

TECHNICAL REPORT ON THE SALINAS GRANDES LITHIUM PROJECT

SALTA PROVINCE, ARGENTINA

**REPORT FOR NI 43-101
PREPARED FOR OROCOBRE LTD.**



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SUMMARY

Orocobre, through its 85% owned subsidiary South American Salars (SAS), owns 87,817 ha of mining properties (tenements) over the Salinas Grandes salar. These properties host brine containing elevated concentrations of lithium, potassium and boron. 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 Mr 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 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 Salinas Grandes salar is located in the east of the Puna (high plain) region in the provinces of Salta and Jujuy, NW Argentina. The project has favorable infrastructure with the paved highway to the international border with Chile, (approximately 170 km by road to the west) crossing the salar. A gas pipeline passes between the Salinas Grandes and Guayatayoc salars and a railway crossing from northern Argentina to Chile passes approximately 80 km south of the project.

Salinas Grandes is one of the larger Puna salars, with the Salinas Grandes-Guayatayoc drainage basin covering ~16,000 km². Within this, the Salinas Grandes salar salt pan covers an area of approximately 250 km². Salinas Grandes is separated from the Guayatayoc salar to the north by an internal drainage divide. Only the Salinas Grandes project is covered by this technical report.

Salinas Grandes has an east-west to north-east orientation, which is unusual in the Puna. This orientation is probably related to complex faulting underlying and bordering the salar. Several rivers flow into the Salinas Grandes part of the drainage basin, with the River Burras in the north and San Antonio River to the south. Alluvial fans of different sizes surround the salar.

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 rates in the Puna are an important aspect of commercial production, with solar concentration of Li and K in brine taking place 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 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 moving 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 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 (halite, gypsum) occurred in the center of basins where evaporation is the only means of water escaping from the hydrological system.

Precambrian to Cambrian metamorphosed sediments lie on the southern margins of the salar, with Ordovician sediments and younger volcanics west of the salar and Cretaceous to younger sediments east of the salar. Quaternary clastic deposits 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 at least 400 m deep. Reverse faults are interpreted on the eastern and western sides of Salinas Grandes, based on mapping by Segemar and a seismic line between Salinas Grandes and Guayatayoc. A fault is interpreted to control subsidence on the southern margin of the salar basin, with the possibility of multiple faults within the salar.

Salar Geology

Salinas Grandes is an immature salar dominated by clastic sediment, in the classification of Houston et.al., 2011. Geological interpretation suggests the salar can be divided into six lithological units:

- Halite (salt) reaches a maximum thickness of 0.5 m in the southern central part of the salar.
- Beneath the surficial halite, Unit B consists of sand, silt and clay, with an increasing portion of sand on the northern margin of the salar.
- Unit C is a black to green organic rich clay and silt. The depocentre of this unit is in the south of the salar, close to the interpreted southern fault.
- Unit D is a red/brown fine sand, with silt and clay and brackish water intervals and artesian pressures.
- Unit E is a green to brown silt and clay with minor sand.
- Unit F, at the base of drilling, includes medium to coarse sand and conglomerate units. These deeper units of the salar may be part of clastic sedimentation from the alluvial fan to the north of the salar.

Unit B and the upper levels of Unit C host the shallow brine resource.

Exploration

A total of 12 diamond drill holes were drilled in the salar to depths up to 180 m, but on average 71.4 m deep. Drilling did not intersect the basement of the salar. Diamond core samples were sent to the British Geological Survey (BGS), with a total of 117 samples

analysed for total porosity (Pt) and specific yield (Sy). This testing determined a range of Sy values for each lithological type, with the averages for sands (16%), silt mixes (4%) and clays (2%) used in the shallow zone resource modelling.

Diamond drilling established that Li, K and B concentrations in brine are elevated (generally exceeding 600 mg/l Li) in the upper 10-15 m of the Salinas Grandes salar. However, diamond drilling showed that concentrations decrease with depth, with only isolated Li-bearing intervals (concentrations generally < 500 mg/l Li) to depths of approximately 80 m.

