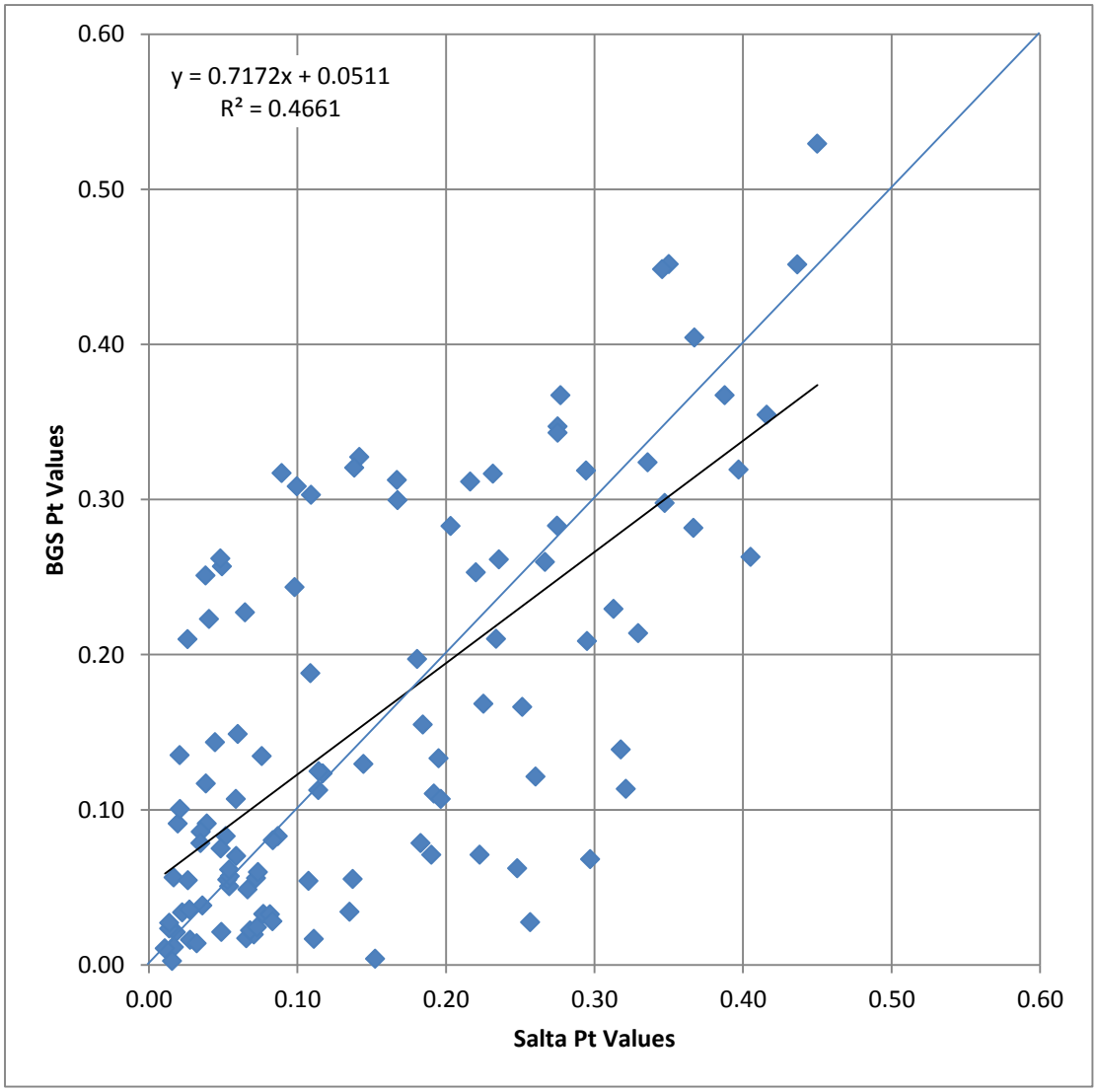


Figure 10.5 Comparison of Independent BGS and Company Salta laboratory values for total porosity

Hole	Depth m	Sy	Pt
CAU001D	**145.2**		3.9%
CAU001D	**145.2**	1.5%	1.9%
Average		1.5%	2.92
Std Dev			1.38
RSD%			47%
RPD%		0%	67%
CAU001D	**151.2**		14.2%
CAU001D	**151.2**	22.5%	23.0%
CAU001D	**151.2**	11.1%	13.6%
Average		16.8%	16.93
Std Dev		8.1%	5.27
RSD%		48.2%	31%
RPD%		68.2%	56%
CAU002D	**65.8**	4.0%	8.7%
CAU002D	**65.8**	2.8%	5.2%
Average		3.4%	6.94
Std Dev		0.9%	2.47
RSD%		26.2%	36%
RPD%		37.0%	50%

Table 10.1 BGS repeat sampling of coarse sand units

10.1.5 Porosity data by lithology

The relationship of total porosity and specific yield values has been evaluated by comparing values within the simplified classifications of clay; silt mixes; sands; halite-clay/silt mixtures; compact halite and slightly to moderately porous halite – with halite forming the predominant lithology encountered during drilling. Histograms were plotted to evaluate the statistical distribution of porosity values. A summary of the data is provided in Table 10.2. The scatter graph (Figure 10.4) shows the distribution of total porosity values by lithology, compared to data from Fetter, a standard industry text.

		Salta Lab		BGS Lab				Olaroz BGS Data			
# Samples Pt/Pt/Sy	Lithology	Pt %	St Dev %	Pt %	St Dev %	Average Sy%	Std Dev %	Average Pt %	Std Dev	Average Sy	Std Dev %
10/18/12	Clay dominant	36%	12%	37%	5%	2%	2%	44%	6%	2%	2%
29/19/19	Silt and mixes	30%	10%	20%	10%	5%	4%	38%	11%	6%	4%
10/4/3	Sand dominant	22%	14%	14%	7%	4%	3%	32%	8%	13%	7%
25/22/16	Halite sediment mixes	22%	9%	12%	10%	7%	7%	29%	10%	4%	2%
43/39/29	Compact halite	4%	3%	3%	1%	2%	1%				
18/34/28	Porous halite	10%	7%	14%	8%	9%	8%				
13/11/11	V porous halite	20%	18%	23%	5%	16%	7%				

Table 10.2 Average BGS porosity (by liquid resaturation) and specific yield (by centrifuge), classified by lithological type (Olaroz results from Houston, 2010a)

10.1.6 The relationship of Sy sample determinations to down hole logs

John Houston has previously outlined a methodology for relating neutron logs – corrected for the hole diameter – to physical porosity measurements made on core at Olaroz. The intention for this project was to follow this methodology. However, most of the drill holes do

not have geophysical logs for their full depths, due to the loss of drilling equipment within the holes.

Analysis of the drill hole lithological samples further shows there is a bimodal population with respect to Pt and Sy values, with halite samples and clastic samples. There is a dominance of halite samples, with generally low values of Pt and Sy, but with some highly porous halite samples, and a mixture of samples with clastic sediment and halite.

A conditional algorithm relating Sy and Pt can be defined (Figure 10.6); however there is a problem with non-uniqueness, as a certain Pt value could correspond to a low Sy clastic sample or a higher Sy halite sample. A single linear algorithm could be used to relate Sy and the Neutron Pt values. However, an alternative method is to apply the algorithm best fitting halite to the halite dominated lower unit and the algorithm best fitting finer grained clastic units to the overlying clastic unit. This modified approach to defining Sy values for drill intervals has been applied to each drill hole.

Sy values for silts and clays are similar to that defined in the Olaroz and Salinas Grandes salars. Sy values for sands and halite sediment mixes are lower than defined at Olaroz, probably due to halite cementing of sediments. Similarly Pt values for all lithological units are lower than measured in Olaroz, which is thought to reflect halite cementation of units at Cauchari.

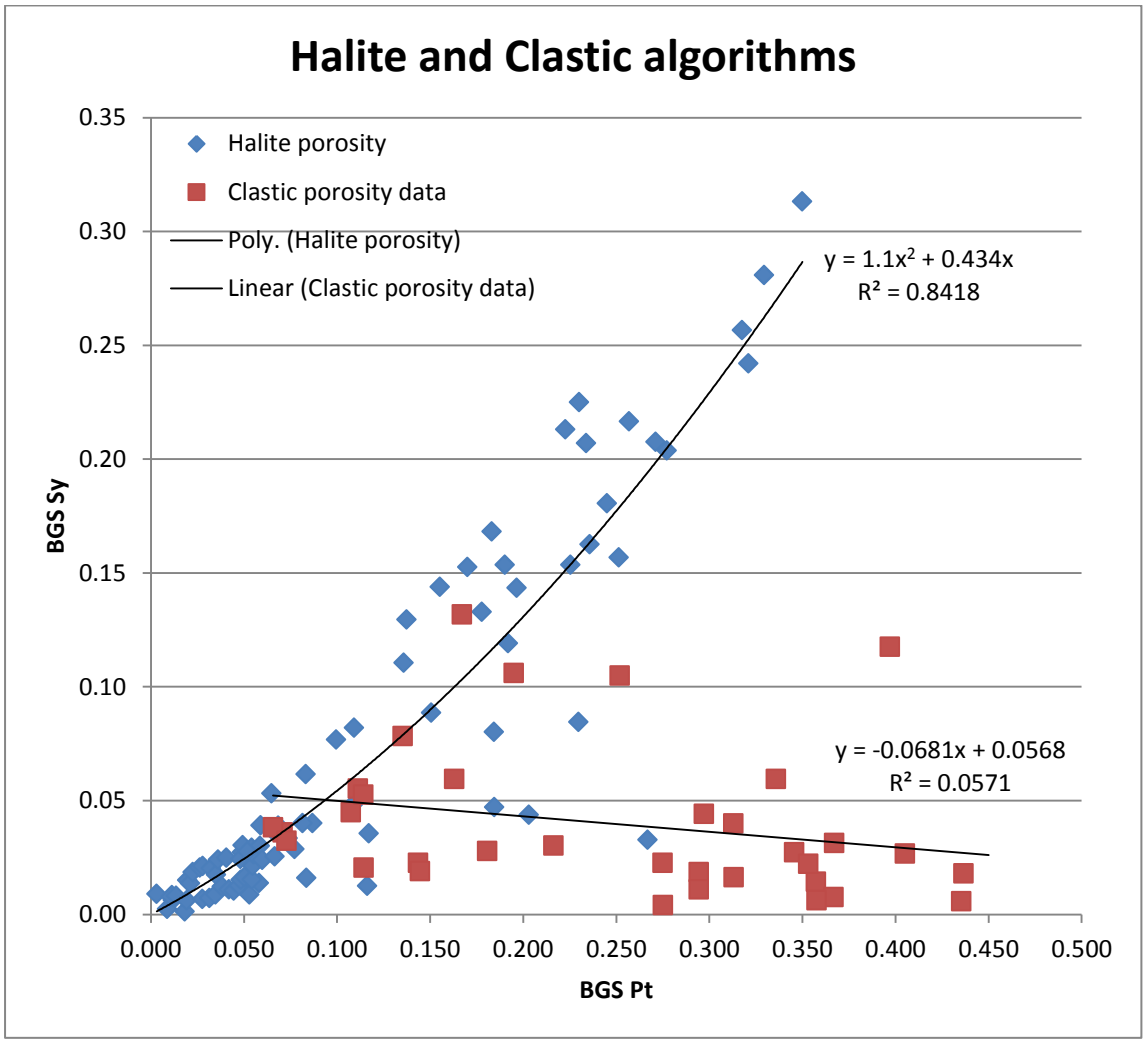


Figure 10.6 Algorithm for halite and clastic sediments

10.1.7 Summary

Evaluation of porosity data has shown the BGS total porosity and specific yield data to be similar to those of other salar projects and the BGS Sy data has been applied to the resource estimation. However, it is noted that the halite sediment mixtures show considerable variation in Pt and Sy values, as do the more porous examples of halite.

10.2 Fluid chemistry sample analysis - Diamond and auger drilling bailed samples

10.2.1 Sample preparation

The field parameters of fluid samples were measured at the drill site, with density, pH, electrical conductivity, temperature and Eh measured and recorded for samples. Samples were gravity filtered at the field camp and a 150 ml sample bottle was sent to the laboratory, identified by a unique sample number from a printed sample booklet. Samples were generally sent to the laboratory in lots of 10 to 30 samples, with standard and duplicate samples inserted into the sequence of samples.

10.2.2 Sample analysis – Alex Stewart laboratories

The drilling samples from the Cauchari salar were analyzed by Alex Stewart Assayers (ASA) of Mendoza, Argentina. Alex Stewart laboratories have extensive experience analyzing lithium bearing brines. The Alex Stewart Mendoza laboratory is ISO 9001 accredited and operates according to Alex Stewart Group standards consistent with ISO 17025 methods at other laboratories. Samples were analyzed for metals at Alex Stewart laboratories using the Inducted Coupled Plasma spectrometry (ICP) method. Certificates of analysis and excel data sheets were received by SAS personnel and checked against sample chain of custody forms, assigning sample depth and hole number data to the analytical data. Samples were imported to a project database by the database administrator, using validation criteria to ensure consistency in the format of data loaded to the database.

Table 10.3 lists the suite of analyses requested from Alex Stewart Laboratories. The laboratory uses methods based upon American Public Health Association (APHA), Standard Methods for Examination of Water and Wastewater, Environmental Protection Agency (EPA), and American Society for Testing Materials (ASTM) protocols. Determination of lithium, potassium, calcium, sodium and magnesium is achieved by fixed dilution of filtered samples and direct aspiration into an induced coupled plasma instrument. The suite of analytes and the laboratory method requested have been the same for the analyses of all the samples in this project, although the detection limits advised by the laboratory have varied from batch to batch, depending on the concentration of samples and the dilution that was required to carry out the analysis.

In the laboratory density, conductivity, pH, temperature and total dissolved solids were measured to provide a check on field parameters.

10.2.3 QA/QC analysis - relative percentage differences (RPD)

Standard and duplicate samples have been evaluated by calculating the relative percentage difference between the two or more samples for each standard sample. The standard formula used consists of:

Relative percent difference = ABS (value 1-value 2) / AVERAGE (value 1, value 2)
Where ABS = the absolute value of the difference between the two (or more) samples. In the case of more than two samples the greatest difference was used, with the average of all the

samples used. In addition the mean and standard deviation has been calculated for each standard analysed.

10.2.4 Alex Stewart laboratories standard analyses

Four laboratory standards prepared by Alex Stuart Assayers (ASA) were used as part of the QA/QC program on the Cauchari project. Results are presented in Table 10.4. Additionally a field "standard" (not prepared in the laboratory) was used during the program. This is brine from the Salinas Grandes salar, pit 1314. A bulk sample of pit 1314 brine was collected for use as this non-laboratory certified "standard" throughout the drilling program. The "standard" sample results are shown in Table 10.5 together with the RPD evaluation.

Analysis	Alex Stewart Method	Detection Limit
Sample preparation		
Filtration		
Physical Parameters		
Density	IMA-28 Determination by picnometry	g/ml
Electrical conductivity	SM-2510-B Electrical Conductivity	
pH	SM-4500-H+B	
Temperature	Thermometer	^{o}C
Total solids	SM-2540-B-Gravimetry Drying at 180^{o}C	10 mg/l
Anions		
Chloride (Cl)	SM-4500-Cl-B Determination by argentimetry	5 mg/l
Sulfates (SO4)	SM-4500.SO4=-C Gravimetric determination	10 mg/l
Alkalinity	SM-2320-B: Total Alkalinity	5 mg/l
Nitrates (NO3)	SM-4500-NO3^{-}-: nitratos	0.5 mg/l
Cations		
Arsenic (As)	ICP-13 Brines and samples TDS > 0.05%	0.105 mg/l
Barium (Ba)	ICP-13 Brines and samples TDS > 0.05%	0.01 mg/l
Boron (B)	ICP-13 Brines and samples TDS > 0.05%	1 mg/l
Calcium (Ca)	ICP-13 Brines and samples TDS > 0.05%	2 mg/l
Chromium (Cr)	ICP-13 Brines and samples TDS > 0.05%	0.009 mg/l
Copper (Cu)	ICP-13 Brines and samples TDS > 0.05%	0.012 mg/l
Iron (Fe)	ICP-13 Brines and samples TDS > 0.05%	0.3 mg/l
Lithium (Li)	ICP-13 Brines and samples TDS > 0.05%	1 mg/l
Magnesium (Mg)	ICP-13 Brines and samples TDS > 0.05%	1 mg/l
Manganese (Mn)	ICP-13 Brines and samples TDS > 0.05%	0.01 mg/l
Nickel (Ni)	ICP-13 Brines and samples TDS > 0.05%	0.03 mg/l
Potassium (K)	ICP-13 Brines and samples TDS > 0.05%	2 mg/l
Silica (Si)	ICP-13 Brines and samples TDS > 0.05%	0.06 mg/l
Sodium (Na)	ICP-13 Brines and samples TDS > 0.05%	2 mg/l
Strontium (Sr)	ICP-13 Brines and samples TDS > 0.05%	0.5 mg/l

Table 10.3 Analytical methods and detection limits
Note that these are limits that apply to samples prior to dilution and the actual limits are consequently different in some analytical reports

Exploration at Cauchari involved submitting 43 laboratory and non-laboratory prepared standards as part of the 268 samples submitted for analysis (16%). Statistics regarding analysis of standards are presented in Table 10.4, with data plots presented in Figures 10.7-10.11. This included:

Samples of laboratory prepared standards submitted for analysis included:

- 7 samples of the 1SG standard
- 7 samples of the 2SG standard
- 12 samples of 4G standard
- 6 samples of 5G standard
- 11 samples of non-laboratory standard 1314

Figure 10.7 shows the results for the non-laboratory standard 1314, with the dashed line showing the average value. Two blank samples were submitted in addition to the five different standard samples.

Values for relative standard deviation (RSD the standard deviation presented as a percentage of the average) and relative percentage difference (RPD – see definition above) are presented in the Table 10.4. The RPD values exceeded 10% for many of the analytes in the standards. However, it is important to note that these RPD values are calculated using the minimum and maximum values returned for any standard, so the results of one analysis can result in a large RPD value for an analyte. Scatter plots of analytes are presented in Figures 10.7 through 10.11, showing the variation in the standard analytes.

It is noted that:

- Lithium RPD values are between 6 and 14.3% for the laboratory standards, with low RPD values compared to other analytes. Lithium values plot within 10% of the prepared standard value for all laboratory standards (Figure 10.8).
- Potassium has RPD's exceeding 10% for the 2SG and 4G standards at 14.5% and 14% respectively and at 16.6% for the CJ1314 standard. Potassium values plot within 10% of the standard value for the all the laboratory standards (Figure 10.9).
- Boron RPD values are between 10 and 20% except for standard 1SG (which has a low standard concentration) and standard 5G – where the RPD% is 7.9%.
    - Approximately half the 4SG boron standard samples values plot between 10 and 20% below the prepared standard value of 400 mg/l (Figure 10.10).
- Calcium shows an RPD value of 5.8-11.6% for all laboratory standards, with all except 4G, below 10%.
- Magnesium RPD values are 20.3 and 20.4% for the 2SG and 4G standards respectively. RPD values are below 10% for the higher concentration 1SG and 5G standards. The magnesium analyses plot within 10% of the standard value (Figure 10.11).
- Sodium RPD values range from 4.4 to 16.4% for laboratory standards, with a value of 21.6% for standard CJ1314.
- Sulphate RPD values range from 6 to 13.8% (27.7% for CJ1314). The results for 4G and 5G analyses plot slightly above +20% of the prepared standard values (sulphate standard values were not provided for standards 1SG and 2SG). There is a systematic analytical bias for results exceeding standard values.
- Chloride RPD values range from 1.3 to 5.1%. Analyses are within 10% of the prepared standard value, with the exception of three 1SG1 and one 5G standard sample. The 2SG samples exceed the standard value significantly and it is thought there is a misreported value of Na in the standard.

	B mg/l	Ca mg/l	K mg/l	Li mg/l	Mg mg/l	Na mg/l	Chlorides mg/l	Sulfates mg/l
Field standard CJ 1314								
# Samples	11	11	11	11	11	11	11	11
Average	392	2,189	17,235	1,547	4,159	93,338	184,782	4,335
StdDev	23	157	1,017	68	318	6,147	3,987	382
RSD%	6.0%	7.2%	5.9%	4.4%	7.6%	6.6%	2.2%	8.8%
Max	430	2,316	18,904	1,658	4,474	103,728	193,035	4,989
Min	364	1,875	16,042	1,467	3,571	83,569	177,210	3,787
RPD %	16.7%	20.1%	16.6%	12.3%	21.7%	21.6%	8.6%	27.7%
STD SG1	**20**	**1,000**	**9,000**	**1,000**	**1,735**	**80,000**	**143,556**	
# Samples	7	7	7	7	7	7	7	7
Average	21	1,176	8,494	942	1,695	87,485	131,680	22,270
StdDev	4	31	210	35	17	4,985	833	809
RSD%	18.7%	2.7%	2.5%	3.8%	1.0%	5.7%	0.6%	3.6%
Max	30	1,224	8,908	1,018	1,714	92,383	132,246	23,799
Min	18	1,143	8,304	912	1,672	78,016	130,483	21,387
RPD %	54.2%	6.9%	7.1%	11.2%	2.5%	16.4%	1.3%	10.8%
STD SG2	**80**	**200**	**6,000**	**600**	**1,301**	**90,000**	**149,289**	
# Samples	7	7	7	7	7	7	7	7
Average	69	363	6,121	584	1,133	121,435	142,596	61,823
StdDev	4	11	313	30	78	1,588	988	1,362
RSD%	5.4%	2.9%	5.1%	5.2%	6.9%	1.3%	0.7%	2.2%
Max	73	374	6,307	645	1,301	123,709	144,036	63,526
Min	62	347	5,418	561	1,071	118,365	141,329	59,838
RPD %	16.4%	7.4%	14.5%	14.3%	20.3%	4.4%	1.9%	6.0%
STD-4G	**400**	**200**	**4,000**	**400**	**1,820**	**80,000**	**129,446**	**7,500**
# Samples	12	12	12	12	12	12	12	12
Average	349.5	252.1	3943.7	401.7	1841.8	80544.9	126666.2	8688.2
StdDev	14.9	10.0	184.0	18.5	134.1	3766.8	1662.4	380.9
RSD%	4.3%	4.0%	4.7%	4.6%	7.3%	4.7%	1.3%	4.4%
Max	369.7	265.5	4171.5	438.4	2019.6	87279.7	129195.9	9203.4
Min	320.7	236.3	3618.1	385.0	1644.2	75146.4	124093.8	8092.1
RPD %	14.0%	11.6%	14.0%	13.3%	20.4%	15.1%	4.0%	12.8%
STD-5G	**800**	**100**	**7,500**	**800**	**2,707**	**85,000**	**142,200**	**11,000**
# Samples	6	6	6	6	6	6	6	6
Average	707	197	7,318	802	2,632	83,219	137,497	12,469
StdDev	20	4	144	19	81	4,572	3,119	640
RSD%	2.8%	2.2%	2.0%	2.3%	3.1%	5.5%	2.3%	5.1%
Max	734	202	7,451	820	2,716	87,768	141,417	13,295
Min	677	191	7,121	772	2,544	76,549	134,435	11,607
RPD %	7.9%	5.8%	4.5%	6.0%	6.8%	13.4%	5.1%	13.8%

Table 10.4 Evaluation of standard samples used on the Cauchari project

It is noted that at Cauchari there are large differences in concentrations between adjacent samples of brine and brackish water obtained from drilling in the upper 100 m of drill holes, with lesser variation below this. However, the results of standards over this interval were generally within +/-10% of standard values.