Diamond holes HCJ002D and HCJ006D contain lithium values exceeding 500 and 1000 mg/l respectively to depths of approximately 60 m. However, as values of this magnitude below the shallow zone are limited to these two holes and as there is poor grade continuity within the holes themselves and between these holes and adjacent holes no resource has been estimated for this potentially deeper zone.

Following the diamond drilling a program of shallow auger drilling was undertaken in the central area of the salar, with 47 holes drilled, typically to depths of 12 m. Auger drilling produced composite brine samples at 4 m intervals and better defined the distribution of lithium and porous units within the shallow zone of the salar.

Interpretation of the auger and diamond drilling suggests that the salar is heterogeneous and many lithological units are lenticular, with lateral and vertical changes in Li, K and B concentrations. There are more consistent intervals of sand in the northern part of the salar, with minor sand in the centre.

Resource Estimate

Brine sample results and lithological information collected during the auger drilling was used to calculate a resource for the shallow brine zone. The Sy values from the BGS analyses were used to calculate a weighted Sy value for each auger hole, based on the lithologies and thicknesses recorded.

The weighted Sy data was used to calculate an equivalent brine thickness at each auger hole. The composite brine sample results as kg/l values were multiplied by the equivalent brine thickness (litres contained over a m²), to produce a kg/m² value for each auger hole. This data was kriged across the salar to produce a set of kg/m² concentration maps for Li, K and B across the Orocobre tenements. When summed this is the total resource mass, presented in the table below. Extensive QA/QC evaluation was undertaken on the geochemical data and assays from the laboratory, Alex Stewart Assayers (Argentina) S.A., are considered acceptable for use in the inferred resource estimate.

A shallow inferred resource has been estimated with 56.5 million cubic metres of brine at 795 mg/L lithium and 9,550 mg/L potassium, which is equivalent to 239,200 tonnes lithium carbonate (44,960 tonnes lithium metal) and 1.03 million tonnes of potash (KCl – equivalent to 539,850 tonnes of potassium) to an average depth of 13.3m

Resource Category	Brine body parameters				Average resource concentrations			Tonnes contained metal		
	Area km ²	Average thickness m	Mean specific yield %	Brine volume Million m ³	Lithium mg/l	Potassium mg/l	Boron mg/l	Lithium	Potassium	Boron
Inferred resource	116.2	13.3	4.1%	56.5	795	9,547	283	44,960	539,850	12,100

Brine chemistry and processing

Evaporation test work has been underway on the project since late 2010. The Salinas Grandes brine has a very attractive chemistry, with low Mg/Li and low SO₄/Li ratios and is amenable to a similar process to that used at the Salar de Atacama. The brine also has high K concentrations and evaporation test work suggests high K recoveries are likely, with the production of high K grade silvinite as feed stock for the KCl plant.

The test ponds have confirmed the expected evaporation route of halite followed by silvinite. The silvinite salts, with potassium contents between 10 and 17%, were ground and floated at the laboratory scale at the University of Jujuy. This work produced a concentrate with 43-47% potassium (82-89 %KCl). These concentrates are normally washed in order to obtain a +95% KCl product.

Extraction assessment

To evaluate the potential for brine extraction from the salar, pump testing was completed on 10 of the shallow and small diameter auger holes. This confirmed that units at Salinas Grandes have generally low hydraulic conductivities, in the order of ~3 m/day. One of the 10 holes showed a considerably higher permeability of ~50 m/d, which may reflect a more permeable channel within the salar.

The pump testing was generally conducted at flow rates of 1.5 l/s or less limited by bore casing diameter and small pump size. Pumping at or exceeding these flow rates may be sustainable with larger diameter bores over longer periods.

Recommendations

To better understand the behavior of pumping from the shallow brine zone it is recommended to conduct 4 pump tests on purpose constructed large diameter test production bores. These should be in different areas of the salar to evaluate brine extraction rates and brine grade over a period of months and better understand the potential for commercial production. Positive results from the test production pumping would provide important information and the justification to undertake further resource definition drilling and a Preliminary Economic Assessment (PEA) of the project.