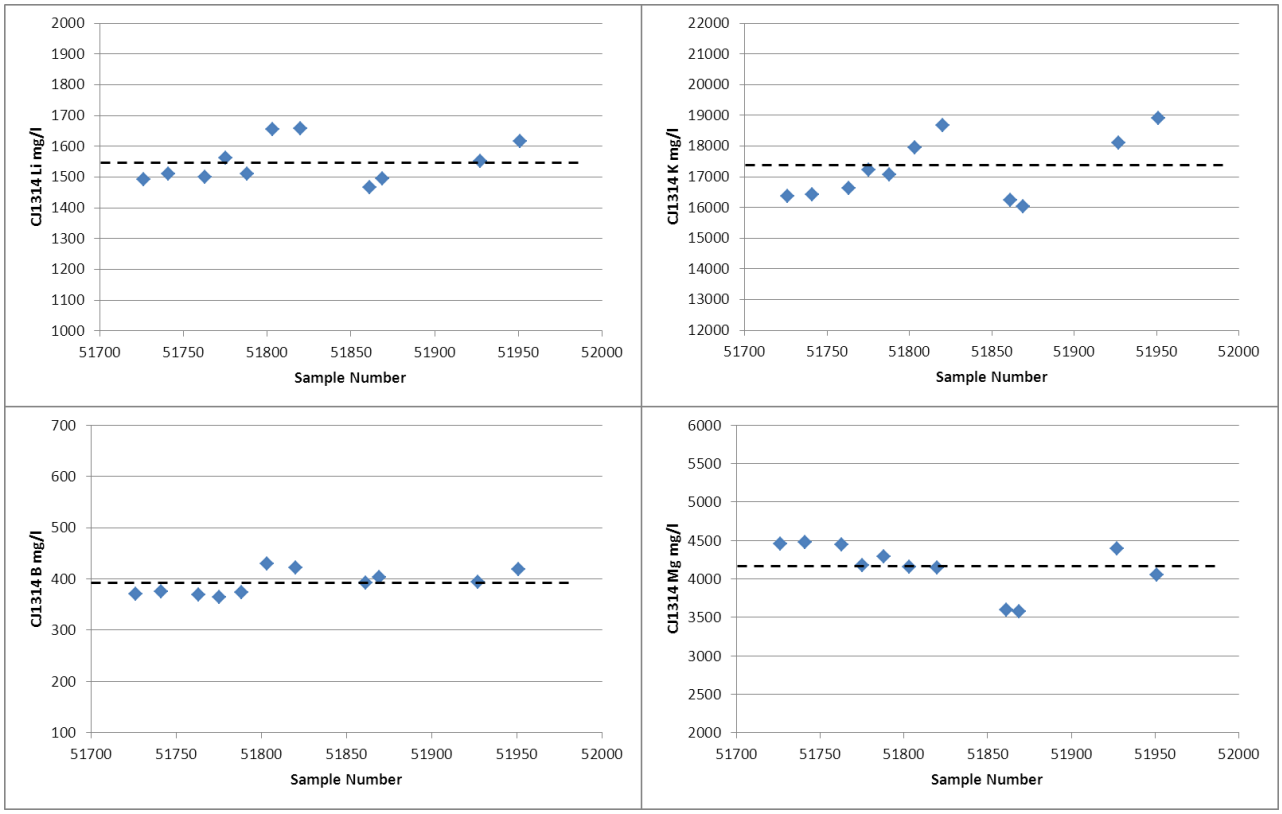


Figure 10.7 Plots of field standard CJ1314 data

10.2.5 Alex Stewart laboratories duplicate analyses

Analytical quality was monitored through the use of randomly inserted quality control samples, which included duplicate samples every 10 original samples, in addition to standards. Results are presented in Figures 10.12 to 10.14.

For Cauchari:

- 19 duplicate samples were included in the 268 samples submitted in total (7.1 %). Results are presented below in Table 10.5; and
- 25 duplicate samples analysed by ASA as part of the laboratory program of QA/QC (comprising 9.6 % of the original samples). A comparison of RPD values for these samples is provided below in Table 10.6.

Duplicate results from the samples submitted by Orocobre and those analysed internally by ASA show that analyses are highly reproducible, with low RPD values for all elements analysed, indicating a high level of analytical precision in the analyses (Tables 10.5 and 10.6). When original and duplicate samples are plotted samples generally fall well within +/- 10% error bounds and have high graphical r^2 values.

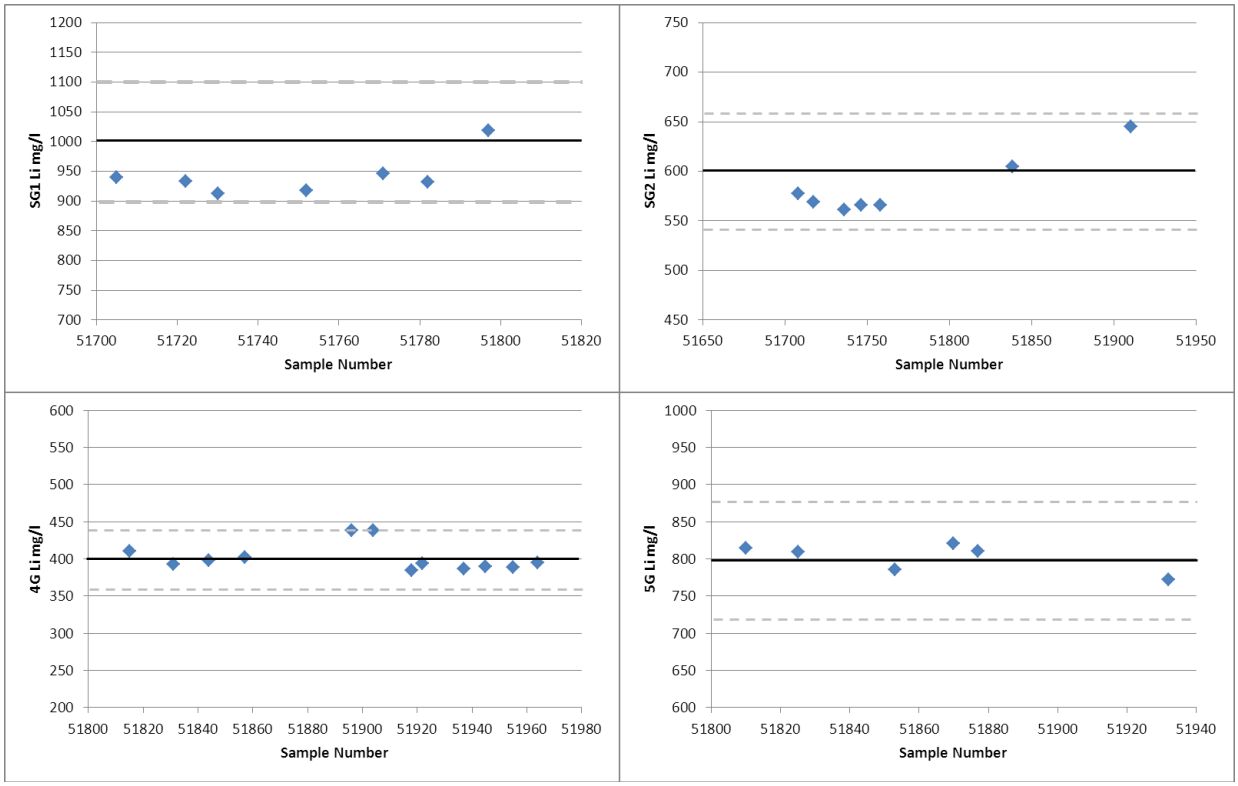


Figure 10.8 Standard analyses for lithium

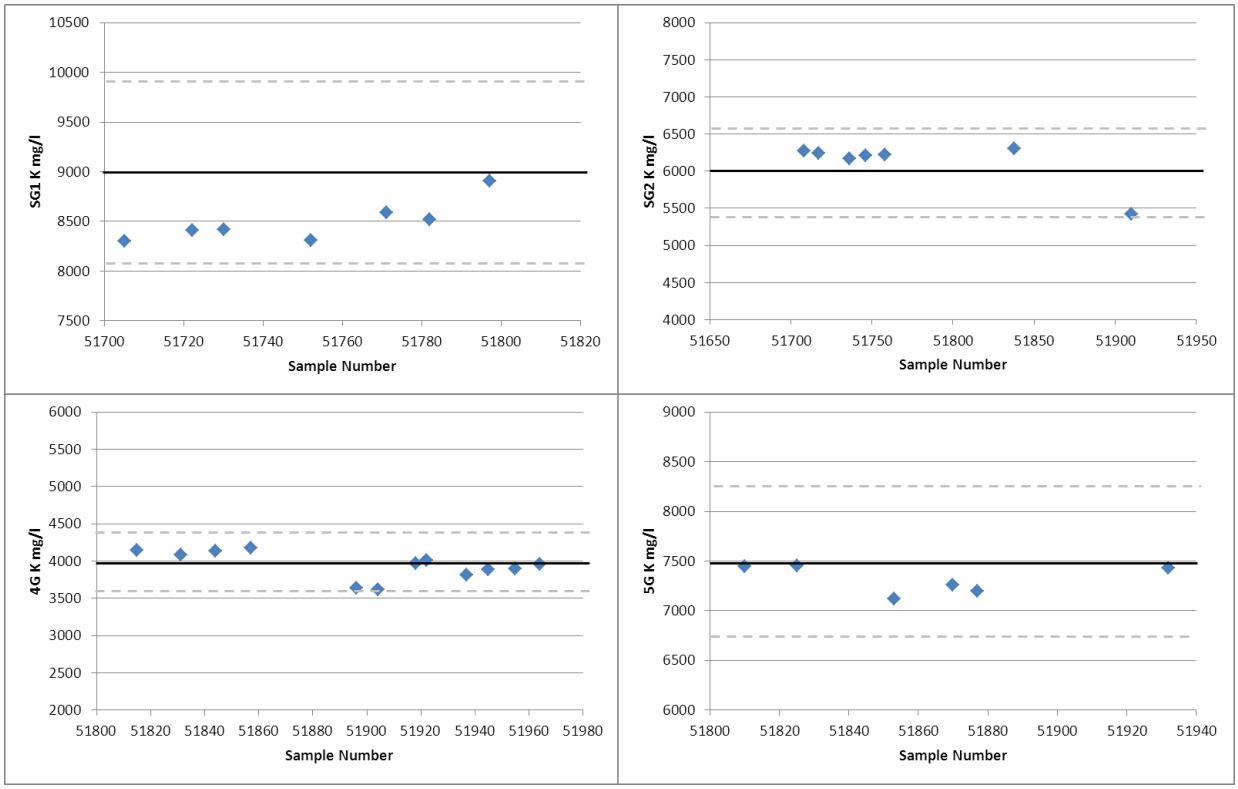


Figure 10.9 Standard analyses for potassium

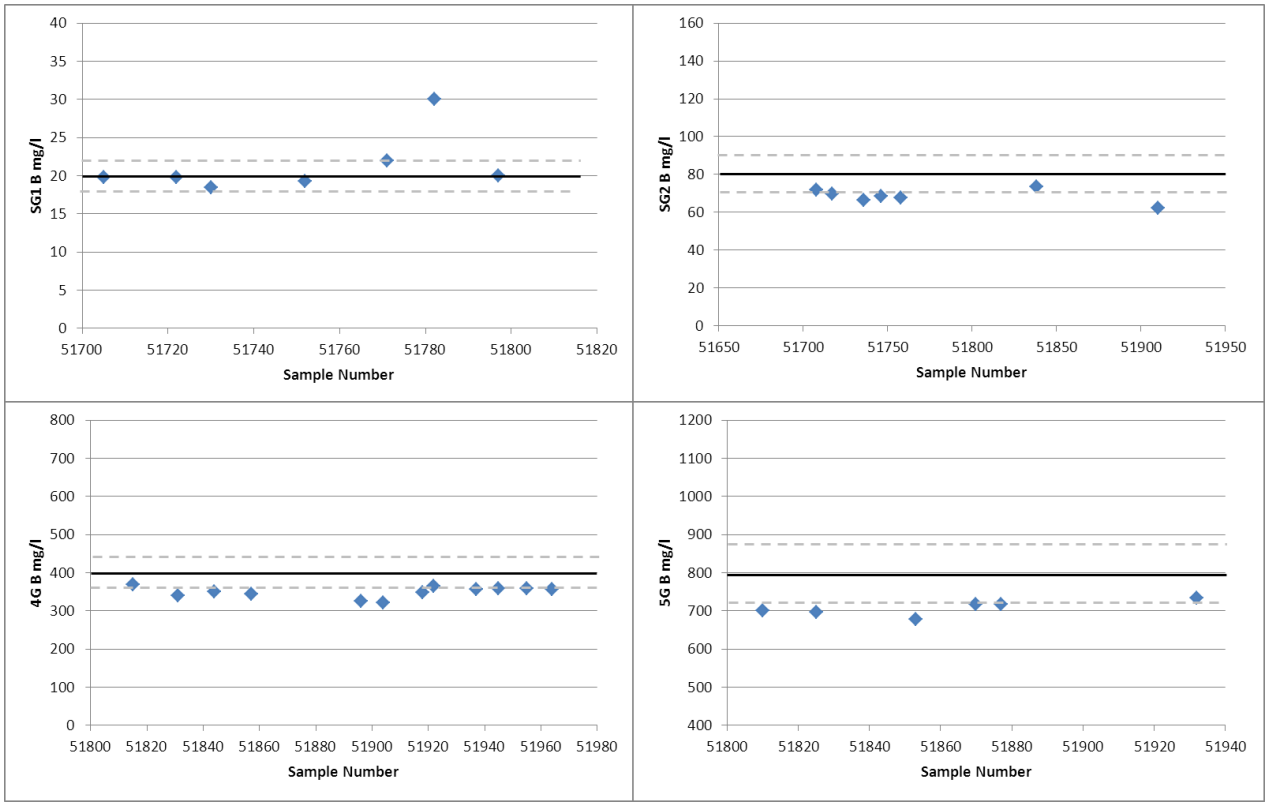


Figure 10.10 Standard analyses for boron

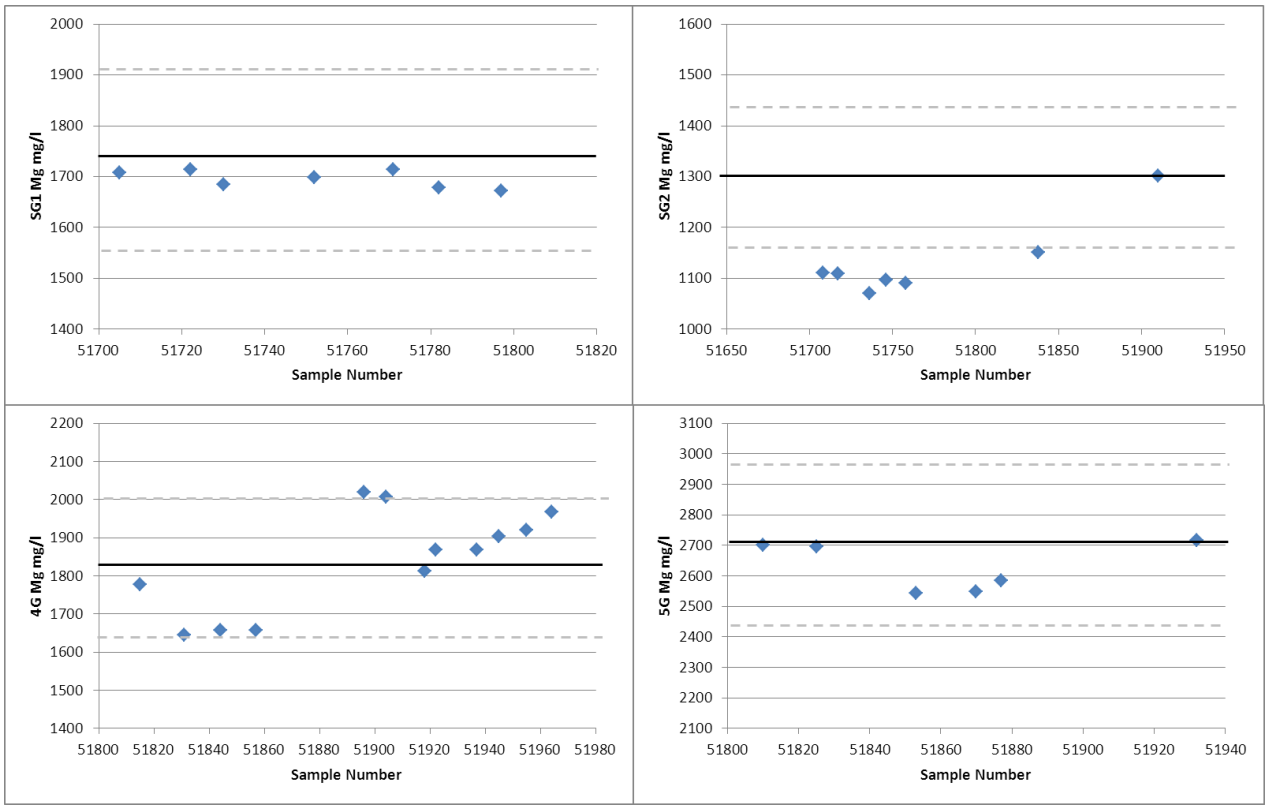


Figure 10.11 Standard analyses for magnesium

	B		K		Li		Mg	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
# Samples	19	19	19	19	19	19	19	19
Average mg/l	646	650	4283	4317	458	463	1143	1158
Std Dev	314	309	2292	2306	288	285	795	795
Graph r^2	0.992		0.996		0.994		0.997	
RPD%	0.6%		0.8%		1.0%		1.3%	
	SO4		Cl		TDS		Density	
	Original	Duplicate	Original	Original	Original	Duplicate	Original	Duplicate
# Samples	19	19	19	19	19	19	19	19
Average mg/l	21,499	21,372	165,287	165,283	303,932	303,917	1.2	1.2
Std Dev	7,284	7,309	16,503	16,712	32,315	32,140	0.0	0.0
Graph r^2	0.934		0.980		0.985		0.977	
RPD%	0.6%		0.0%		0.0%		0.0%	

Table 10.5 Orocobre submitted duplicate sample statistics

	B		K		Li		Mg	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
# Samples	25	25	25	25	25	25	25	25
Average mg/l	611	603	4530	4512	474	472	1169	1168
Std Dev	363	350	3560	3541	363	359	925	919
Graph r^2	0.996		1.000		1.000		0.998	
RPD%	1.3%		0.4%		0.4%		0.1%	
	SO4		Cl		TDS		Density	
	Original	Duplicate	Original	Original	Original	Duplicate	Original	Duplicate
# Samples	25	25	25	25	25	25	25	25
Average mg/l	20,863	21,057	144,173	143,568	269,726	270,066	1.2	1.2
Std Dev	12,012	12,119	42,942	42,455	75,862	76,436	0.0	0.0
Graph r^2	0.996		0.998		0.999		0.997	
RPD%	0.9%		0.4%		0.1%		0.0%	

Table 10.6 Alex Stewart internally submitted laboratory duplicates

10.2.6 Anion-cation balances

Anion-cation balances were conducted on all samples collected during the diamond and auger drilling programs. There were a total of 268 samples analysed in total by ASA (Figure 10.15), including the duplicate samples and standards. The cation-anion balance is calculated as follows when values are converted from mg/l to miliequivalents:

$$\frac{\text{Sum (cations – anions)}}{\text{Sum (cations + anions}} \times 100$$

As the fluids should be electrically neutral, with a balance of ~ zero, the size of the balance provides a good indicator of the accuracy of the corresponding analysis. Analyses with balances of <+/-5% are generally considered to be accurate, with analyses having higher values likely to be less reliable. No samples exceed 5% (with maximum balances of -4.9 and 5). The average ion balance for the ASA drilling and pump testing data is +/-2.1%, for the ASA analyses. Results are considered to be highly repeatable and of acceptable quality.