1 INTRODUCTION

1.1 Authorship and terms of reference

The author, Murray Brooker, was contracted by Orocobre Ltd. (“Orocobre”) to undertake a resource estimate and produce a Technical Report in compliance with NI43-101. Prior to this the author had provided input to the design and overall scope of the drilling programs and quality control systems for work at Salinas Grandes. Day to day supervision has been provided by Orocobre management and geologists.

Previous exploration and evaluation data have been made available to the author by Orocobre and consists of surface pitting results, brine sample data and geophysics. This report draws on information compiled in the “Technical Report on the Salinas Grandes Project” (Houston, April 2010b), particularly for sources of general geologic and climatic data. The author has also reviewed other published geological and hydrogeological reports in preparation of this document.

The author has previous experience with similar brine resource projects in Argentina relevant to the Salinas Grandes project, having provided consulting services to Orocobre on the Olaroz, Salinas Grandes and Cauchari projects. Regarding the Salinas Grandes Project, the author has spent approximately 3 months at the project site between October 2010 and December 2011.

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 Differences between brine and hard rock prospects

There are important 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 move 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)

Section 7 of this report (Deposit types) discusses the characteristics of the aquifers hosting mineralized brine. Section 8 (Mineralization) discusses characteristics of the brine. Section 15 (Mineral processing and metallurgical testing) makes reference to important aspects of economic development of a brine project, such as the water balance and the conditions of pumping brine.

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

The preparation of this report was supervised by the independent QP, Mr Murray Brooker, M.AIG. Mr Brooker is a geologist and hydrogeologist, with experience spanning 20 years as a consultant and technical manager for mining and engineering companies on mining and groundwater-related projects. This expertise in hydrogeology, geochemistry and geology is an appropriate foundation to undertake the resource estimate and produce the associated Technical Report.

Mr Peter Ehren (MAusIMM) is a consulting mineral processing engineer with significant experience in lithium brine deposits. He has acted as a consultant on the company's Olaroz and Cauchari lithium projects as well as consulting extensively for other clients. Mr Ehren is responsible for the mineral processing and metallurgical testing statements in section 15 of this report.

For the purpose of this report the author, Mr. Brooker, relies on Orocobre Ltd and lawyer, Santiago Saravia Frias for information provided in a report entitled "Salinas Grandes Project Due Diligence Report", dated 13 April, 2012. The reliance is regarding the legal status of the properties, the property agreements and mining law, the surveyed limits of properties and provinces, permits, environmental reporting status and surface property rights. This information is provided in section 3 of the report, with property (tenement) boundaries shown in figures in following sections.

The author also relies on topographic maps published by the Argentine Instituto Geografico Militar and geological maps produced by the Argentine geological survey (Segemar) in addition to imagery obtained from Google Earth.

3 PROPERTY LOCATION AND DESCRIPTION

3.1 Location

The Salinas Grandes project is located in the Puna region of the province of Salta (Figure 3.1), with a minority of tenements in the adjacent province of Jujuy. The project is at an altitude of 3400 m above sea level, and is located 132 km north-northwest of the capital city of Salta, in Salta province and 90 km northwest of the capital of Jujuy province. Both provincial capitals have regular flights to Buenos Aires.

The project site sits astride the paved highway passing through the international border with Chile, approximately 170 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 Cobres, located at the western end of the salar. The regional administrative center of Susques (population 2000) is one and a half hour's drive northwest of the project site.

3.2 Exploration and exploitation licenses

3.2.1 Types of licenses & co-ordinate system

The location of the Orocobre licenses is shown in Figure 3.2, with tenement (property) 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 tenements 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 total of \$400 Argentine pesos must be paid per unit (500 hectares) applied for.

Minas (Mining Permits) are licenses which allow the holder to exploit the property 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.