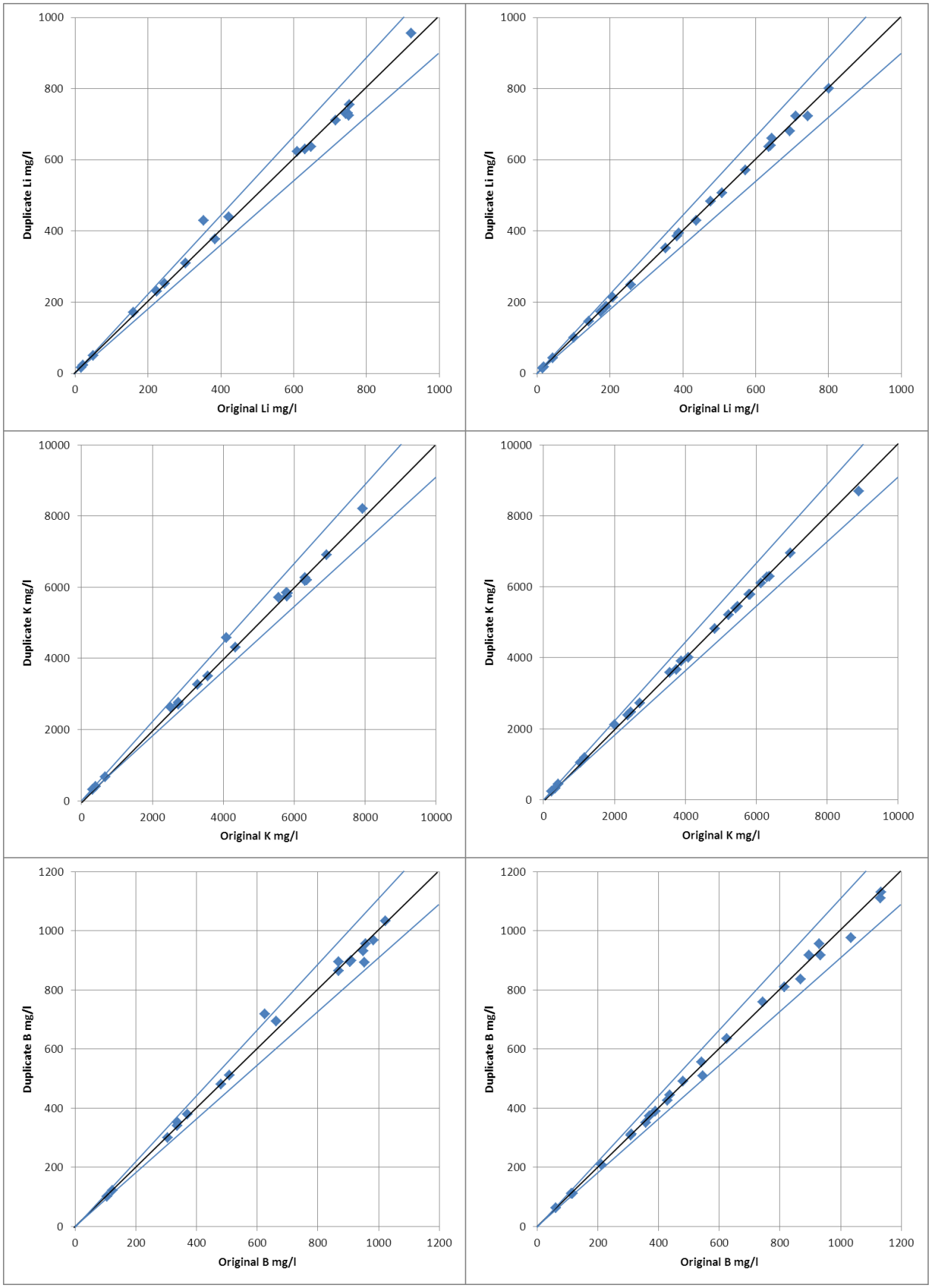


Figure 10.12 Duplicate sample data Orocobre and ASA submitted samples
Orocobre submitted samples shown left and ASA internally submitted duplicate samples on the right.

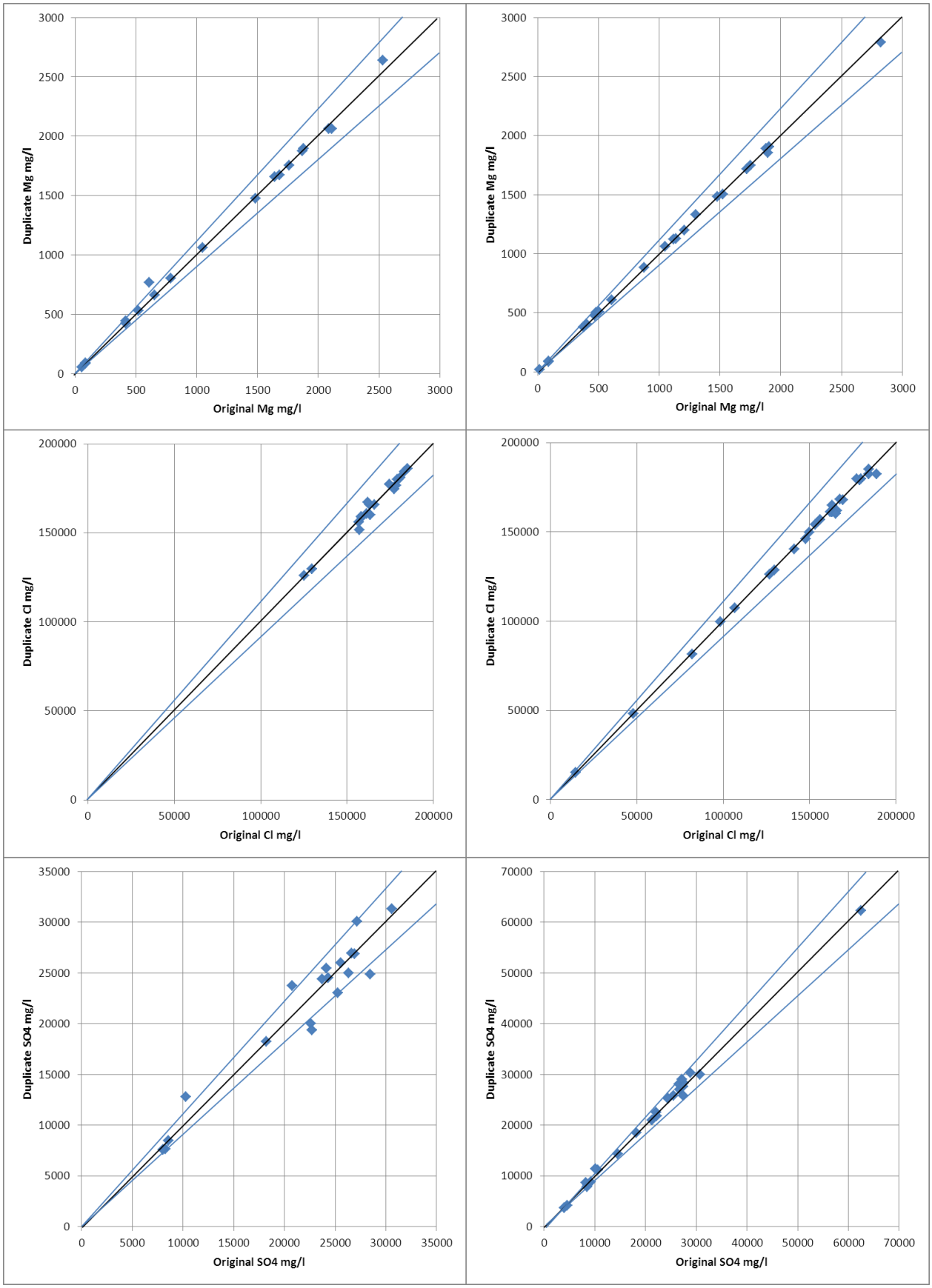


Figure 10.13 Duplicate sample data Orocobre and ASA submitted samples
Orocobre submitted duplicates shown left and ASA internally submitted duplicate samples on the right.

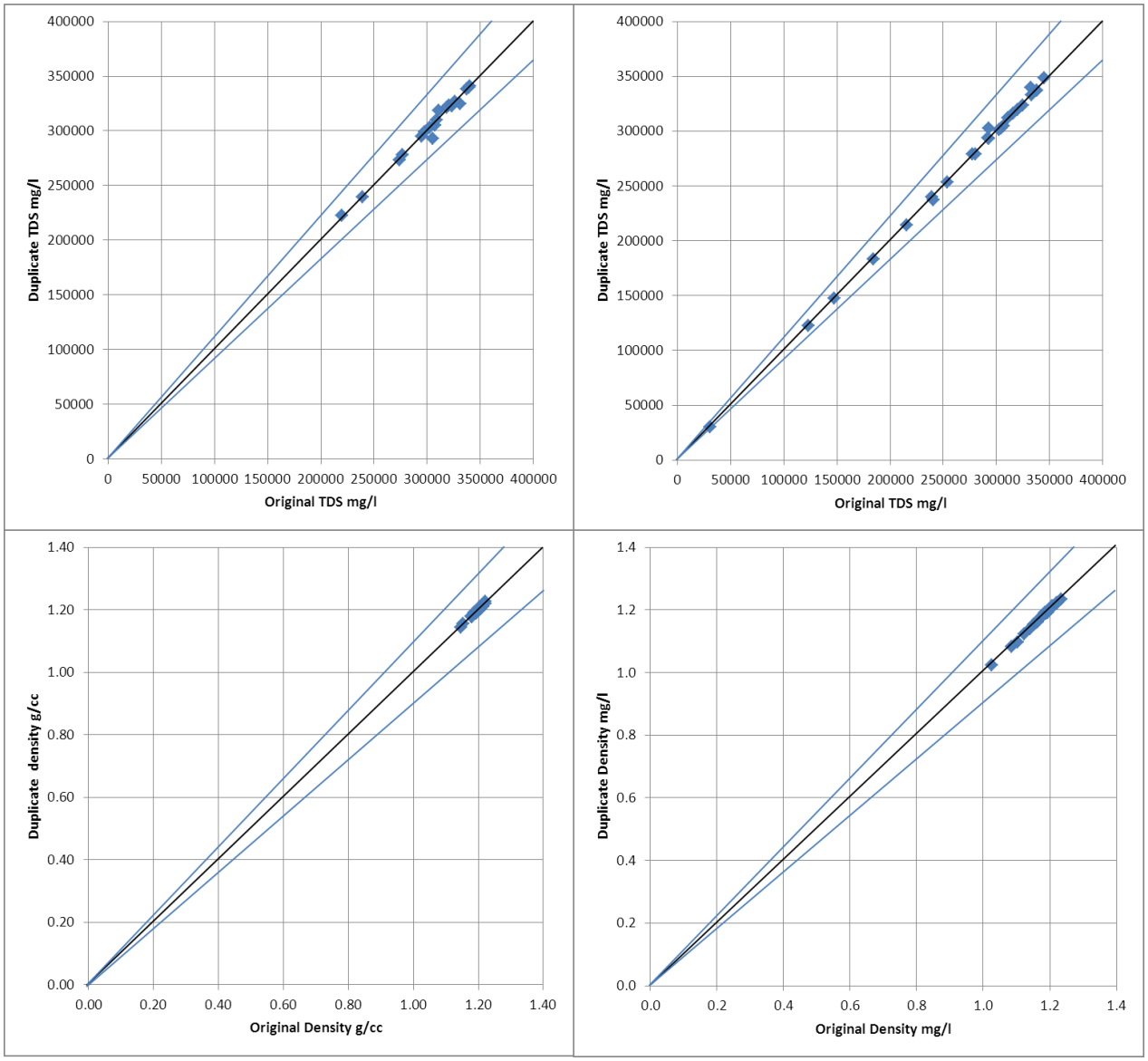


Figure 10.14 Duplicate sample data Orocobre and ASA submitted samples
Orocobre submitted duplicates shown left and ASA internally submitted duplicate samples on the right.

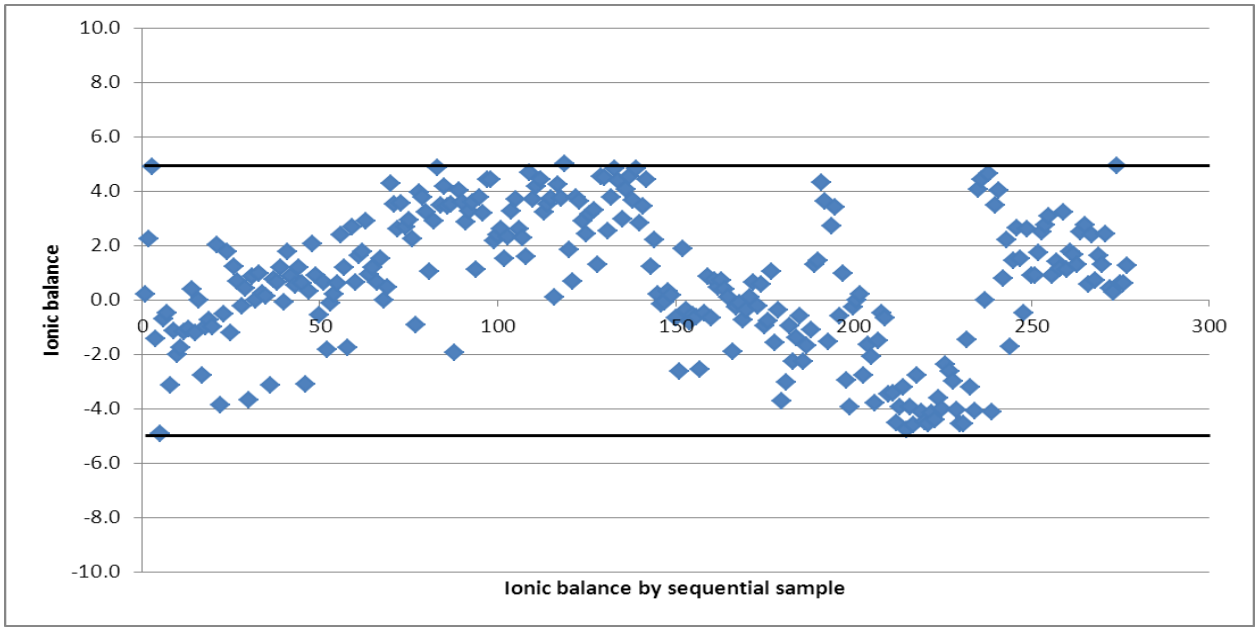


Figure 10.15 Ionic balances for ASA laboratory samples

10.2.7 Inter-laboratory samples summary

Fifteen duplicate samples were submitted to the University of Antofagasta laboratory in Chile, as an independent check on results from bailer samples analysed at the ASA laboratory in Mendoza. Within this sample batch a 4G and 5G standard were also submitted. The University of Antofagasta was selected as the check laboratory as the university has extensive experience analyzing samples from brine projects. The university uses the Atomic Absorption method for brine analyses, compared to the ICP equipment used by the other laboratories.

The results show a generally high level of correlation between the laboratories. Values of Li for both standards had RPD and RSD values of <10%. RPD and RSD values were higher for K (12 and 17% respectively) and 9 and 14% for B respectively in the 4G and 5G standards.

Overall for the inter-laboratory duplicate samples (Tables 10.7 and 10.8 and Figure 10.16) analyses:

- Li values were < 10%, except for sample CAU001D 126 m and corresponding duplicate 60903, with an RPD% of 11.3%;
- K values exceeded an RSD and RPD of 10% in approximately half the samples, with values averaging 16.6% RPD. The maximum was for CAU005D 72 m and duplicate 60910 at 28% and 39% respectively. K values are noted to be systematically lower, compared to ASA values, in the University of Antofagasta duplicates;
- Mg values were generally < 10%, with maximum values of 15 and 21% RSD and RPD;
- Ca values averaged 10.5% RPD, with several sample RPD's up to 16% and one low concentration sample (Standard 5G/sample 60913) up to 61%.The maximum RSD% was 43%;
- B showed very high RSD and RPD values. The RPD averaged 18.6%, to a maximum of 74.7%, with a maximum RSD% of 52.8. Overall boron showed the highest percentage variations;
- Na showed RPD% values of < 10% in all cases, averaging 3.2%;

- Sulphate showed RPD% values averaging 7.1% with a maximum of 25.9% and RSD% of <10% in most cases;
- Chloride showed RPD% values of 3.2% or less; and

- Total alkalinity values showed RPD's <10% in all but two cases, with a maximum 30.7 RPD%.

Overall results show a generally high correlation of results between ASA bailer sample results and duplicate analyses at the University of Antofagasta, suggesting that the ASA analyses are of sufficient quality (and accuracy) for the purpose of calculating a resource.

HoleID	Sample #	Na mg/l	K mg/l	Li mg/l	Mg mg/l	Ca mg/l	B mg/l	Sulfates mg/l	Chlorides mg/l
STD-4G		**80000**	**4000**	**400**	**1820**	**200**	**400**	**7500**	**129446**
Duplicate	**60907**	**78950**	**3393**	**415**	**1819**	**236**	**457**	**7952**	**127931**
Average		79475	3696	408	1819	218	428	7726	128689
StdDev		742	430	11	1	25	40	320	1071
RSD%		0.9%	11.6%	2.6%	0.0%	11.5%	9.4%	4.1%	0.8%
Max		80000	4000	415	1820	236	457	7952	129446
Min		78950	3393	400	1819	200	400	7500	127931
RPD %		1.3%	16.4%	3.7%	0.1%	16.3%	13.3%	5.9%	1.2%
STD-5G		**85000**	**7500**	**800**	**2707**	**100**	**800**	**11000**	**142200**
Duplicate	**60913**	**83050**	**6325**	**831**	**2690**	**188**	**841**	**12035**	**139369**
Average		84025	6913	816	2699	144	821	11518	140784
StdDev		1379	831	22	12	62	29	732	2002
RSD%		1.6%	12.0%	2.7%	0.4%	43.0%	3.6%	6.4%	1.4%
Max		85000	7500	831	2707	188	841	12035	142200
Min		83050	6325	800	2690	100	800	11000	139369
RPD %		2.3%	17.0%	3.8%	0.6%	60.9%	5.0%	9.0%	2.0%

Table 10.7 Inter-laboratory check of standard samples 4G and 5G

10.3 Fluid chemistry sample analysis – brine extraction samples

10.3.1 Pore fluid extraction

Pore fluid extraction is a technique that has been used on the Olaroz project to compare pore fluids with samples obtained during drilling. The same technique was applied to the Cauchari project, with the samples extracted from diamond cores used as a comparison with those bailed over 1.5, 3 and 6 m intervals.

Pore fluid was recovered from core by centrifugation using the free drainage method. This involves sub-sampling material from the centre of the larger diameter 'Lexan' core liners to avoid contamination of pore fluids by drilling fluids. The material was placed on top of a filter in a centrifuge bucket. The material was then centrifuged at 14 000 rpm for 40 minutes in a refrigerated high speed MSE25 centrifuge. Using a sterile syringe, drained pore fluid was removed from the centrifuge bucket and syringed into a labelled sample bottle refrigerated and stored at 5 ^{0}C prior to any treatment or dilution for analysis. All samples were tested at dilution, the dilutions being carried out volumetrically.

Halite cores were particularly challenging to work with and to sub-sample for brine extraction, as the halite is brittle and a number of the halite cores tested were porous and fragile. For the porous cores the potential for contamination from drilling fluid is greater than for the more compact cores. However, comparison of drilling fluid densities monitored during drilling, with the density of fluid extracted from pores, shows the values are distinctly different, suggesting contamination has not occurred.

HoleID	Sample #	Na mg/l	K mg/l	Li mg/l	Mg mg/l	Ca mg/l	B mg/l	Sulfates mg/l	Chlorides mg/l	Total Alkalinity
CAU001D	51710	121,809	6,309	749	2,085	371	983	20,753	177,210	821
CAU001D 69 m	60901	117,700	5,900	797	2,100	347	1,026	26,919	177,379	771
RSD%		2%	5%	4%	1%	5%	3%	18%	0%	4%
RPD %		3%	7%	6%	1%	7%	4%	26%	0%	6%
CAU001D	51716	117,654	6,357	752	2,113	427	954	26,902	174,565	838
CAU001D 82.5 m	60902	119,300	5,835	797	2,140	394	994	25,046	179,842	804
RSD%		1%	6%	4%	1%	6%	3%	5%	2%	3%
RPD %		1%	9%	6%	1%	8%	4%	7%	3%	4%
CAU001D	51753	124,998	5,772	631	1,683	285	958	23,741	185,145	848
CAU001D 126 m	60903	121,800	5,083	706	1,809	287	1,060	25,338	186,529	784
RSD%		2%	9%	8%	5%	0%	7%	5%	1%	6%
RPD %		3%	13%	11%	7%	1%	10%	7%	1%	8%
CAU001D	51790	105,134	2,685	213	517	477	422	24,268	159,577	543
CAU002D-39	60904	111,050	2,091	229	625	449	510	22,761	159,606	523
RSD%		4%	18%	5%	13%	4%	13%	5%	0%	3%
RPD %		5%	25%	7%	19%	6%	19%	6%	0%	4%
CAU002D	51801	38,269	1,600	161	314	1,681	466	10,850	59,952	1,079
CAU002D-39	60905	39,600	1,254	154	376	1,523	1,022	10,455	59,126	984
RSD%		2%	17%	3%	13%	7%	53%	3%	1%	6%
RPD %		3%	24%	4%	18%	10%	75%	4%	1%	9%
CAU002D	51824	107,558	7,312	841	1,768	363	1,187	27,758	176,335	854
CAU002D-87	60906	114,200	6,110	866	1,870	350	1,316	26,104	177,731	809
RSD%		4%	13%	2%	4%	3%	7%	4%	1%	4%
RPD %		6%	18%	3%	6%	4%	10%	6%	1%	5%
CAU002D	51834	121,021	5,231	529	947	342	827	31,133	171,097	726
CAU002 105 m	60908	117,700	4,230	563	1,170	329	970	30,755	172,628	702
RSD%		2%	15%	4%	15%	3%	11%	1%	1%	2%
RPD %		3%	21%	6%	21%	4%	16%	1%	1%	3%
CAU002D	51834	121,021	5,231	529	947	342	827	31,133	171,097	726
CAU002 105 m	60912	118,000	4,353	568	1,160	329	969	31,586	172,803	700
RSD%		2%	13%	5%	14%	3%	11%	1%	1%	3%
RPD %		3%	18%	7%	20%	4%	16%	1%	1%	4%
CAU002D	51865	134,143	3,291	238	416	339	508	29,429	176,661	727
CAU002 168 m	60909	131,300	2,755	238	495	295	634	35,587	177,555	681
RSD%		2%	13%	0%	12%	10%	16%	13%	0%	5%
RPD %		2%	18%	0%	17%	14%	22%	19%	1%	7%
CAU005D	51885	52,880	621	54	249	1,149	140	12,883	74,973	384
CAU005D 72 m	60910	54,450	417	49	257	1,025	193	12,002	77,427	282
RSD%		2%	28%	7%	2%	8%	22%	5%	2%	22%
RPD %		3%	39%	10%	3%	11%	32%	7%	3%	31%
CAU005D	51900	135,362	5,485	481	706	343	1,008	26,334	178,385	787
CAU005D 144 m	60911	123,150	5,203	470	768	344	1,264	25,758	183,890	752
RSD%		7%	4%	2%	6%	0%	16%	2%	2%	3%
RPD %		9%	5%	2%	8%	1%	23%	2%	3%	5%
CAU003D	51913	124,086	5,515	722	1,422	238	877	32,451	171,491	842
CAU003D-53.5	60914	121,250	5,008	681	1,368	236	1,087	31,669	179,490	795
RSD%		2%	7%	4%	3%	1%	15%	2%	3%	4%
RPD %		2%	10%	6%	4%	1%	21%	2%	5%	6%
CAU004D	51925	118,129	5,744	597	1,152	388	780	28,442	166,320	728
CAU004D-24	60915	118,100	5,240	638	1,280	349	857	29,191	170,868	656
RSD%		0%	6%	5%	7%	8%	7%	2%	2%	7%
RPD %		0%	9%	7%	11%	11%	9%	3%	3%	10%
Average RPD%		3%	17%	6%	9%	10%	19%	7%	2%	7%
Max RPD%		9%	39%	11%	21%	61%	75%	26%	5%	31%
Max RSD%		7%	28%	8%	15%	43%	53%	18%	3%	22%

Table 10.8 Sample results for original ASA and inter-laboratory duplicate analyses at the University of Antofagasta

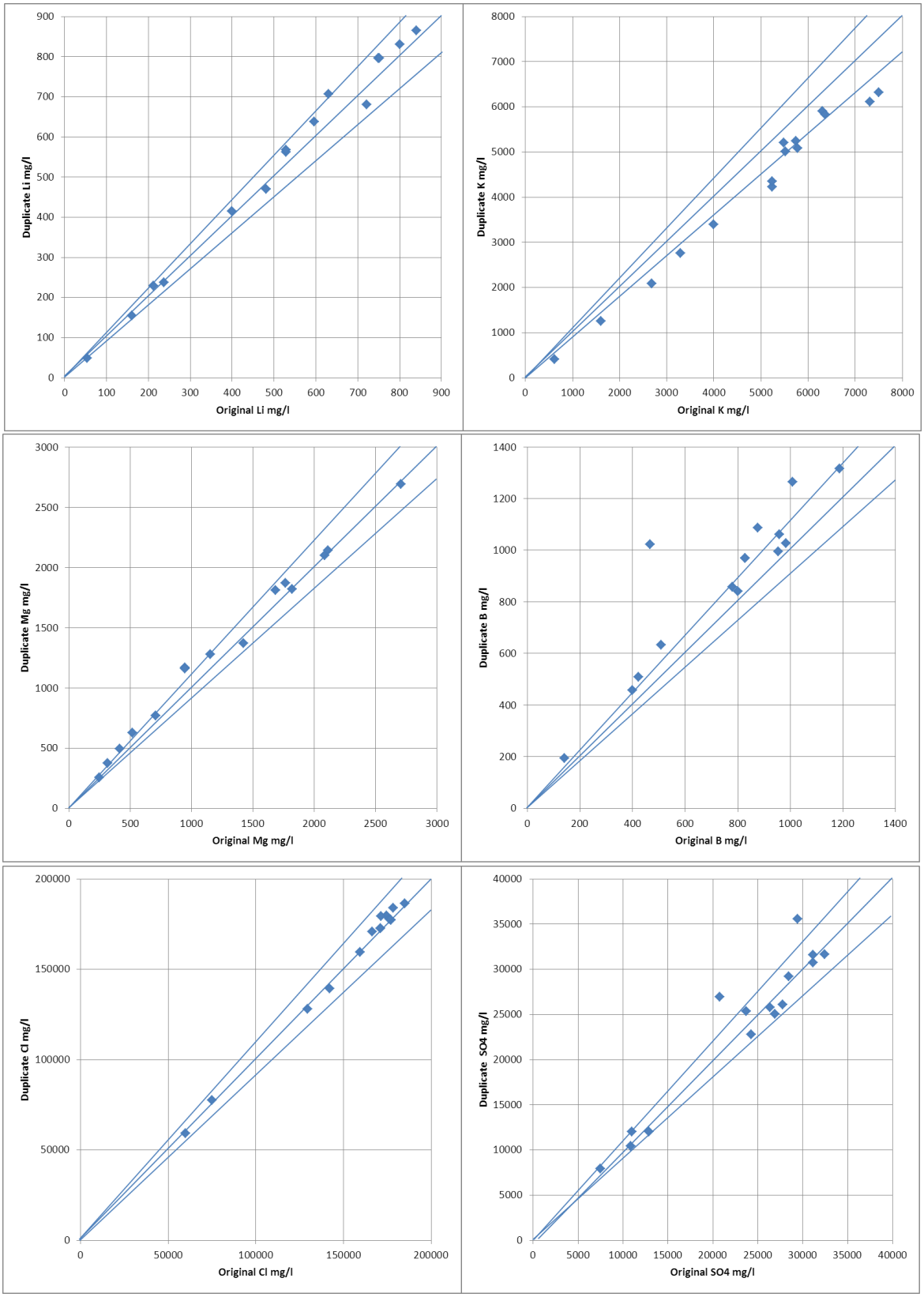


Figure 10.16 Inter-laboratory comparison of results from ASA and the University of Antofagasta

10.3.2 Hydrochemical analysis of pore water samples

If required, the recovered pore fluid was filtered and split, one portion being preserved with 1% nitric acid. If appropriate, the unacidified sample was analysed for alkalinity and conductivity immediately by potentiometric titration, after which the samples were prepared for the following laboratory analyses (Table 10.9):

Analytes	Test Method
Determination of the major and minor cations (27 elements): Ca, K, Mg, Na, S (as SO_4) Al, As, B, Ba, Ca, Cd, Co, Cr, Cu, Fe, La, Li, Mn, Mo, Ni, P, Pb, Si, Sr, V, Y and Zn	ICP-AES
Determination of major anions Cl, SO_4, NO_3, NO_2, F, HPO_4	Ion chromatography

Table 10.9 Analytical methods used by the British Geological Survey

Density

The brine extraction samples were brines close to or at saturation, with appreciably elevated density. Density measurements were recorded explicitly during preparation of the dilutions. Most samples were of the order of 15-20% denser than water. However, the upper samples of drill hole CAU005D were noticeably less dense. These measurements were double-checked and the repeat measurements were consistent with the originals.

Dilutions.

The brines as extracted were far too concentrated to be introduced to the instruments directly; they would have swamped the detectors. Substantial dilutions were therefore used to bring the samples into the directly measurable range. First stage and anion dilutions were prepared in ultrapure deionised water (DI); final dilutions for ICP were prepared in 1% nitric acid, which is a standard matrix for preservation of metals during ICP analysis. For major metals analysis by ICP-OES dilution included:

- First stage: 0.5 mL in 9.5 mL DI, x20
- Second stage: 0.4 mL in 9.6 mL 1% HNO3, x25
- Total dilution for ICP, x500

For anion analysis by IC:

- The same first stage as for cations above was carried out,
- Second stage: 0.2 mL in 4.8 mL DI, x25
- Third stage: 0.5 ml in 4.5 mL DI, x 10
- Total dilution for IC, x5000

10.3.3 BGS standard analyses

A total of 245 samples were analysed by the BGS, with this number including 36 duplicate and 38 standard samples and 19 blank samples. The standard results are presented in Table 10.10

For ICP analyses a solution representative of the sample matrix was analysed repeatedly, between every block of 5 samples, to provide additional confidence in instrument response and drift. For CAU001D, this drift standard was derived from one of the samples. Results were acceptable. However, it was observed that the solution contained concentrations of B

below detection, so did not provide the same level of control over B data as for the other elements.

Consequently, for analytical batches involving samples from holes CAU002-5D the drift standard was a synthetic in-house mixture prepared quantitatively from traceable commercial analytical standards. This ensured that all elements were present in proportionate concentrations; the concentrations used were designed to mimic the typical concentrations observed for the brine samples after allowing for dilution.

Results for the drift standards have been reported as determined. Drift corrections have not been applied. The data for the drift standard therefore provide a measure of the overall analytical uncertainty associated with the application of the ICP method to the brine matrix.

The data show that the overall recovery against target concentrations was generally good, with observed relative standard deviations of around 4-6% for both standards, across all elements determined. **This would lead to an estimate of overall expanded uncertainty for the analysis of approximately 8-12%**, which is consistent with what might normally be expected for analyses of this type, involving these technique, matrix and serial dilutions.

The same drift standards were not used for anion analysis by ion chromatography. The technique is much slower to run so higher numbers of QC samples are relatively inefficient and can extend the overall run time so that the original calibration becomes less stable. The standard method QC checks, used for the lab ISO 17025 accredited method, were applied throughout the analysis and were passed satisfactorily.

Different standard samples were used for CAU001D and the other drill hole brine samples. These were not the Olaroz standards which had previously been provided to the laboratory. As these standards were exhausted, the laboratory prepared standards which were used in place of the Olaroz standards 4G and 5G. The standards used for CAU001D show RSD% values generally < 5% for samples, while RPD values are up to 18% for potassium and 16% for lithium, with lower values for anions (7% for Cl and 10% for SO_4). A second standard used for CAU001D shows RSD% values of <3% and RPD values of 6% or less. Both standards show there is a drift to higher Li values for the same standard from start to finish of CAU001D.

The standard used for holes CAU002D through CAU005D shows RSD values of 6.5% or less, with RPD values of up to 28% for Ca, with 19% for potassium and 22% for Lithium. The standards show there was a minor drift lower for Li values during the analysis of samples from CAU002D through CAU005D.

The standard RPD% values are slightly larger than those for the standards analysed by ASA for bailer samples (maximum for Li of 14.3% and 16.6% for K). The greater dispersion in values probably reflects the small sample volumes available and the dilution undertaken for analysis (see above).

Blanks

Of the 19 blank samples included in the sample sequence three showed above detection levels of potassium to 0.43 mg/l. Five of the blank samples also showed above detection levels of sodium to 1.55 mg/l.

These above detection blank values occur at the base of hole CAU002D through CAU003D and CAU005D, suggesting there is some cross contamination of samples for K and Na in the latter samples of the program.

		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Hole	B	Ca	K	Li	Mg	Na	S	Cl	SO4
	Standard		**900**	**7,500**	**900**	**1,500**	**80,000**	**6,000**		
1	**CAU001D**	**<60**	**905**	**7,405**	**897**	**1,476**	**78,066**	**5,788**	**134,262**	**17,007**
2	CAU001D	<60	887	7,177	860	1,451	78,142	5,554		
3	CAU001D	<60	955	7,665	917	1,549	76,703	5,918	130,342	16,082
4	CAU001D	<60	876	6,995	864	1,414	73,791	5,464		
5	CAU001D	<60	900	7,424	849	1,453	76,545	5,635		
6	CAU001D	<60	926	7,891	896	1,518	78,991	5,998	134,866	17,199
7	CAU001D	<60	971	7,962	916	1,547	82,071	6,031		
8	CAU001D	<60	944	7,797	894	1,520	80,202	6,059	136,259	17,299
9	CAU001D	<60	895	7,328	886	1,461	74,235	5,658		
10	CAU001D	<60	923	7,612	888	1,511	81,952	5,996		
11	CAU001D	<60	959	8,229	946	1,594	80,960	6,292	136,540	17,299
12	CAU001D	<60	954	7,484	945	1,541	82,041	6,273	136,575	17,432
13	CAU001D	<60	984	8,134	993	1,594	86,288	6,398	136,916	17,408
14	CAU001D	<60	972	8,346	922	1,586	83,069	6,362		
15	CAU001D	<60	1,024	8,122	964	1,658	87,522	6,268	140,034	17,816
16	CAU001D	<60	974	7,765	957	1,560	80,592	5,996		
Average			941	7,708	912	1,527	80,073	5,981	135,724	17,193
Std Dev			41	392	40	65	3,846	295	2,765	504
RSD%			4.4%	5.1%	4.4%	4.2%	4.8%	4.9%	2.0%	2.9%
Max			1,024	8,346	993	1,658	87,522	6,398	140,034	17,816
Min			876	6,995	849	1,414	73,791	5,464	130,342	16,082
RPD%			16%	18%	16%	16%	17%	16%	7%	10%
	Standard	**1,000**	**500**	**7,500**	**1,000**	**1,000**	**100,000**	**7,500**		
1	**CAU002D**	**1,053**	**568**	**7,485**	**1,042**	**1,022**	**100,735**	**7,898**		
2	CAU002D	947	516	6,988	1,000	942	94,473	7,168		
3	CAU002D	889	472	6,570	931	889	91,177	6,765		
4	CAU002D	908	474	6,650	954	880	92,872	6,672		
5	CAU002D	934	496	7,043	968	901	92,823	6,891		
6	CAU002D	992	541	7,602	1,074	975	103,017	7,727		
7	CAU002D	970	529	7,398	1,029	943	101,878	7,473		
8	CAU002D	933	497	7,027	986	888	97,010	7,061		
9	CAU002D	873	463	6,659	924	866	88,624	6,591		
10	CAU002D	923	503	7,196	982	929	98,199	7,123		
11	**CAU003D**	**923**	**503**	**7,196**	**982**	**929**	**98,199**	**7,123**		
12	CAU003D	955	519	7,247	1,017	950	98,980	7,274		
13	CAU003D	935	509	7,187	1,022	924	98,636	7,112		
14	**CAU005D**	**927**	**461**	**6,584**	**954**	**887**	**88,681**	**6,726**		
15	CAU005D	990	427	6,264	856	794	86,809	6,019		
16	CAU005D	976	485	6,858	986	912	94,437	6,962		
17	CAU005D	989	505	7,172	987	938	96,642	7,191		
18	CAU005D	964	499	7,101	1,009	940	97,487	7,234		
Average		949	498	7013	983	917	95593	7056		
Std Dev		43	32	354	50	48	4682	429		
RSD%		4.5%	6.5%	5.0%	5.0%	5.3%	4.9%	6.1%		
Max		1,053	568	7,602	1,074	1,022	103,017	7,898		
Min		873	427	6,264	856	794	86,809	6,019		
RPD%		19%	28%	19%	22%	25%	17%	27%		

Table 10.10 Standard sample results from the BGS analyses

The analysis of standards is presented in Table 10.10 and plotted in Figure 10.17.

10.3.4 BGS duplicate analyses

Duplicate samples were analysed by the BGS with a duplicate sample generally every six primary samples. The duplicate samples (Figure 10.18) were analysed immediately following each block of six samples (after which a standard and in some cases a blank were also inserted) from which they were selected, so they were not subject to significant calibration drift throughout each sample batch. Overall it is noted:

- The 29 duplicates have RSD values of up to 6.4% on average, with RPD% values of up to 9% on average.
- For Li the average RPD is 9%, with 8 of the duplicate samples exceeding 10%, to a maximum of 38%.
- For K the average RPD is 6%, with 2 of the duplicate samples exceeding 10%, to a maximum of 22%.

Runs were repeated if there were concerns about QC performance until acceptable performance was obtained. It is observed that there is significant variation in some cases between the observed concentrations of elements from one sample to the next. This results in somewhat spiky profiles with depth and so was subject to additional qualitative assessment during data verification.

High concentrations of alkali metals are known to affect the plasma and observed responses under certain conditions during ICP analysis. However, care was taken during dilution to reduce the working concentrations to levels sufficient to avoid problems and there is no evidence of any bias or enhancement in the results. The concentration of Na in the samples has been broadly consistent as the dominant matrix. Variation observed in other elements, notable Li and K shows no correlation with Na; the whole range of Li values from a few mg to 1000 mg occurring in the presence of roughly constant Na concentrations.

If the variations in Li concentrations were due to fluctuation in the instrument response between individual samples one might expect such correlations to occur across all the elements, not only between Li and K. However, as indicated with Na above, this is not the case. The Na signal (relatively constant) is observed in the same visible part of the detector range as both the Li and K (variable) signals, so the changes are not attributable to gross changes in detector response.

Measurements of the elements using alternative wavelength signals were recorded simultaneously during the original analysis. These are not reported as they are of lesser analytical quality, but they provide secondary corroboration of the primary data. In addition, variations in instrument response would tend to be observed as relative changes in signal of some % (say 100 +/- 20 or 30), but not the order of magnitude variation displayed by Li, (between 10s and >1000 mg/L). In this context the correlation between Li and K, but not with Na, Ca or Mg is suggestive of true variation in sample chemistry, with lower occurrence of the minor alkali metals in certain areas within the overall Na brine deposits.

Overall, no grounds for concern in the QC or analytical behaviour were identified that suggest the results do not properly represent the concentrations in the test samples.

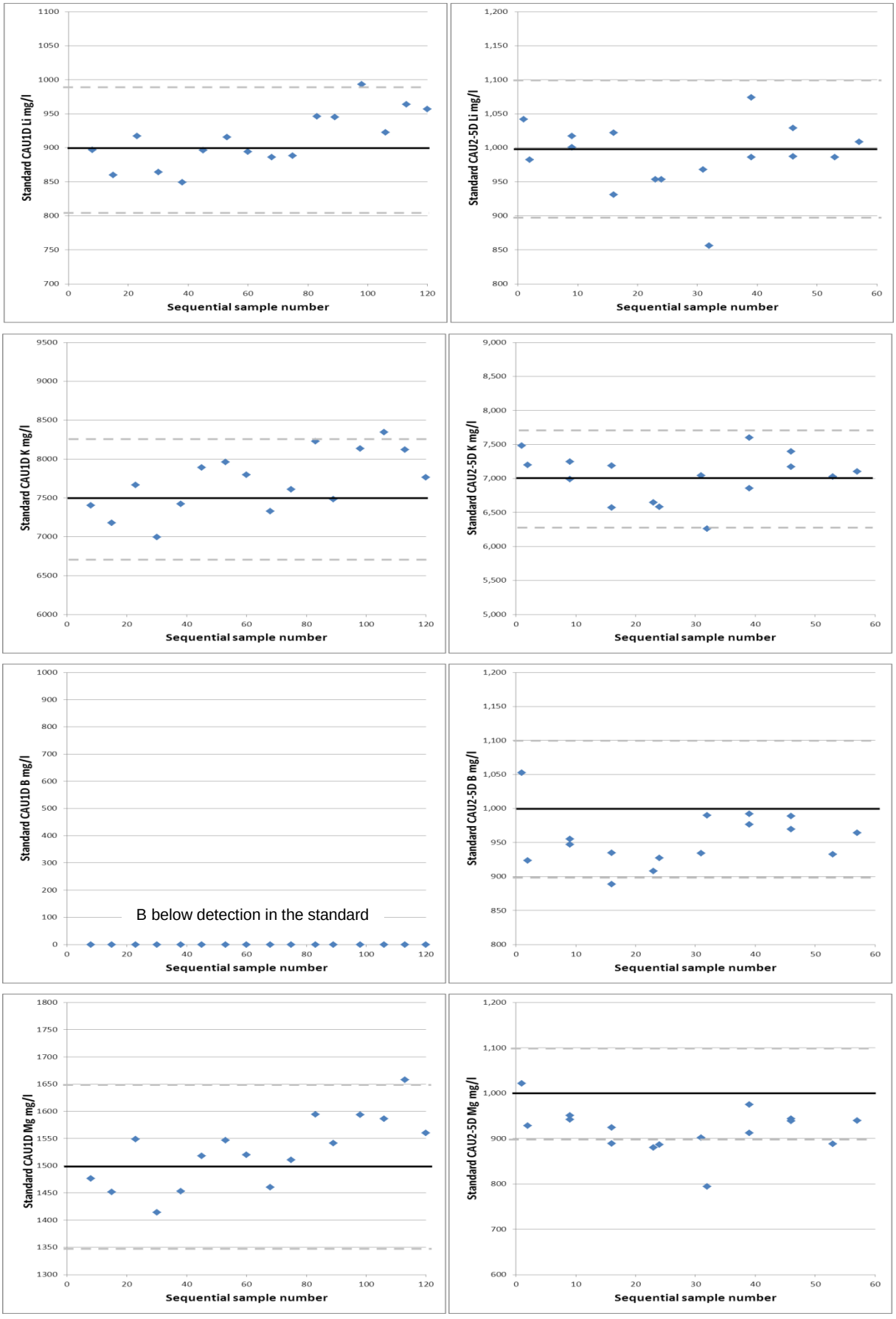


Figure 10.17 BGS standard analyses and standard values

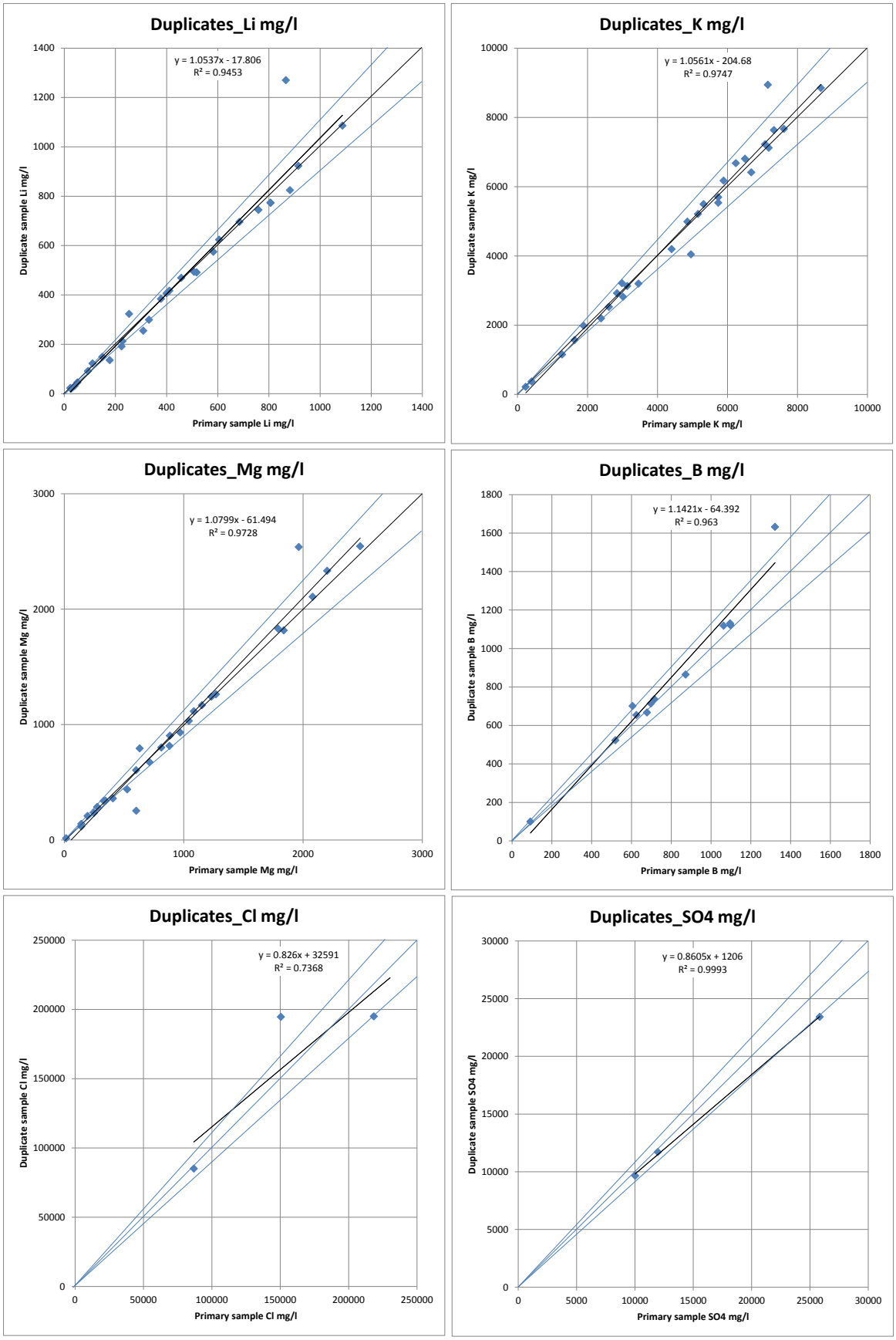


Figure 10.18 Comparison of original and duplicated data for BGS chemical analyses

Duplicate results show a slight bias, with duplicate values slightly higher than original values for Li, K, B, and Mg. Only limited anion analyses were completed with duplicate samples, so no meaningful conclusion can be drawn regarding bias in the analysis of the anions.

Overall the results suggest that BGS analyses are repeatable and of acceptable quality.

10.3.5 BGS ionic balances

Anion-cation balances were conducted on the BGS samples, with the samples having an absolute average balance of 4.8%, with a strong skewness towards a negative overall balance (Figure 10.19 - suggesting that some cations may not be captured in the analysis). Of the 245 original analyses 169 samples had full analyses to analyse the ionic balances.

A total of 75 of these (44 %) had balances exceeding 5%, while 4 samples (2%) had balances exceeding 10%. The poor balances probably reflect the small sample volumes extracted and an apparent bias to higher anion versus cation concentrations. The ionic balances show a trend towards a lower average balance over the period analyses were conducted, although there were still analyses of >5% ionic balance despite a lower average balance.

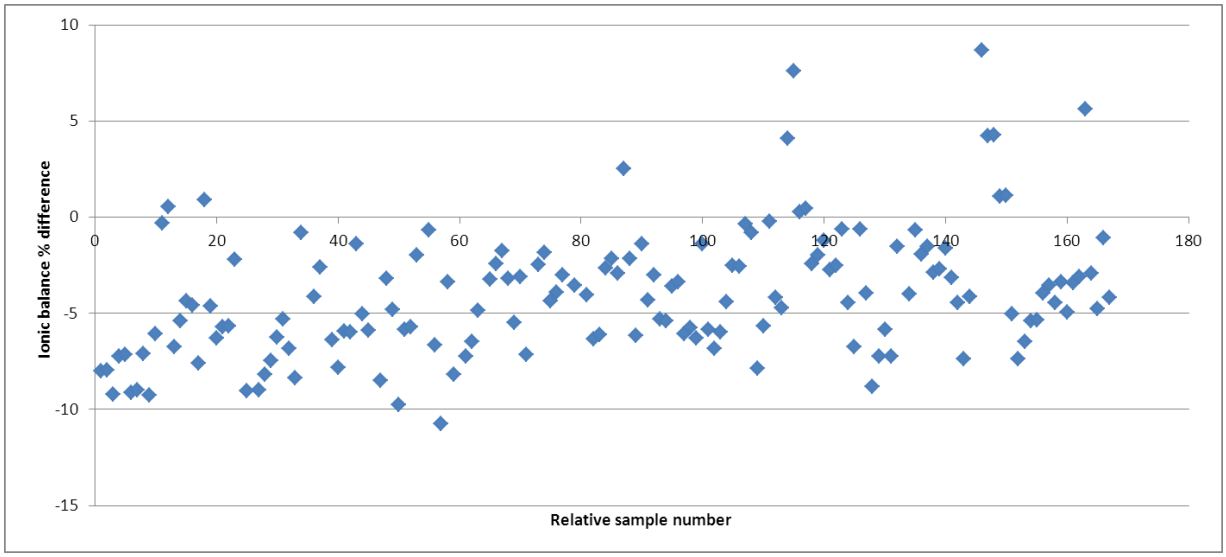


Figure 10.19 BGS sample ionic balances

10.3.6 Observations regarding BGS geochemistry

Blank samples are showing elevated K and Na in samples from the base of CAU002D and from CAU003D and CAU005D, suggesting there may be sample cross-contamination in samples from these holes.

Drift standards generally show RSD values of < 6.5% for elements and RPD% values of up to 18% in CAU001D and up to 28% in the other holes. However, there is a noted drift to higher concentrations (from 860 to 960) in the standard values for CAU001D. The standard used for samples in the other 4 holes does not show any appreciable drift.

In CAU001D the BGS geochemistry is noted to:

- Be lower (except for Ca) than the ASA bailed samples in the upper sediment sequence, overlying the halite;

- Show considerable spread of values in adjacent samples and with respect to ASA samples at similar depths throughout the halite zone. BGS sample results show an overall trend of decreasing values down hole for Li, K, B and Mg;
- Show lower or significantly lower values than ASA results at the same depth in the high porosity zones identified in CAU001D and 2D (i.e. around 150 m deep). Field densities suggest intervals of lower density (fresher) waters in this interval. It is possible there are a number of discrete porous zones that may contain fresher water.
    - It is possible ASA brine samples in this more porous core are contaminated by lower concentration Li-bearing drilling fluid. However, the BGS core extraction brine is generally lower concentration than the ASA samples – suggesting they would also be contaminated.
    - When Sy values decrease (as core is less porous) deeper in these holes, the BGS results are higher than, or similar to the ASA results. However, it is important to note that in this zone the BGS potassium values generally exceed those of the ASA values, unlike those for Li.
- In a lower zone of higher porosity in CAU001D (and above this zone) there are again lower BGS values, compared with the ASA values.
- The BGS values are higher from 214.3-220 m below surface, when Sy is low and ASA values are low (200 mg/l). BGS values are elevated to 249 m (EOH) and do not correlate well with the ASA bailer values in the upper part of this interval. It is suspected that the ASA values reflect inflows down the casing of relatively low grade Li in an Interval of low porosity/permeability. However, it is uncertain whether the BGS values at depth are reliable and other deeper drill holes in the tenement will be needed to compare with this hole.

In assessing how representative samples are, it is important to consider other information such as the following:

- Visual sample quality
- The ionic balance of the sample

However, plotting results from the ASA and BGS data, based on the assessed core quality for BGS brine extraction and the ionic balances, did not clearly show that samples of lesser assessed quality or higher ionic balances correspond with greater differences between the BGS and ASA samples.

It is therefore concluded that there is:

- A calibration difference between the ASA and BGS analytical results (this is suggested by the Cl in particular).
- The ASA values were found to be consistent with analytical values produced by the University of Antofagasta. However, the BGS values may have a consistent calibration difference with the ASA results.
- However, it is likely that the small size of the BGS samples (<10 cc) and the composite nature of the ASA samples (over vertical intervals of up to 6 m) is also responsible for much of the difference in values (on the basis that the salar sequence has heterogeneity within units).

10.3.7 Comparison of ASA and BGS data

The overall correlation of ASA analyses, (from bailer sampling during diamond coring), with the BGS results show a poor general correlation. However, the poor correlation, not-withstanding the ASA and BGS sample data sets, clearly show the same general pattern of low and variable results in the clastic sediments overlying the halite dominated Unit B, with

values within the halite sequence decreasing with depth (in holes CAU001D through 4D) and values increasing below 90 m in CAU005D.

Sampling method

When comparing the bailer and the BGS brine extraction data sets it is important to consider what each data set represents:

- Bailer sampling was designed to provide 3 m (or in some cases 6) composite samples of inflows within the corresponding interval to provide a sample broadly representative of the interval and of the relative contributions from different units within it.
    - Sampling was conducted with the drill casing 3 m (or 6 m), with the drill rods pulled back 3 m (or 6 m) to allow inflow from this bottom part of the hole.
    - Fluid is bailed from the hole until the required well volume is removed and there is no evidence of fluorescein dye (added to the drilling fluid)
    - Contamination from overlying intervals could have occurred if drill casing was not well seated in the drill hole, and contamination from drilling brine could occur even if fluorescein is not identified if drill casing split, which is why holes CAU003D and 4D were abandoned.

Brine extraction sampling was used on the Olaroz project and designed as a check on bailed sample results. In theory the brine extracted from the centre of cores has a low likelihood of contamination by drilling fluid (brine and additives) and consequently these samples were considered a check on the bailed samples to assess whether contamination of the bailed samples had occurred. The samples for Olaroz showed a very good correlation with the corresponding bailed samples – although there was an analytical bias between the laboratories.

Observations

It is noted for the Cauchari diamond hole bailer samples analysed by ASA that:

- Li bailer samples in diamond holes CAU001D and 2D decrease with depth. CAU005D intersects a higher grade Li zone at ~ 100 m, which is probably the top of the brine body in that hole.
- There are intervals of lower brine density within holes. This is most notable in the upper clastic parts of holes (Unit A), where densities are low and brine shows higher concentrations of calcium. Zones of lower density brine are less common within the halite body but are still noted to occur.
- The bailer sampling suggests that low density zones can be restricted vertically to several meres or less, adjacent to higher density brine.

It is noted for the BGS samples that:

- There is a higher level of variation between BGS samples, relative to the variation between adjacent samples analysed by ASA, **due to the point versus interval nature of the sample** types. There is considerable scatter in duplicates of the BGS results, although most show RPD'S of < 10%.
- There are several intervals where BGS samples show very poor correlation with the ASA samples. Intervals in CAU001D include between 159-160 m, 183-198 m and 206.8-224.8 (where BGS lithium values are considerably higher than the ASA results)

Conclusions

The general differences between the data sets are interpreted to reflect a number of factors, including:

- Lithological data show the salar consists of a clastic sequence overlying a halite sequence with periodic clastic inputs. Consequently there is vertical and lateral variation in lithology.
- Differences in the scale of sampling.
    - ASA Bailer samples represent 3 or 6 m composite samples, whereas BGS brine extraction samples represent intervals of <0.2 m.
    - The most permeable units (sands, sandy silts) present in the bailed intervals may provide a high volume of the bailed sample, whereas the BGS samples come from essentially one depth in the hole.
- There exists the possibility of sample contamination for the bailed diamond samples due to fractured casing.
- In the case of the brine extraction samples, the brine is extracted from the central parts of the cores. It is considered unlikely drilling fluid would have infiltrated the central part of the cores but where core is porous there is a greater possibility it is contaminated with drilling brine.

10.3.8 Summary

Analyses of the geochemical standards by ASA showed little systematic drift in the results relative to the standard values over the period of analysed. Results are generally within 10% of stated standard values, with a small number of exceptions for each element. However, boron values were consistently below the standard value for standards 4G, 5G and 2SG. The BGS standards show higher RSD and RPD values than ASA analyses.

Duplicate samples show there is a high level of analytical repeatability and precision in the bailer analyses analysed by ASA, with duplicates generally well within +/-10%. Repeat analysis of brine extraction samples by the BGS showed results from a number of analytes falling outside the +/-10% range, suggesting that the small sample volumes and dilution required for analysis of the brine extraction sampling may be contributing to uncertainties with this data. Overall duplicate samples suggest results from ASA and BGs laboratories are readily repeatable.

Ionic balances show the ASA analyses are of good quality, with no ASA samples exceeding 5% for the ionic balance. The BGS analyses have 44% of the analyses with balances exceeding 5%, although only 4 samples had balances exceeding 10% ionic difference. The higher number of samples with elevated ionic balances suggests the small sample size and sample dilution may be contributing to the ionic balances.

A suite of inter-laboratory check samples were analysed at the University of Antofagasta. These samples showed generally low RPD values between the ASA and University of Antofagasta laboratory, suggesting ASA analyses have an acceptable level of accuracy as well as precision. Overall the ASA results are considered of acceptable accuracy and precision to be used for the purpose of the inferred resource estimate.

11 DATA VERIFICATION

11.1 Assay data

Orocobre and South American Salars carried out an internal validation of the available assay and location data for the pit and drill hole sample sites in the current database. Original copies of the Cauchari analytical certificates from ASA, BGS and the University of Antofagasta laboratories were received by the primary author. These certificates do not specify the methods employed by the laboratory for the analysis listed on the certificate, but it is assumed the methodology requested by the company and listed in Table 10.3 was the methodology used. Analytical and sampling quality control measures employed by the company are discussed in Section 10 above.

11.2 Geological data

The system of geologically logging core has been verified by the author. Observations on sediment colour, grain size, texture and bedding relationships has been recorded and stored in the project database. Field measurements of water samples were recorded after each sample was taken and the results compiled in the project database. Observations were noted on paper tags, which were taped onto sample bottles. Samples sent to laboratories were labeled with printed sequential sample tickets and data regarding the sample recorded on the sample tickets in a sample book and in excel sheets used as sample registers.

11.3 Survey data

Hand held Garmin GPS units were used to collect the location of drill holes. In the salar setting the GPS signal is typically strong and a minimum horizontal precision is expected to be ±15 m. Data was collected in the Argentine co-ordinate system in Zone 3 of the Argentine Gauss Krueger Transverse Mercator projection, using the Posgar 94 datum.

12 MINERAL PROCESSING AND METALLURGICAL TESTING

N/A – refer to the other relevant data and information section

13 MINERAL RESOURCES ESTIMATES

Diamond drilling data on the Cauchari project has contributed to the estimation of an inferred in situ resource for the project. Details of the resource estimate are outlined in the following section. The resource for this project was originally reported in accordance with the JORC Code and announced to the Australian Stock Exchange by Orocobre Limited on 22 October, 2012. The resource was estimated by a Competent Person as defined by the JORC Code. A summary of the resource and estimation procedure were provided in this original public disclosure and this is considered to remain both relevant and reliable.

The effective date for the reporting of the Cauchari resource is the 5 December 2016, the date this report was declared effective and publicly announced. The quantity and grade of the resource is outlined in the following sections, along with the key assumptions, parameters, and methods used to estimate the mineral resource. Risks associated with the mineral resource estimate are discussed in the risks section of the conclusions chapter of this report.

13.1 Background to the resource estimate

Diamond drilling established that Li, K and B concentrations in brine are elevated (generally exceeding 300 mg/l Li) in the northeastern SAS properties (968-R-2008, 965-R-2008 and 950-R-2008 – application for mina 2053-R-2014) in the Cauchari salar. Diamond drilling showed that elevated Li, K and B concentrations continue to > 200 m. Drilling in adjacent properties not owned by SAS has encountered clastic sediments to 450 m below surface, with elevated lithium concentrations reported to this depth. Pit sampling in the south of the SAS Cauchari properties identified locally elevated Li values. However, sulphate concentrations are believed to be higher in the south of the salar and no drilling has been carried out here by SAS to date.

13.2 Area covered by the resource

The area containing the resource is defined on the basis of:

- The area where geophysics indicates brine is present and where drilling has confirmed elevated Li, K and B is present,
- The SAS tenement boundaries, and;
- The salar morphology.

The resource has been, based on results from the five diamond holes drilled by Orocobre, and the Cauchari North geophysics line conducted by Orocobre, taking into account the third party drilling conducted on adjacent properties.

No internal cutoff grade has been applied to the resource, as the fluid nature of the resource does not allow low grades to be excluded from the resource in the event the brine resource is developed.

The resource is categorized by the author as an inferred resource under JORC and CIMM definitions, based on the data density and level of geological data available. The author notes that the CIMM definition of an ‘Inferred Mineral Resource’ is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, pits, and drill holes.

It is probable that Li-bearing brine continues south from the Orocobre Olaroz project and west from the LAC Cauchari project into tenements held by SAS on the western margin of

the Cauchari salar (951-R-2008, 1083-P-2008). The company has not conducted any drilling in these properties to date, however pit sampling in the south of this area by SAS and the distribution of the original resource in the adjacent properties (King, 2010a) supports this suggestion. No resources have been estimated in these western properties as part of this study and this is a key area for investigation in future work.

13.3 Hole spacing and data density

The hole spacing is 3.3 km, including the rotary hole CAU006R (excluded from the resource). The hole density is a hole per 6.2 km^2 in the resource area.

13.4 Resource estimation methodology

As there are a limited number of holes in the project area and there is considerable variation in the hole depths an inferred resource for the area has been estimated using a simple methodology,

Because drilling was carried out to different depths within the properties it was necessary to assign a different thickness to the estimated resource depending on the drilling depth. Consequently the resource was broken into a northern and a southern area. In the north of the SAS tenements a resource thickness of 170 m was used, based on the depth of the shallowest hole (CAU005D) in this area. In the south of the properties a resource thickness of 50 m was used, based on the shallowest hole (CAU004D) in that area.

The resource estimation involved:

- Using the salar outline, the Orocobre tenement boundaries, geophysics and the salar geomorphology to define the external boundaries of the resource area of 31.04 km^2.
- Defining the base of the Li-bearing brine body, with the depth limits of drilling and laterally from geochemistry (170 m used in the north, controlled by the depth of hole CAU005D, 50 m used in the south – controlled by the depth of hole CAU004D). The unit thicknesses and the position within the units influence the Li concentrations.
- Calculating an average Sy value for each diamond drill hole. Average Sy data was obtained for each hole by averaging the results for each hole from:
    - A depth weighted Sy value, based on the proportion of sand, silt, clay and in particular halite recorded in each hole, using the logged geology and the Sy values determined for each lithology type (with halite classified as compact or porous) by the BGS.
    - Developing a continuous Sy log for each drill hole, using the neutron log porosities (recorded every cm), where geophysical logging (neutron logs) was available. Where neutron logs were not available an appropriate average value was applied, based on lithology and the values of Sy calculated where neutron logs were available.
    - An unweighted (for lithology) average of results for each hole (which can be biased, due to sampling).
- Using the average Sy values to calculate an equivalent brine thickness value for the length of each drill hole over a m^2 unit area (depth of hole by Sy value = equivalent brine thickness for each hole as m/ m^2).
- Converting the composite Li, K and B values from mg/l to a kg/l value for each hole depth.
- Calculating the grade thickness of each element at each hole using grade thickness = equivalent brine thickness (m/m^2) x composite concentration (kg). This calculation was performed by multiplying the thickness and grade values over a m^2 unit area at each hole.

- Kriging the grade thickness across the area of the resource, to produce a grid of cells with kg values (per 100 m^2 horizontal grid cell).
- Clipping the grade thickness grid with the tenement holding, to exclude an estimated grade outside the tenements.
- Summing the kg/m^2 values over the grid area to produce a total contained kg and contained tonnes value. In the case of lithium the factor of 5.32 was used to convert tonnes Li to tonnes Lithium Carbonate Equivalent. Potassium was converted to KCL potash (Muriate of Potash = MOP), using a conversion factor of 1.91.

The resource calculation was undertaken using cells with 300 m x and y dimensions, to minimize the number of new data points created during kriging. Comparison with 100 m and 25 m cell sizes showed differences of <3% in the total contained tonnage.

13.5 Resource estimation outputs

The output of the resource estimation is shown in Figure 13.1 and Figure 13.2, with distribution maps as kg/m^2 for Li and K. The grid values were summed and multiplied by the block dimensions to obtain the contained tonnage of each analyte.

An inferred resource from the combined northern and southern resource areas contains an estimated 230 million cubic metres of brine at 380 mg/l Li and 3,700 mg/l K. This is equivalent to 470,009 tonnes of lithium carbonate (88,348 tonnes lithium metal) and 1.62 million tonnes of potash (KCl - equivalent to 848,761 tonnes of potassium). The effective date of the resource is 5th December 2016.

	Brine body parameters				Average resource concentrations		Tonnes contained			
Inferred Resource Area	Area km^2	Average thickness m	Mean specific yield %	Brine volume Million m^3	Lithium mg/l	Potassium mg/l	Lithium metal	Potassium	Lithium carbonate	Potash (KCl)
North 0-170 m	19.69	170	6.1%	204	400	3,800	81,000	780,000	430,000	1,500,000
South 0-50 m	11.35	50	4.6%	26	260	2,500	7,000	60,000	40,000	120,000
Combined	31.04			**230**	**380**	**3,700**	**88,000**	**840,000**	**470,000**	**1,620,000**

Table 13.1 Resource estimate results for the Cauchari brine

The Cauchari brine has attractive chemistry, with low Mg/Li and high K/Li ratios and is amenable to a similar process to that used at the Salar de Atacama and the process designed and operated at the adjacent Olaroz lithium project. Due to the similarities in brine chemistry and the proximity to the company's Olaroz project Cauchari brine could potentially be processed at the Olaroz lithium plant.

13.6 Reasonable prospects for extraction - resource extraction comments

The Cauchari project is located between the Olaroz project, which is an operating lithium production facility (mine) since 2015, and the Cauchari project owned by Lithium Americas Corp. A feasibility study has been completed on the Lithium Americas project and the company is in joint venture with major Chilean lithium brine producer, SQM, which is listed on the New York Stock Exchange.

Although the lithium concentration of this project resource is lower than the adjacent Orocobre Olaroz (690 mg/l Li – Houston, 2011) and Lithium Americas Cauchari (600 mg/l, King et. al., 2012) resources. The previous SAS drilling intersected potentially economic lithium concentrations as a likely extension of the Lithium Americas resource. The same aquifers hosting lithium brine in the adjacent Olaroz mine and advanced LAC Cauchari project are likely to extend into the Company's Cauchari project. Consequently the Qualified

Persons believe there are reasonable prospects for economic extraction of brine in the resource. Details of other lithium projects are provided for comparison in the Adjacent Properties section of this report.

Drilling data shows elevated Li, K and B concentrations in brine extend to over 250 m below surface, with project geophysics and drilling on adjacent projects suggesting potential for additional resources below this depth. Further drilling is required to confirm the lithium concentrations below the depth of current drilling

13.7 Exploration target

Based on available geophysics, geology and geochemistry it is possible to define an exploration target:

- Beneath the resource and
- In the western SAS properties, where no drilling has been undertaken to date.

The relationship of an exploration target to the CIM and JORC resource definitions is shown in Figure 13.3.

It must be stressed that an exploration target is not a mineral resource. **The potential quantity and grade of the exploration target is conceptual in nature, and there has been insufficient exploration to define a Mineral Resource in the volume where the Exploration Target is outlined. It is uncertain if further exploration drilling will result in the determination of a Mineral Resource in this volume**, however available information suggest this is likely.

The exploration target is where, based on the available geological evidence, there is the possibility of defining a mineral resource. In keeping with Clause 18 of the JORC Code and CIM requirements the exploration target defined at Cauchari is:

- Not to be considered a resource or reserve,
- Based on information summarized below.

It is a requirement of stating an exploration target that it is based on a range of values, which represent the potential geological conditions. Values have been selected to present an upper and a lower exploration target size. It is likely that the lithium and potassium contained in the exploration target lies somewhere between this Upper and Lower Case.

13.7.1 Information Used to Define the Exploration Target

SAS drilling intersected lithium grades of >400 mg/l at or near the base of holes CAU001D (249 m), CAU002D (186 m) and CAU005D (168 m). Accordingly elevated Li grades are likely to continue beneath the depth of the Cauchari northern and southern resource areas (defined to 170 m and 50 m respectively) and beneath the depth of CAU001D.

Orocobre previously conducted a geophysical survey in the Cauchari Resource area (Cauchari North line) in which gravity and Audiomagnetotelluric (AMT) data was collected. The AMT data (Figure 13.4) suggests brine is present in salar sediments beneath the Orocobre properties to depths of ~350 m or more (depth limit of the survey).

Additional information is available from the work undertaken in adjacent properties by Lithium Americas Corp, including drilling and geophysics. This information, which principally relates to the area immediately west of the SAS resource, suggests salar sediments were intersected to 449.5 m below surface (hole DDH007 in Appendix 1 of King, 2010), with

multiple other holes intersecting salar sediments to 350 m deep. Consequently there is reason to believe the lithium-bearing brine in the Orocobre properties may extend to 350 m or deeper.

The deeper drilling conducted by Lithium Americas Corp (Figure 7-7, feasibility study July 11, 2012) suggests there is a thick layer of sand underlying the halite sequence intersected in SAS drilling. This deep sand unit suggests potential for the same unit in the SAS properties, beneath the depth of current drilling.

13.7.2 Estimation of the Exploration Target

The following parameters have been used to estimate an Upper Assumption and Lower Assumption case for lithium and potassium in the Cauchari Exploration Target. The former uses the higher values for all parameters and the latter uses the lower values. Values used are shown in Table 13.2.

The thickness of the resource (Table 13.2) depends on the drilling depths of SAS drill holes and has been separated into a northern and southern area reflecting this. The exploration target (defined to lie immediately below the resource) is consequently also separated into a northern and southern target under the same surface outlines. A separate exploration target area is defined in the western properties, where they continue directly south of the Olaroz lithium project.

Area

- The Northern target covers 19.69 km^2;
- The southern target 11.35 km^2;
- The northwestern target of 22 km^2;
- A small southwestern target of 2.4 km^2

The total area (eastern and western areas and subareas) is 55.44 km^2.

Thickness

A variable thickness is used for the target estimate, depending on the thickness of the overlying resource area and the potential thickness of gravels without Li-mineralised brine in the western area.

Eastern tenements

- In the northern area a thickness of 180 m (from 170 to 350 m depth) as the Upper Assumption and the Lower Assumption; and
- In the southern area a thickness of 300 m (from 50-350 m depth) as the Upper Assumption and 170 m (from 50 to 220 m) as the Lower Assumption, to account for the possibility of basement closer to surface or a thinner brine column.

Western tenements

- In the northwestern area a thickness of 200 m (from 150 to 350 m depth) is the Upper Assumption reducing to 150 m in the Lower Assumption; and
- In the southwestern area a thickness of 300 m (from 50 to 350 m depth) is the Upper Assumption and 200 m (from 50 to 250 m) as the Lower Assumption, to account for the possibility of basement closer to surface or a thinner brine column.

Porosity

Porosity is a vital measurement in determining a brine resource and it is important to understand the difference between definitions of porosity. Only part of the total porosity (Pt) consists of interconnected pores that can be drained. The drainable porosity component is referred to as the specific yield (Sy) – the proportion of water that can be yielded when the aquifer is pumped.

The BGS Sy measurements at Cauchari and Olaroz have been used for the porosity values in the exploration target estimate.

- For the Upper Assumption 13% is used as the specific yield (equivalent to the sand dominant Sy at Olaroz or a mixture of porous halite [16% at Cauchari] and some finer grained sediments)
- For the Lower Assumption 2% is used as the specific yield (equivalent to compact halite at Cauchari)

Lithium and Potassium Concentrations

- A value of 537 mg/L for Li and 5350 mg/l K is used in the upside case for the eastern tenements, (equivalent to the average of chemistry data sets from CAU001D bailer and core extraction samples). This compares to values of 600 mg/l and 570 mg/l Li used for the updated Lithium Americas Corp resource (outlined in the 12 July 2012 Feasibility study). The corresponding K values determined by Lithium Americas Corp were 5156 and 4753 mg/l,
- A value of 260 mg/L Li and 2550 mg/L K is used in the Lower Assumption case (representing the lower grade values from the southern shallow part of the Orocobre Cauchari resource – see Table 1).

The contained lithium in the exploration target (combining values for the eastern and western areas – see Table 13.2) ranges from the Upper Assumption case of 5.6 mt of lithium carbonate and 19 mt of potash to the Lower Assumption case of 0.25 mt of lithium carbonate and 0.9 mt of potash. The concentrations in the Lower Assumption case are not economic brine grades at current market conditions. Note the total exploration target is different to that announced by Orocobre on 22 October 2012, as the western part of the exploration target has subsequently been added, taking consideration of exploration results at the SdJ Olaroz project and the LAC Cauchari project.

It must be stressed the exploration target is based on a series of assumptions and future drilling is required to determine the brine grade and formation porosity (Sy = drainable porosity) values to establish whether a resource can be defined.

UPPER ASSUMPTION ESTIMATE - EASTERN AREA									
Area km^2	Thickness m (to 350 m depth)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash (KCl) metric tonnes
NORTHERN									
19.69	180	13%	460.7	537	250,000	1,300,000	5350	2,500,000	4,700,000
SOUTHERN									
11.35	300	13%	442.7	537	240,000	1,300,000	5350	2,400,000	4,500,000
UPPER ASSUMPTION TOTAL					**490,000**	**2,600,000**		**4,800,000**	**9,200,000**
LOWER ASSUMPTION ESTIMATE - EASTERN AREA									
Area km^2	Thickness m (to 350 m N, 270 m S)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash metric tonnes
NORTHERN									
19.69	180	2%	31.5	260	18,000	100,000	2500	180,000	340,000
SOUTHERN									
11.35	220	2%	18.2	260	10,000	50,000	2500	100,000	180,000
LOWER ASSUMPTION TOTAL					**28,000**	**150,000**		**270,000**	**520,000**
UPPER ASSUMPTION ESTIMATE - WESTERN AREA									
Area km^2	Thickness m (to 450/350 m depth)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash metric tonnes
NORTHERN - 150 m of Barren gravel assumed above brine									
22.00	300	13%	858.0	600	510,000	2,700,000	5350	4,600,000	8,800,000
SOUTHERN - 50 m of Barren assumed above brine									
2.40	300	13%	93.6	600	60,000	300,000	5350	500,000	1,000,000
UPPER ASSUMPTION TOTAL					**570,000**	**3,000,000**		**5,100,000**	**9,800,000**
LOWER ASSUMPTION ESTIMATE - WESTERN AREA									
Area km^2	Thickness m (to 300 m N, 250 m S)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash metric tonnes
NORTHERN - 150 m of Barren gravel assumed above brine									
22.00	150	2%	66.0	260	18,000	90,000	2500	170,000	310,000
SOUTHERN - 50 m of Barren assumed above brine									
2.40	200	2%	9.6	260	2,000	10,000	2500	20,000	50,000
LOWER ASSUMPTION TOTAL					**20,000**	**100,000**		**190,000**	**360,000**
UPPER ASSUMPTION ESTIMATE - COMBINED EASTERN AND WESTERN AREA									
					1,060,000	**5,600,000**		**9,900,000**	**19,000,000**
LOWER ASSUMPTION ESTIMATE - COMBINED EASTERN AND WESTERN AREA									
					48,000	**250,000**		**460,000**	**880,000**

Table 13.2 Exploration target for different parts of the Cauchari tenements

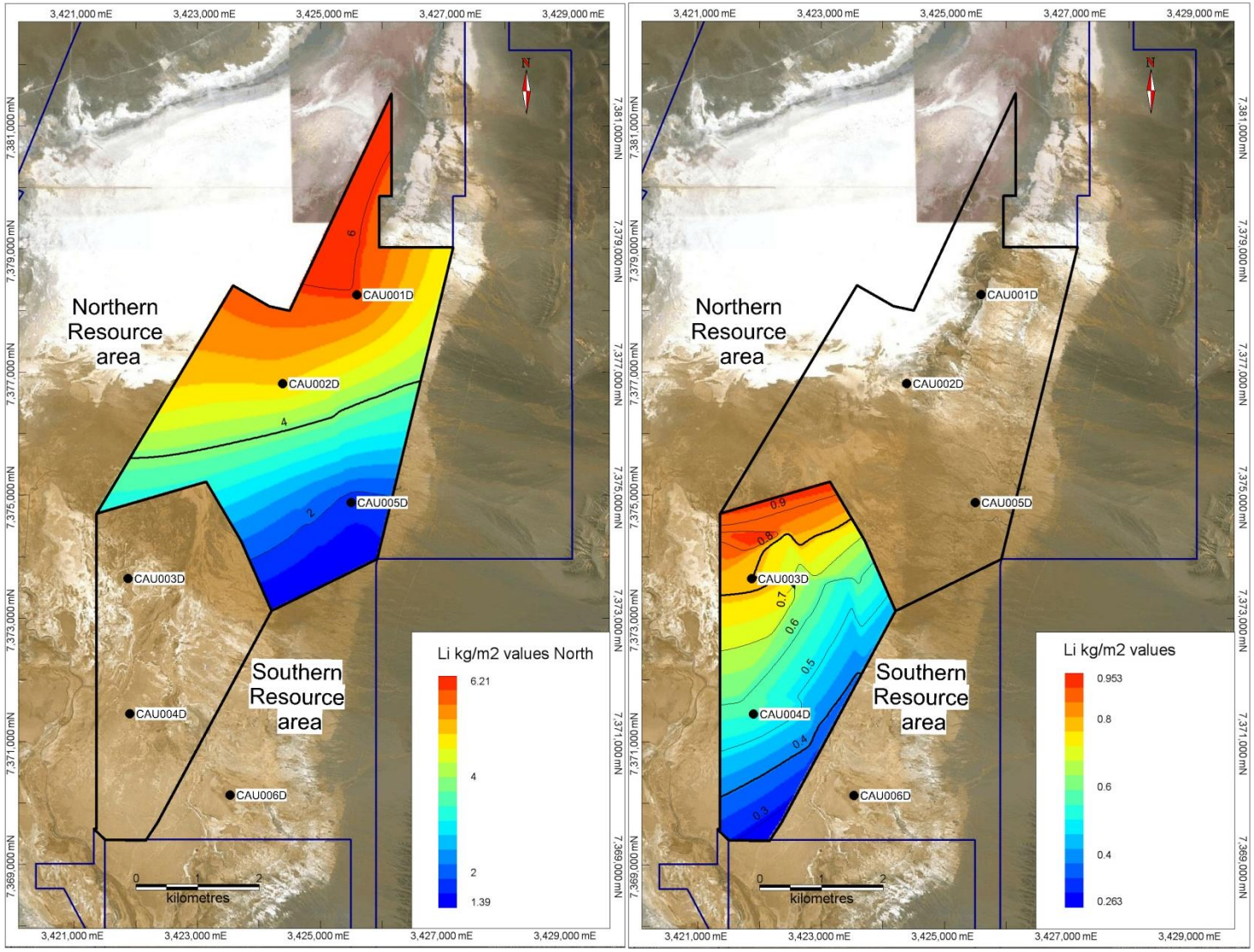


Figure 13.1 Resource area with kg/m^2 values for Li

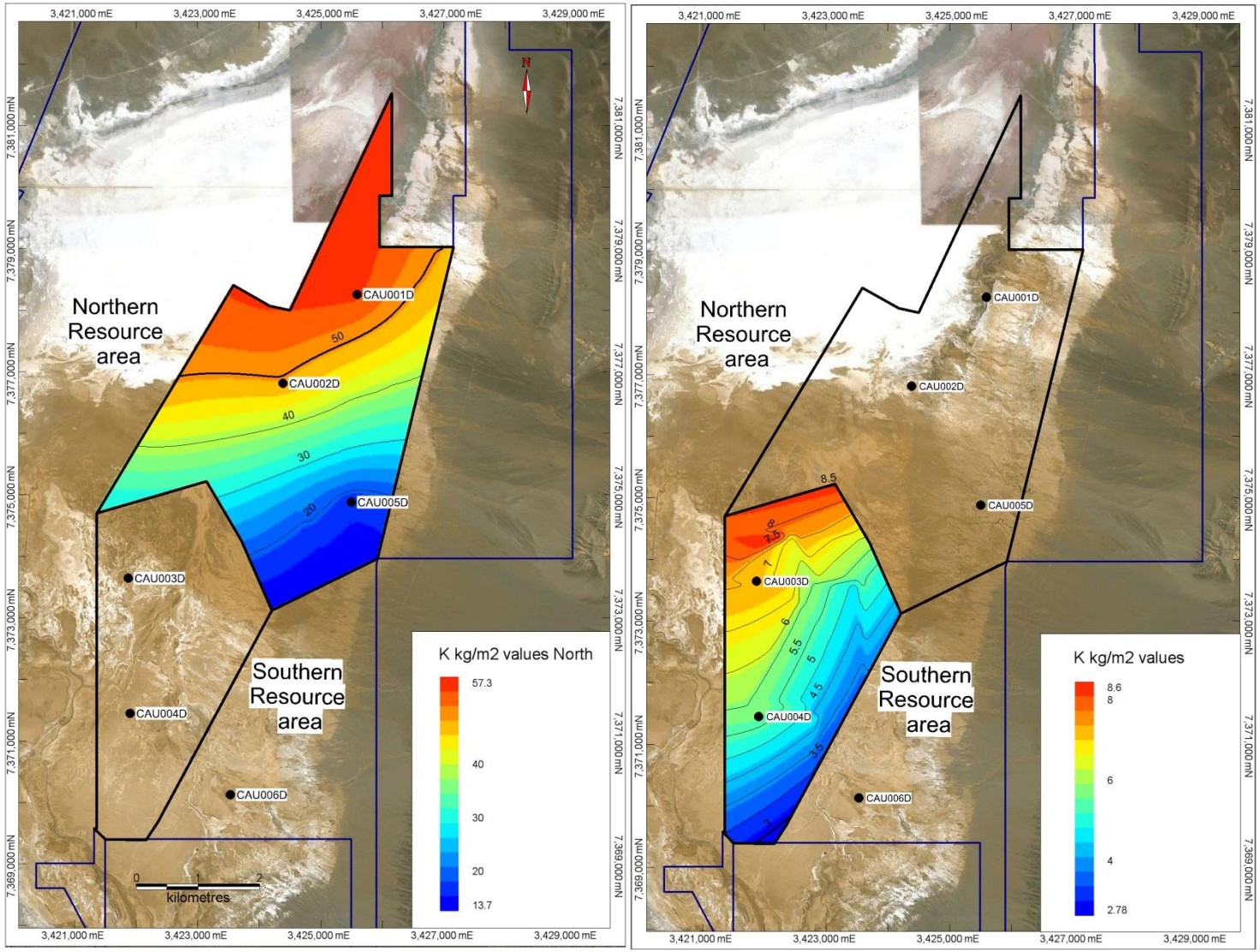


Figure 13.2 Resource area with kg/m^2 values for K

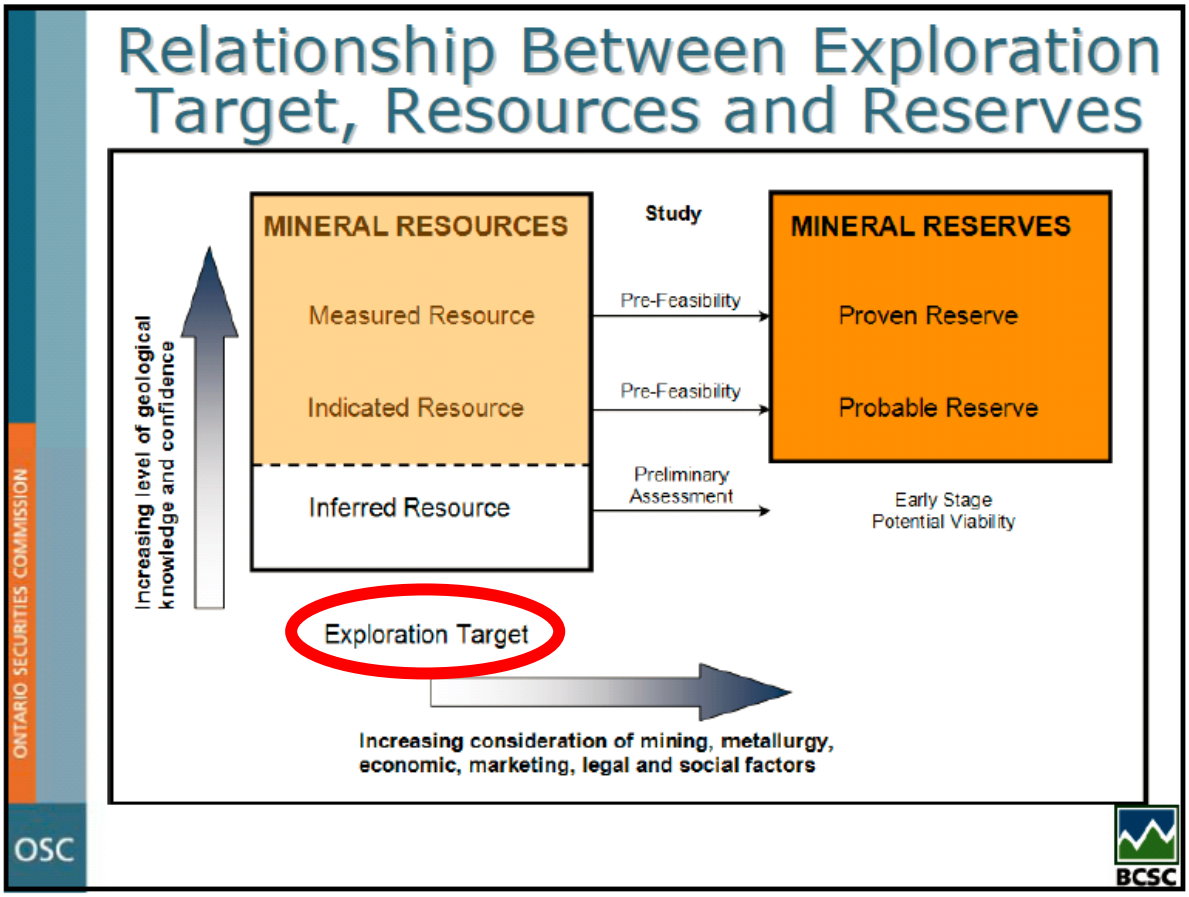


Figure 13.3 Relationship of the exploration target to geological knowledge and mining considerations

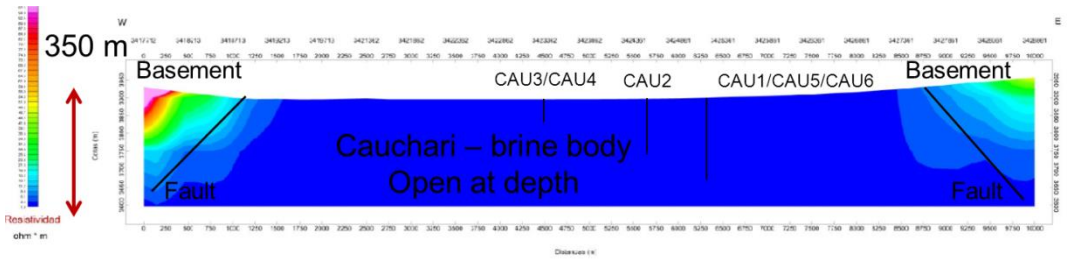


Figure 13.4 Cauchari North AMT line (looking north) with SAS drill holes projected onto the section

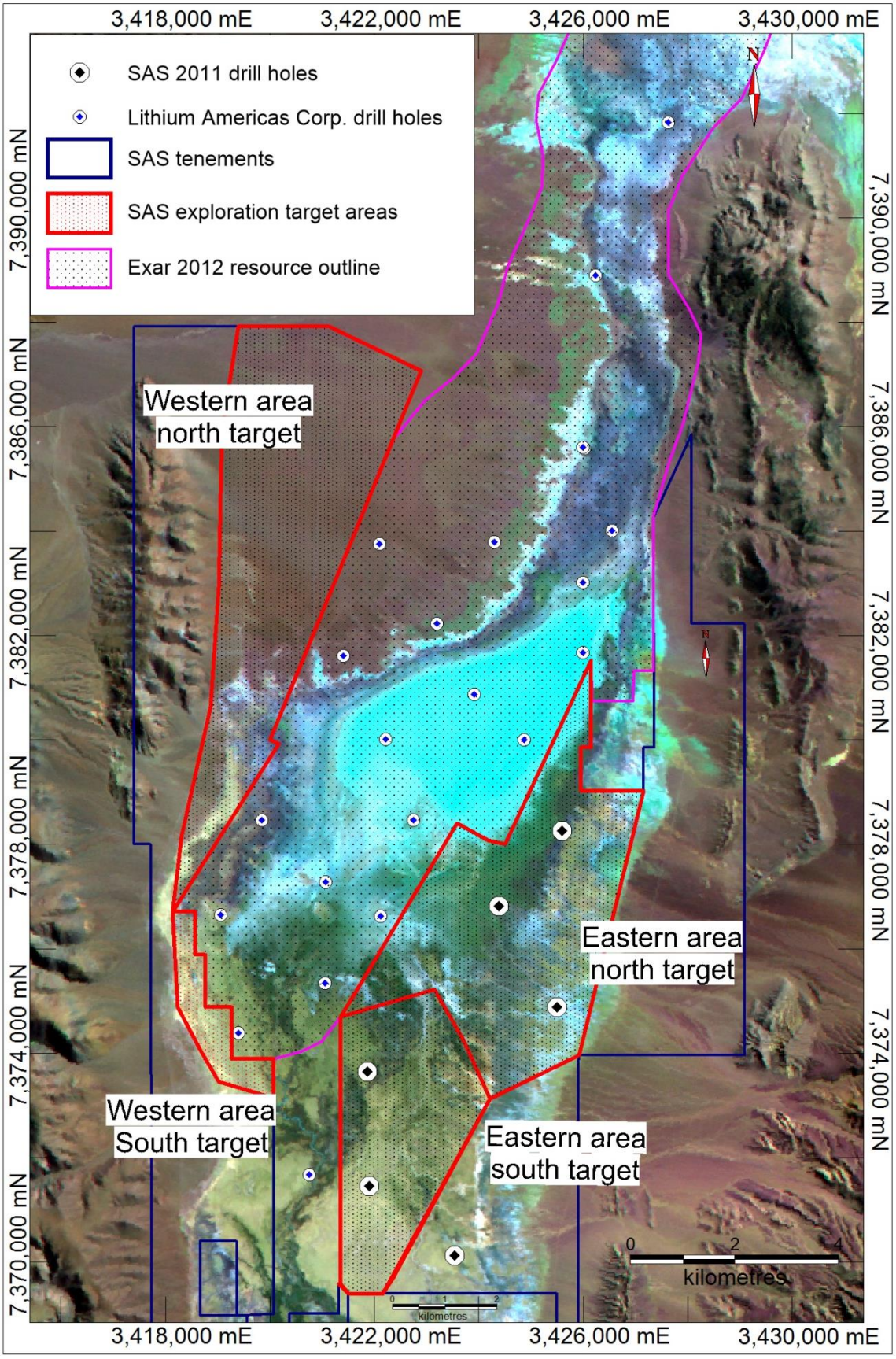


Figure 13.5 Outline of the different exploration target areas in the Cauchari tenements

14 MINERAL RESERVE ESTIMATES

Not applicable.

15 MINING METHODS

Not applicable.

16 RECOVERY METHODS

Not applicable.

17 PROJECT INFRASTRUCTURE

Not applicable.

18 MARKETING STUDIES AND CONTRACTS

Not applicable.

19 ENVIRONMENTAL STUDIES, PERMITING, AND SOCIAL OR COMMUNITY IMPACT

Not applicable.

20 CAPITAL AND OPERATING COSTS

Not applicable.

21 ECONOMIC ANALYSIS

Not applicable.

22 ADJACENT PROPERTIES

22.1 General comments

Two salars in the region have been producing Li, K and B products from brines for more than fifteen years: the Salars de Atacama in Chile, and Hombre Muerto in Argentina. In both salars the host aquifer is a large halite body.

Since 2015 the company Sales de Jujuy (66.5% owned by Orocobre) has been operating the Olaroz lithium project in the Olaroz salar 20-30 km north of the Cauchari properties. This new project has a name plate capacity of 17,500 tpa of lithium carbonate and is currently looking to expand lithium production from this initial stage of the project.

Lithium concentrations are highly elevated throughout the region encompassing Cauchari and Olaroz, with lithium in the Cauchari properties of sufficient concentration for potential economic lithium production, when compared to Olaroz and other advanced lithium projects in Argentina.

The following summary of adjacent properties (tenements) and projects is based on publicly released information that has not been validated by the authors, Hydrominex, PEC, Orocobre or South American salars.

	Salar de Atacama Chile	Hombre Muerto Argentina	Salar de Rincon, Argentina	Salar de Olaroz Argentina	Salinas Grande* Argentina	Guayatayoc* Argentina	Cauchari* Argentina	Salar de Cauchari Argentina	Salar de Uyuni Bolivia	Silver Peak Nevada
	mean	FMC	Sentient	.....	Orocobre	.....		(LAC)		CFC
Li	1,835	744	397	796	775	67	191	618	424	245
K	22,626	7,404	7,513	6,600	9,289	2,185	1,596	5,127	8,719	5,655
Mg	11,741	1,020	3,419	2,289	2,117	115	453	1,770	7,872	352
Ca	379	636	494	416	1,450	628	569	401	557	213
B	783	420	331	822	232	144	244	1,360	242	85
Density	1.223	1.205	1.220						1.211	1.297
Mg/Li	6.4	1.37	8.6	2.88	2.73	1.72	2.37	2.86	18.6	1.43

* mean values include all pit samples from nucleus and margins and are not necessarily representative of possible production values

Data for Salars de Atacama, Hombre Muerto, Rincón, and Uyuni as well as Silver peak, taken from "Evaluation of The Potential of Salar del Rincon Brine Deposit as a Source of Lithium, Potash, Boron And Other Mineral Resources, by Pedro Pavlovic and Jorge Fowler, 2004. Salar de Cuachari (LAC), from NI 43-101, Lithium Americas Corporations, February 15th 2010.

Table 22.1 Comparison of Cauchari (2010 pit sample) results with other salar brine chemical compositions (from Houston, 2010b)

22.2 Adjacent properties to Cauchari

The mineralization on adjacent properties owned by Orocobre (Sales de Jujuy) and Lithium Americas Corporation is not necessarily indicative of the potential of mineralization on the properties that are the subject of this Report. However, it does suggest significant lithium resources may extend into these properties.

Orocobre (Sales de Jujuy)

The company Sales de Jujuy holds mining tenements covering extensive areas of the Olaroz salar, immediately adjacent to the Cauchari tenements discussed in this report. At Olaroz the company announced a resource of 6.4 million tonnes of Lithium Carbonate equivalent and 19.3 million tonnes of potash (KCL) (Houston and Gunn, 2011). Further to that Sales de Jujuy (Orocobre) announced on 23 October 2014 a significant exploration target of between 1.6 and 7.5 mt LCE underlying the resource that was defined to a depth of 200 m. This exploration target requires additional drilling to convert part of this exploration target into project resources and reserves. The western Cauchari properties discussed in this report are immediately adjacent to, and continue south from the Olaroz properties (Figure 13.5).

Lithium Americas Corp.

Between the eastern and western tenements held by SAS the company Lithium Americas Corporation (LAC) has an extensive package of adjacent properties, with 24 properties comprising 14,042 hectares over the Cauchari and Olaroz Salars held through its Argentinean subsidiary Minera Exar S.A. (King et., al. July 11th 2012).

Lithium Americas has conducted an exploration program which includes pitting and brine sampling, seismic traverses, electrical geophysics and gravity profiling, RC and diamond drilling across the tenements. A total of 53 diamond and RC drill holes were completed by the end of October 2010 for a total of 9890 m (4176 m percussion and 5714 of diamond drilling – King, 6 December, 2010). Drill hole depths range from 28 m to 450 m. Lithium results quoted by Lithium Americas are significantly elevated over broad intervals (King, 6 December, 2010).

Lithium Americas produced an NI43-101 report and an inferred, indicated and measured resource for the project in December 2010 (King, 6 December, 2010). This was followed by a Preliminary Economic Assessment (Worley Parsons, 30 April, 2011) and a Definitive Feasibility Study (King et., al. July 11th 2012). LAC state a total measured resource of 576,000 tonnes of Lithium and a total indicated resource of 1,650,000 tonnes of lithium for a

combined resource of 2,226,000 tonnes of lithium. The concentration of the LAC resource is 630 mg/l Li (measured) and 570 mg/l Li (indicated), (NI 43-101 Technical Report and feasibility study July 11th, 2012). The authors and SAS have not validated the data publicly released by LAC and no reliance should be placed on that data with regard to evaluating the SAS properties.

Cauchari project - this report

The Cauchari project properties which are the subject of this report are immediately adjacent to and generally within 5 km of properties owned by Lithium Americas. In the northern of the Cauchari salar the properties in the Cauchari project subject to this report are located immediately west and east of the LAC properties containing that company's resource (Figure 13.5).

22.3 Borate mineralization

Quaternary ulexite mineralization occurs throughout several areas within the salar tenements held by SAS. Some of these occurrences were previously mined by small borate producers, although no records are available.

Ulexite mineralization occurs as a precipitate just below the current surface of the salar (King, 6 December, 2010). The ulexite forms extensive layers, with variable thickness, and irregular geometry. Within the layers ulexite occurs as nodules or bands at the base of sandy horizons, associated with gypsum, and halite (primary author's observations). The extraction of the mineral is conducted manually in the high grade zones, and by the use of a backhoe in zones where the ulexite beds are thicker (primary author's observations).

23 OTHER RELEVANT DATA AND INFORMATION

The following information relates to mineral processing and metallurgical activities carried out by Orocobre on the Olaroz properties. The Cauchari properties subject to this report are mostly located within 20-30 km of the Orocobre Olaroz properties and abut against the southern Olaroz properties. Although there are minor differences in the brine chemistry between Olaroz and Cauchari the brine is sufficiently similar to consider a similar/the same lithium extraction process could be applied to the Cauchari brine. The reader is referred to the summary process sheets provided in the Orocobre NI43-101 Technical Report (p154 and 157, Houston and Gunn, 13 May, 2011).

However, the reader is cautioned that the qualified persons have been unable to verify the applicability of the Olaroz lithium brine extraction process to the brine in the Cauchari project, subject to this report, as no brine test work, evaporation studies or pilot plant testing have yet been carried out on the Cauchari properties subject which are the subject of this report. The information on the Olaroz lithium brine process is provided in the Olaroz NI43-101 technical report mentioned above is not necessarily applicable to the mineralization on the Cauchari property that are the subject of this technical report.

23.1 Aspects relating to the water balance and brine extraction

Brine prospects are different from solid phase industrial mineral projects due to their fluid nature. During production, the flow of brine through the host aquifer will result in an unknown amount of mixing, so it is vital to address the response of the host aquifer to pumping. This requires knowledge of the permeability and the flow regime, not only of the host aquifer within the tenements, but outside the tenements and the margins of the salar, where hydraulic connectivity with adjoining aquifers and surface water may allow flow into the host aquifer.

The Cauchari project is at too early a stage to have a comprehensive suite of such data collected. However, drilling completed as part of the program documented in this report has obtained aquifer samples for analysis of porosity characteristics. Future investigation is anticipated to include evaluation of the salar flow regime characteristics within the South American Salars tenements, by conducting additional drilling, long duration pump testing and monitoring of water levels and chemistry.

23.2 Mineral processing and metallurgical testing

The brine body has attractive grades and, favourable chemistry, with a low magnesium to lithium ratio (below 3 in the higher grade central part of the resource) and a high potassium to lithium ratio of ~ 11. The sulphate to lithium ratio is 61 in the central area of the resource, rising to 114 for all the drill holes. No evaporation ponds have been constructed at the site to date. Brine evaporation rates and chemistry are likely to be very similar to the Sales de Jujuy Olaroz project approximately 20 km to the north of the Cauchari resource, which is the subject of this report.

The chemical processing of the brine is being investigated by consulting processing engineer Peter Ehren, of Ehren Gonzalez Ltda (PEC), a Chilean consultancy who designing the process route for the Sales de Jujuy Olaroz project. Information to date suggests a similar process to that at Olaroz can be applied, which is outlined below.

24 INTERPRETATION AND CONCLUSIONS

The Cauchari salar is located in the Puna region in the province of Jujuy, NW Argentina. The Cauchari salar occupies the southern part of the same drainage basin as the Olaroz salar, with an internal drainage divide separating them near the international highway. The Cauchari salar is elongate north-south, with a typical width of 9 km and a north-south length of approximately 40 km. This orientation reflects north-south trending thrust faults on the eastern and western margins of the salar, contributing to the closed geometry of the basin. Modelling of gravity and AMT (electrical) geophysical survey data and drilling across the salar suggests the salar is at least 400 m deep.

A total of 5 diamond drill holes were drilled in the SAS (South American Salars) properties in 2011 to depths up to 249 m. The three northern diamond holes were drilled to between 168 and 249 m, whereas those in the south were drilled to 46.5 and 72 m deep. A rotary drill hole in the southeast of the Orocobre properties was drilled to 150 m. Geophysical logging of drill holes was carried out, where possible, as some drilling equipment was lost in holes restricting intervals which could be geophysically logged.

Advantage Lithium has entered into a letter of intent ("LOI") with Orocobre Limited (85% owner of SAS) and the minority owners of SAS which will result in Advantage Lithium acquiring up to 75% of the Cauchari project

Interpretation of drill cores, and down hole geophysical logging undertaken on the drill holes, suggests there are two main lithological units (Units A and B), with these units subdivided into a total of 6 sub-units. Unit A consists of clastic sediments, silts and clays with minor sand and halite; whereas Unit B is predominantly halite, generally comprising compact halite, but with some intervals of more porous halite. Correlation with Olaroz suggests that Unit B at Cauchari corresponds to the deeper Unit G at Olaroz, where halite is more common. Drilling did not intersect the basement (Tertiary or older sediments or volcanic rocks) beneath the salar. Re-interpretation of a gravity line across the SAS properties is consistent with drilling results from Lithium Americas Corp on adjacent properties, suggesting the salar basin is more than 400 m deep.

Diamond core samples were sent to the Independent British Geological Survey (“BGS”) laboratory, with a total of 147 samples analysed for total porosity (Pt) and 118 for specific yield (Sy). An additional 155 samples were analysed in the company’s Salta laboratory for total porosity. The Sy analyses provided mean values for sands (4%, due to variable halite cementation), silt mixes (5%), clays (2%), halite-sediment mixes (7%) and halite (2% for compact halite to 16% for porous halite), with a thick sequence of halite interpreted to underlie the area of the Cauchari resource.

Brine sample results and lithological information from the 5 diamond drill holes was used to estimate a resource for the area drilled. Extensive QA/QC evaluation undertaken on the geochemical data and assays from Alex Stewart laboratories indicates the analyses are acceptable for use in the inferred resource estimate. The Sy values from the BGS analyses were used to calculate a weighted Sy value for each drill hole, based on the lithologies and thicknesses of each lithology. These results were compared with Sy calculated from the relationship established between porosity geophysical logs and the laboratory Sy values measured for core samples. The results from the lithology-weighted Sy values and those calculated from porosity logs were averaged and used to calculate an equivalent brine thickness at each diamond hole.

The composite brine sample results as g/l values were multiplied by the equivalent brine thickness (litres contained over a m^2), to produce a kg/m^2 value for each diamond hole. This

data was kriged across the salar to produce a set of kg/m^2 concentration maps for Li, K and B. These grids were then clipped with the Orocobre tenements. The sum of the grid values (accounting for the grid cell size) produced the total resource mass, presented in the table below.

Because drilling was carried out to different depths within the properties it was necessary to assign a different thickness to the calculated resource depending on the drilling depth. In the north of the properties a resource thickness of 170 m was used, based on the depth of the shallowest hole (CAU005D) in this area. In the south of the properties a resource thickness of 50 m was used, based on the shallowest hole (CAU004D) in that area.

An inferred resource from the combined northern and southern resource areas contains an estimated 230 million cubic metres of brine at ~380 mg/l Li and 3,700 mg/l K. This is equivalent to 470,000 tonnes of lithium carbonate (~88,000 tonnes lithium metal) and 1.62 million tonnes of potash (KCl - equivalent to ~840,000 tonnes of potassium) using conversion factors of 5.32 and 1.91 for lithium and potassium respectively.

	Brine body parameters				Average resource concentrations		Tonnes contained			
Inferred Resource Area	Area km^2	Average thickness m	Mean specific yield %	Brine volume Million m^3	Lithium mg/l	Potassium mg/l	Lithium metal	Potassium	Lithium carbonate	Potash (KCl)
North 0-170 m	19.69	170	6.1%	204	400	3,800	81,000	780,000	430,000	1,500,000
South 0-50 m	11.35	50	4.6%	26	260	2,500	7,000	60,000	40,000	120,000
Combined	31.04			230	380	3,700	88,000	840,000	470,000	1,620,000

Table 24.1 Summary of the lithium and potassium resource estimated for the Cauchari project
Note there are differences due to rounding when compared to the table released by Orocobre on the 22 October 2012.

In addition to the inferred resource defined in 2012 an exploration target was also defined in 2012 to cover the area beneath the defined resource. The 2012 drilling campaign did not reach the target depth, except in hole CAU001D. As the Cauchari basin is thought to extend to 400 m below surface there is potential to substantially increase the project resource if the deeper sand unit identified in adjacent properties is intersected in the SAS Cauchari properties. However, it must be stressed that an exploration target is not a mineral resource. The potential quantity and grade of the exploration target is conceptual in nature and there has been insufficient exploration to define a mineral resource in the volume where the Exploration Target is outlined. It is uncertain if further exploration will result in the determination of a Mineral Resource in this volume.

The original 2012 exploration target was defined only in the eastern tenements. Consideration of the western Cauchari properties suggests continuation of the aquifers hosting brine at Olaroz beneath the Archibarca alluvial fan directly into the SAS Cauchari tenements. Drilling by Lithium Americas Corp (LAC) on adjacent properties shows that brine is present beneath the alluvial fan sediments. On that basis an additional exploration target has been defined in the western properties in addition to that publicly released with the original resource estimate. The exploration targets are outlined in the following Table 24.2 using conversion factors of 5.32 and 1.91 for lithium and potassium respectively.

The Cauchari brine has attractive chemistry, with low Mg/Li and high K/Li ratios and may be amenable to the process that is being used to produce lithium at the adjacent Olaroz lithium project. However, process test work has not yet been completed to determine the process that could be used for lithium production from the Cauchari brine.

UPPER ASSUMPTION ESTIMATE - EASTERN AREA									
Area km^2	Thickness m (to 350 m depth)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash (KCl) metric tonnes
NORTHERN									
19.69	180	13%	460.7	537	250,000	1,300,000	5350	2,500,000	4,700,000
SOUTHERN									
11.35	300	13%	442.7	537	240,000	1,300,000	5350	2,400,000	4,500,000
UPPER ASSUMPTION TOTAL					**490,000**	**2,600,000**		**4,800,000**	**9,200,000**
LOWER ASSUMPTION ESTIMATE - EASTERN AREA									
Area km^2	Thickness m (to 350 m N, 270 m S)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash metric tonnes
NORTHERN									
19.69	180	2%	31.5	260	18,000	100,000	2500	180,000	340,000
SOUTHERN									
11.35	220	2%	18.2	260	10,000	50,000	2500	100,000	180,000
LOWER ASSUMPTION TOTAL					**28,000**	**150,000**		**270,000**	**520,000**
UPPER ASSUMPTION ESTIMATE - WESTERN AREA									
Area km^2	Thickness m (to 450/350 m depth)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash metric tonnes
NORTHERN - 150 m of Barren gravel assumed above brine									
22.00	300	13%	858.0	600	510,000	2,700,000	5350	4,600,000	8,800,000
SOUTHERN - 50 m of Barren assumed above brine									
2.40	300	13%	93.6	600	60,000	300,000	5350	500,000	1,000,000
UPPER ASSUMPTION TOTAL					**570,000**	**3,000,000**		**5,100,000**	**9,800,000**
LOWER ASSUMPTION ESTIMATE - WESTERN AREA									
Area km^2	Thickness m (to 300 m N, 250 m S)	Mean specific yield %	Brine volume million m^3	Li Concentration mg/L	Contained Li metric tonnes	Lithium carbonate metric tonnes	K Concentration mg/L	Contained K metric tonnes	Potash metric tonnes
NORTHERN - 150 m of Barren gravel assumed above brine									
22.00	150	2%	66.0	260	18,000	90,000	2500	170,000	310,000
SOUTHERN - 50 m of Barren assumed above brine									
2.40	200	2%	9.6	260	2,000	10,000	2500	20,000	50,000
LOWER ASSUMPTION TOTAL					**20,000**	**100,000**		**190,000**	**360,000**
UPPER ASSUMPTION ESTIMATE - COMBINED EASTERN AND WESTERN AREA									
					1,060,000	**5,600,000**		**9,900,000**	**19,000,000**
LOWER ASSUMPTION ESTIMATE - COMBINED EASTERN AND WESTERN AREA									
					48,000	**250,000**		**460,000**	**880,000**

Table 24.2 Exploration target across the different Cauchari tenements

There are a number of normal risks and uncertainties related to lithium brine projects, and the Cauchari lithium brine project. These are discussed in detail in section 3.7 and include:

- Technical risks, related to brine sampling, porosity measurement, basin depth and the processing route; and
- Regulatory and permitting risks related to property and approvals granting,

Reasonably foreseeable impacts of the aforementioned risks and uncertainties to the project's potential economic viability include the possibility of:

- Not expanding the resource or generating a reserve.
- A less economic project.
- Delays in project permitting and construction.
- Greater government involvement with the project.

25 RECOMMENDATIONS

25.1 Background

The Cauchari evaluation to date has defined a Li, K, and B brine resource, with a low Mg/Li ratio and relatively high K/Li ratio. The current brine resource is relatively small, but there is significant potential to increase the size of resource from that defined in 2012. Further drilling is recommended to explore further the eastern properties, in the vicinity of the previous drilling, and to test the potential in the western properties for brine to extend south from Olaroz.

25.2 Objectives

Future exploration activities should focus on defining the full extent of the resource in the Cauchari properties. Further work should focus on deeper drilling, defining the thickness of the sediments and confirming porosities, brine concentrations and the extractability of the brine resource in long term pumping.

25.3 Recommended Phase 1 work program

25.3.1 Drilling

The 2011 Cauchari drilling program was affected by the limited time available for drilling as part of the conditional drilling approval, and early arrival of the wet season at the beginning of January 2012. A further complication during the drilling program was the problem encountered with the failure of locally manufactured drill casing in the Cauchari holes. This resulted in the abandonment of CAU003D and CAU004D. CAU006R was drilled as a rotary hole, in order to have information at this drill site, which would not have been obtained in the available time frame with the diamond drill rig.

It is recommended that five additional deep drill holes (to 400 m plus) are completed in the Cauchari properties as an initial exploration program. Four holes are recommended in the eastern properties, advancing the drilling program undertaken in 2011. A fifth hole is proposed in the western properties, to evaluate the possible extension of brine-bearing aquifers south from Olaroz into these properties. If the result of this hole is positive then additional drilling is recommended in the western properties, with the objective of defining a resource in this area. It is recommended to conduct a new resource estimate with the new drilling information. Geophysical logging of the holes is recommended to assist correlation of geological units.

25.3.2 Long term pumping tests and permeability assessment

Drilling has established the stratigraphy is dominated by halite in the SAS properties to the depth drilling has been conducted. Intervals of highly porous halite have been observed locally, however the extent of connection between pores and cavities within this halite is uncertain. It is recommended that:

- Packer testing should be considered during future drilling of intervals of porous halite, to establish the permeability of such zones relative to more compact halite and clastic sediments. Low flow sampling and pump testing should also be considered for specific intervals identified as having high porosity in the core.

- Wells should be installed in holes where favourable lithologies are identified. These holes should be drilled and wells installed by an experienced and reliable drilling contractor and adequately developed before pumping, to clean any drilling-related

fluids or muds from the holes. An adequately sized sand pack should be established, to minimize ingress of fine material to the hole. A minimum of three monitoring wells should be drilled at each site, with wells at different depths and distances from the pump bore. The number of monitoring wells is additional to the number of exploration holes/pumping wells, as it is uncertain whether all drill holes will be converted to wells for pump testing.

- Long term pump testing should be undertaken at different locations within the salar, to evaluate the productivity of the halite sequence and the target underlying sand sequence. Test production bores should be constructed at a sufficient diameter to allow installation of a high volume submersible pump. The objective is to pump over an extended period and evaluate the brine quality and variations, in addition to assessing the possible long term pump rate.

- The wells should be monitored continuously during pumping, with the depth to water level measured and brine samples taken regularly. Parameters such as pH, temperature, density and electrical conductivity should be measured in the field before samples are sent to a laboratory with experience analyzing brines. Results should be plotted and interpreted on a daily basis.

- Water discharged from the pump wells should be discharged at a distance of >500 m from the pump site, to minimize recirculation affecting the pump test. A “V-notch” weir and tank with a water level logger at the discharge point should be used to measure flow rates. Testing should include an ~8 hour test with a 4 stage step test (pump test) followed by measurement of the water level recovery and pumping at a constant rate for a period of several months.

- A decision on additional work on the project should be made on the basis of the test production pumping results.

25.3.3 Process test work

Test work on a laboratory and pilot plant scale should be conducted to verify that the same process as the Olaroz process can be applied to brine from the Cauchari project.

25.3.4 Water level monitoring

Water levels should be monitored in the existing SAS drill holes and all the new holes drilled, to evaluate any drawdown caused from pumping by neighbouring company LAC in the salar and the extent of any drawdown.

25.3.5 Gravity surveying

The Cauchari North gravity survey line passes through the resource area. It is recommended that some additional gravity surveying is conducted in the resource area to better understand the depth to the basement of the salar, and the likely variations in thickness of the brine-bearing salar units.

25.3.6 Climate monitoring

Rainfall, wind speed, evaporation and other climatic data should be collected in the Cauchari properties, with regular downloading of weather station data, followed by plotting the results.

25.3.7 Data analysis and reporting

Data analysis should be undertaken throughout field work to check the data collected and quickly identify any errors or omissions in data collection.

25.4 Estimated costs

The following is a breakdown with the cost of the proposed Phase 1 exploration program.

Activities	Cost $US
Drilling 5 rotary holes to 400m deep, installing as wells, plus monitoring wells	$2,000,000
Geophysics, surface and downhole	$100,000
Pump tests, hydrogeological studies	$150,000
Process test work and climate monitoring to evaluate applicability of the Olaroz process	$200,000
Total cost Phase 1 program	$2,450,000

26 DATE AND SIGNATURE PAGE - CERTIFICATE of AUTHOR

I, Murray Brooker, M.Sc., Geol., M.Sc. Hydro, do hereby certify that:

1 I am an independent consultant of:
63 Carlotta St,
Greenwich, NSW 2065, Australia.

2. I have the following academic and professional qualifications:

Academic:

I. B.Sc.(Honours) in Geology from Victoria University of Wellington, New Zealand in 1988
II. M.Sc. in Geology from James Cook University of North Queensland, Australia, in 1992
III. M.Sc. in Hydrogeology from the University of Technology, Sydney, Australia, in 2002.

Professional:

I. Australian Registered Professional Geoscientist (RPGeo) in the fields of mineral exploration and hydrogeology
II. Member of the Australian Institute of Geoscientists (MAIG)
III. Member of the International Association of Hydrogeologists (MIAH).

3. I have practiced my profession for twenty four years.

4. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, past relevant work experience, and affiliation with a professional association (as defined in NI 43-101) I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101. This report is based on my personal review of information provided by the Issuer and on discussions with the Issuer's representatives. My relevant experience for the purpose of this report is:

- 2010-Present Principal Hydrominex Geoscience Consultants
- 2006-2010 Principal Geoscientist – Global Ore Discovery – Mining Industry Consultants
- 2004-2006 Acting Manager Hydrogeology – Parsons Brinckerhoff.
- 2003-2004 Hydrogeologist, Otek Environmental
- 2002-2003 Hydrogeologist, Parsons Brinckerhoff
- 1991-2000 Exploration Geologist and Exploration Manager, North Limited, Argentina, Chile, Mexico, Australia

I have previously been involved in the following brine resource projects:

- Salar de Olaroz for Orocobre, Argentina (2010)
- Salar Salinas Grandes for Orocobre, Argentina (2010)
- Salar de Centenario (2011, 2016) for Lacus Minerals and Lithium Power
- Salar de Pocitos (2011, 2016) for Lacus Minerals
- Lake Mackay, Western Australia for Agrimin (2015-2016)
- Salar de Maricunga for Lithium Power International, Argentina (2016)

5. I am responsible for the technical report entitled "Technical Report on the Cauchari Lithium Project" (the "Technical Report") prepared for Orocobre Limited and Advantage Lithium Corp and dated effective December 5, 2016, amended 22

December, 2016. I am independent of Orocobre Limited and Advantage Lithium Corp. I spent approximately 2 months at the Cauchari project between November and December 2011, and supervised diamond drilling on the project. My last visit was for the duration of 1 day on the 29th June, 2016.

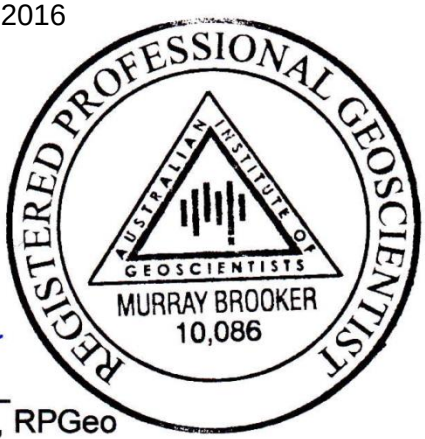
6. I have not had prior involvement with the properties that are the subject of the Technical Report.

7. As of the date of this certificate, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

8. I am independent of the issuer applying all of the tests in section 1.5 of NI 43-101.

9. I have read NI 43-101 and Form 43-101F1 (the "Form"), and the Technical Report has been prepared in compliance with NI 43-101 and the Form.

Effective date: 5th Day of December 2016
Date of signing: 4th Day of December 2016



Signature of Murray Brooker M.Sc, RPGeo

Murray Brooker M.Sc, RPGeo.

Amended date 22 December, 2016

I, Peter Ehren, MSc., AusIMM (CP = Chartered Professional), do hereby certify that:

1 I am an independent consultant and owner of Ehren-González Limitada at Alberto Arenas 4005 112, La Serena, Chile

2. I graduated with a Master of Science Degree in Mining and Petroleum Engineering, with a specialization in Raw Materials Technology and Processing Variant at the Technical University of Delft, The Netherlands in the year 1997

3. I am an independent consultant, a Member of the Australasian Institute of Mining (AusIMM) and metallurgy and a Chartered Professional of the AusIMM.

4. I have practiced my profession for 19 years.

5. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101. This report is based on my personal review of information provided by the Issuer and on discussions with the Issuer's representatives. My relevant experience for the purpose of this report is:

- 1997 Final Thesis of MSc.degree: "Recovery of Lithium from Geothermal Brine, Salton Sea", BHP Minerals, Reno Nevada.
- 1998-2001 Process Engineer, Salar de Atacama, SQM
- 2001-2006 R&D Manager, Lithium and Brine Technology, SQM.
- 2006 Process Project Manager, SQM
- 2007 till data Independent Lithium and Salt Processing Consultant, Ehren-González Limitada

I have previously been involved in the several brine resource projects, where under:

- Salar de Olaroz for Orocobre, Argentina (2009-2016)
- Salar de Cauchari for Orocobre, Argentina (2010)
- Salar Salinas Grandes for Orocobre, Argentina (2010-2013)
- Salar de Maricunga for Li3 Energy and Minera Salar Blanco, Chile (2011-2016)
- Salar de Atacama and Silver Peak for Albermarle, Chile (2014 - 2016)
- Rann of Kutch, Archean Group, India (2015)
- Lake Mackay, Agrimin, Australia (2014-2016)

6. I am responsible for section 23 of the technical report entitled "Technical Report on the Cauchari Lithium Project" (the "Technical Report") prepared for Advantage Lithium Corp. and dated effective December 5th, 2016, amended 22 December, 2016. The latest site visit was for the duration of one day on the 25th of October, 2016. I am independent of Orocobre Limited and Advantage Lithium Limited.

7. I have not had prior involvement with the properties that are the subject of the Technical Report.

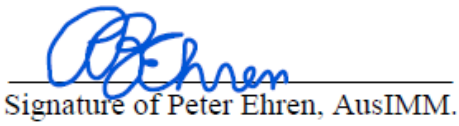
9. As of the date of this certificate, to the best of my knowledge, information and belief, the technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

9. I am independent of the issuer applying all of the tests in section 1.5 of National Instrument 43-101.

10. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

11. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Effective date:- 5th Day of December, 2016
Date of signing:- 5th Day of December, 2016



Signature of Peter Ehren, AusIMM.

Peter Ehren
Printed name of Peter Ehren, AusIMM (CP)

Amended date 22 December, 2016

27 REFERENCES

Allmendinger, R.W., Jordan, T.E., Kay, S.M., and Isacks, B.L., 1997, The Evolution of the Altiplano-Puna Plateau of the Central Andes: Annual Review of Earth and Planetary Science, v. 25, p. 139-174.

Alonso, R.N., Jordan, T.E., Tabbutt, K.T. and Vandevoort, D.S. 1991. Giant evaporate belts of the Neogene central Andes. Geology, 19: 401-404.

Chernicoff, C.J., Richards, J.P., and Zappettini, E.O., 2002, Crustal lineament control on magmatism and mineralization in northwestern Argentina: geological, geophysical, and remote sensing evidence: Ore Geology Reviews, v. 21, p. 127-155.

Coira, B., Davidson, J., Mpodozis, C., and Ramos, V., 1982, Tectonic and Magmatic Evolution of the Andes of Northern Argentina and Chile: Earth Science Reviews, v. 18, p. 303-332.

de Silva, S.L., 1989, Altiplano-Puna volcanic complex of the central Andes: Geology, v. 17, p. 1102-1106.

de Silva, S.L., Zandt, G., Trumball, R., Viramonte, J.G., Salas, G., and Jiménez, N., 2006, Large ignimbrite eruptions and volcano-tectonic depressions in the Central Andes: a thermomechanical perspective, *in* Troise, C., De Natale, G., and Kilburn, C.R.J., eds., 2006, Mechanisms of Activity and Unrest at Large Calderas: Geological Society, London, Special Publication 269, p. 47-63.

Garzione, C.N., Molnar, P., Libarkin, J.C., and MacFadden, B.J., 2006, Rapid late Miocene rise of the Bolivian Altiplano: Evidence for removal of mantle lithosphere: Earth and Planetary Science Letters, v. 241, p. 543-556.

Gregory-Wodzicki, K.M., 2000, Uplift history of the Central and Northern Andes: A review: Geological Society of America Bulletin, v. 112, p. 1091-1105.

Hartley, A.J., Chong, G., Houston, J. and Mather, A. 2005. 150 million years of climatic stability: evidence from the Atacama Desert, northern Chile. Journal of the Geological Society, London, 162: 421-424.

Houston, J. 2006a. Variability of Precipitation In the Atacama Desert: Its Causes and Hydrological Impact. International Journal of Climatology 26: 2181-2189

Houston, J. 2006b. Evaporation in the Atacama desert: An empirical study of spatio-temporal variations and their causes. Journal of Hydrology, 330: 402-412.

Houston, J and Ehren, P. Technical Report on the Olaroz Project, Jujuy Province, Argentina. NI 43-101 report prepared for Orocobre Ltd, April 30, 2010a

Houston, J. Technical Report on the Cauchari Project, Jujuy-Salta Provinces, Argentina. NI 43-101 report prepared for Orocobre Ltd, April 30, 2010b

Houston, J., Gunn, M. Technical Report on the Salar De Olaroz Lithium-Potash Project Jujuy Province, Argentina. NI 43-101 report prepared for Orocobre Ltd, May 13, 2011.

Houston, J., Butcher, A., Ehren, P., Evans, K., and Godfrey, L. The Evaluation of Brine Prospects and the Requirement for Modifications to Filing Standards. Economic Geology. V 106, p 1225-1239.

Igarzábal, A. P. 1984. Estudio geológico de los recursos mineros en salares del NOA (Puna Argentina). Proyecto de Investigación. Consejo de Investigación. Universidad Nacional de Salta

Jordan, T.E., Alonso, R.N. 1987. Cenozoic stratigraphy and basin tectonics of the Andes Mountains, 20-28^{o}S latitude. American Association of Petroleum Geologists Bulletin, 71:49-64.

King, M. 2010. Measured, Indicated and Inferred Resource Estimation of Lithium and Potassium at the Cauchari and Olaroz Salars, Jujuy Province, Argentina. December 6, 2010.

King, M., Kelly, R., and Abbey, D. NI 43 – 101 Technical Report Feasibility Study Reserve Estimation and Lithium Carbonate and Potash Production at the Cauchari-Olaroz Salars, Jujuy Province, Argentina. 11 July, 2012.

Roskill Information Services. 2009. The Economics of Lithium. 11th ed. Roskill Information Services Ltd., 27a Leopold Road, London SW19 7BB, United Kingdom.

Salfity, J.A., and Marquillas, R.A. 1994. Tectonic and sedimentary evolution of the Cretaceous-Eocene Salta Group basin, Argentina. In Salfity, J.A. (ed) Cretaceous tectonics of the Andes, Earth Evolution Series, Vieweg, Weisbaden.
Vazques, G. L. 2011. Investigación Hidrogeológica en Salares con la Aplicación del Método Geoeléctrico Salar De Olaroz–Cauchari - Departamento Susques - Jujuy -Argentina. VII Congreso Argentino de Hidrogeología y V Seminario Hispano-Latinoamericano Sobre Temas Actuales de la Hidrología Subterránea. Hidrogeología Regional y Exploración Hidrogeológica Salta, Argentina, 2011.
Worley Parsons, 2011. NI 43 - 101 Technical Report Preliminary Assessment and Economic Evaluation of the Cauchari-Olaroz Lithium Project, Jujuy Province, Argentina. 30 April, 2011.

28 LIST OF ABREVIATIONS AND DEFINITIONS

°C :	Temperature in degrees Celsius
AAS :	Atomic absorption spectrometry
AMT:	Audio magneto tellurics – a type of electrical geophysics
APHA :	American Public Health Association
Aquifer :	An aquifer is a wet underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, or silt) from which groundwater can be extracted using a well or bore.
ASA	Alex Stewart Assayers, with a Mendoza, Argentina laboratory that was used as the primary laboratory for chemical analyses.
ASTM:	American Society for Testing and Materials
Bailer:	A tube with a non-return valve at the base, which is used to collect water from within a drill hole, with the bailer being winched to the surface to recover the brine or fluid sample
Brine:	Brine is water with a high concentration of dissolved salts (i.e. sea water, water in salars). Brine may be saturated or under saturated with salts, whereas fluid in the context of salars and this report refers more generally to fresh water, brackish water and brine
B:	Boron
BGS:	British Geological Survey. An independent laboratory where porosity testing (total and effective porosity and specific yield) and chemical analyses on brine extracted from cores were carried out for this project
Ca:	Calcium
CaCO3:	Calcium carbonate
Cateo:	Argentine mineral exploration licence
Cl:	Chloride
CO3:	Carbonate
Depocentre:	The area where the major deposition of a geological unit took place
Fluid:	Liquid substance (i.e. brine) which flows when subject to a gradient
GPS:	Global positioning system
ha:	Hectare
HCO_3:	Bicarbonate
ICP:	Inductively Coupled Plasma spectrometry – laboratory equipment typically used for chemical analysis of brine samples
JORC :	Joint Ore Reserve Committee code for reporting of mineral resources – the Australian mineral resource and reserve reporting code
K:	Potassium
K:	Not to be confused with the element potassium – this term refers to the hydraulic conductivity (permeability) of a geological unit, as determined by pump or permeability testing
K/Li	Potassium to lithium ratio
L:	Litre (liter) of volume
LAC	Lithium Americas Corporation – a Canadian listed company in joint venture with Chilean lithium company SQM in the Cauchari salar
Li:	Lithium
Li_2CO_3:	Lithium carbonate – common saleable lithium product, with a conversion of 5.32 from contained lithium mass to lithium carbonate mass
m asl:	Metres above sea level

mg/L:	Milligrams per litre
Mg/Li:	Magnesium to lithium ratio
Mg:	Magnesium
Minas:	Type of Argentinian mining licence, which provides the right to exploit minerals, subject to meeting other provisions required for mining
Mmol/L :	Millimoles per litre
mS/cm^2:	Millisiemens/centimeter squared – a measure of electrical conductivity of a fluid
MT:	Magneto tellurics - a type of electrical geophysics
Na:	Sodium
Orocobre	Operator to the Sales de Jujuy lithium project on the Olaroz salar. Controlling entity of South American Salars
pH :	Measure of hydrogen ion activity and the relative acidic or basic character of a fluid
ppm:	Parts per million
Pe	Effective porosity, a measure of the porosity corresponding to the interconnected pores. Not to be confused with Sy (Specific yield or drainable porosity, which refers to pores which can be drained under the influence of gravity
Pt	Total porosity. This relates to the volume of pores within a unit volume of aquifer material. Except in well sorted sands some of the pores are isolated from others and only pores in mutual contact can be drained. The interconnected porosity is referred to as effective porosity (Pe). If the effective porosity is totally saturated only part of this will drain under gravity during pumping. This part of the Pe is referred to as the specific yield (Sy). A portion of the fluid is retained in the pores due to capillary forces and adsorption, and this portion is referred to as specific retention (Sr). Pt > Pe and Pe = Sy + Sr
QA/QC:	Quality assurance/quality control
QP:	Qualified person as specified under Canadian NI43-101 requirements
Reserve:	Mineral reserves are resources known to be economically feasible for extraction. Reserves are either Probable Reserves or Proven Reserves. Generally the conversion of resources into reserves requires the application of various modifying factors. Definition of reserves in salar projects is problematic, due to the fluid nature of brine. The reader is referred to Houston et. al., (2011) for a more detailed discussion of this issue
Resource:	Mineral resources are those potentially economic mineral concentrations that have undergone enough scrutiny to quantify their contained metal to a certain degree. None of these resources are ore (economically extractable mineral material), because the economics of the mineral deposit may not have been fully evaluated. Resources consist of inferred, indicated and measured categories, with increasing associated confidence regarding the conditions of the resource.
Salar:	Salt flat, salt pan. Other similar terms include playa and salt lake (note lagoons of brine or fresh water may be present adjacent to salt flats and together these constitute salars in the general usage of the term).
SAS	South American Salars – 85% subsidiary of Orocobre prior to the sale agreement with Advantage Lithium

SdJ	Sales de Jujuy, the joint venture company between Orocobre (66.5%), Toyota Tshusho (25%) and provincial mining authority Jemse (8.5%)
SO_4 :	Sulphate, part of the chemical composition of Gypsum. $CaSO_4 \cdot 2H_2O$
Sy:	See Pt section above
T:	This refers to the transmissivity of a unit, a hydrogeological term which is defined as T=Kb, where K is the hydraulic conductivity of the unit and b is the saturated thickness of the unit
TDS:	Total dissolved solids, generally measured in mg/L
Tenement:	An exploration or mining license granted to a company or individual or applied for and not yet granted
TM :	Transverse Mercator coordinate system
UoA	University of Antofagasta – the chemical laboratory selected for check sampling of samples analysed at the Primary Laboratory – Alex Stuart Assayers
uS/cm^2:	Microsiemens/centimeter squared – a measure of electrical conductivity of a fluid
WGS:	World Geodetic System. WGS84 is the geodetic system used with GPS systems
wt%:	Weight percent