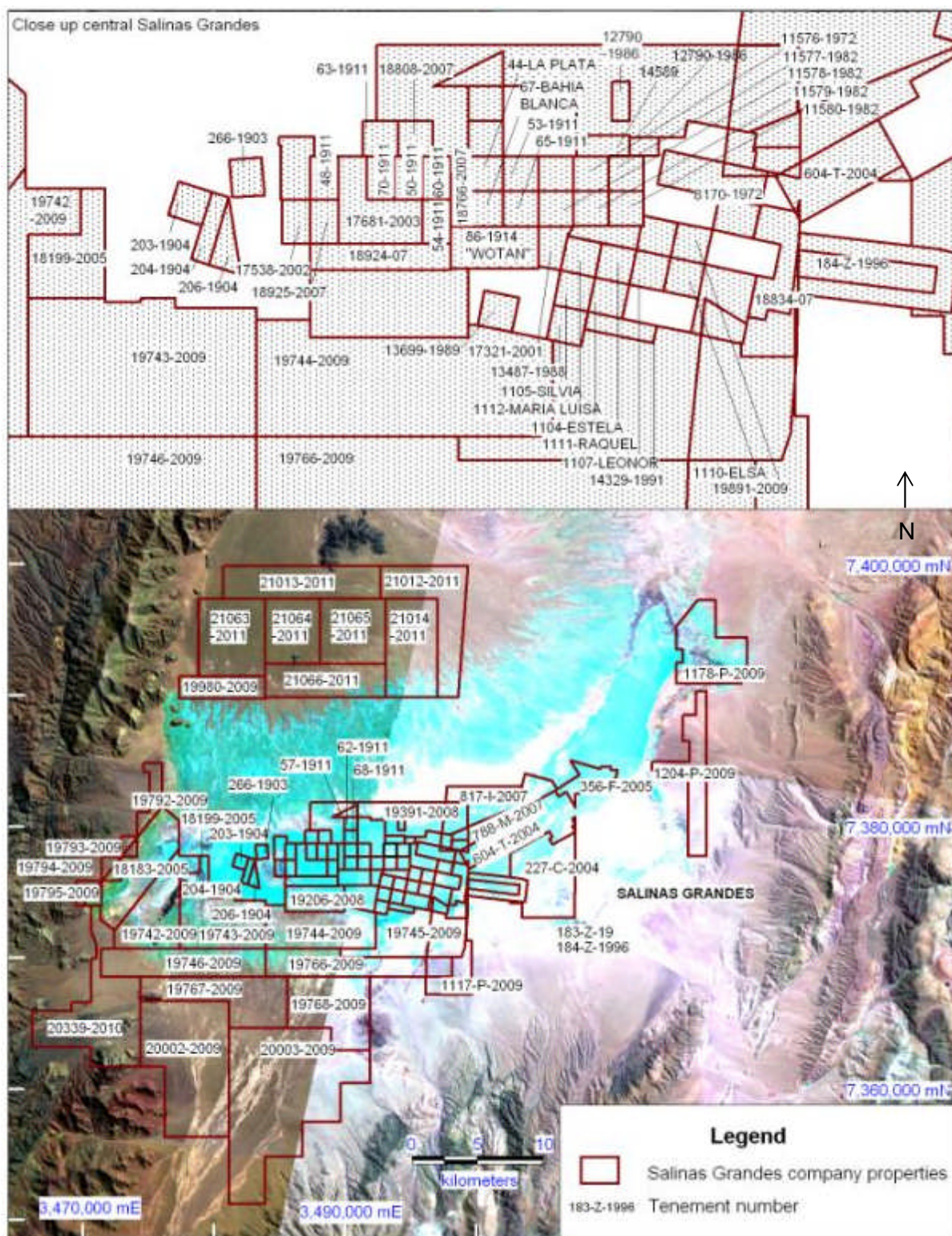
The investment commitment is 300 times the annual rent payment, to be spent over a five year period and payable within five years of the filing of a capital investment plan. The annual tenement tax varies according to the mineral commodity. For brines it is \$800 Argentine pesos/year per 100 hectares.

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 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.



Figure 3.1 Location of the Orocobre Salinas Grandes tenements
Small squares indicate villages in the area. Orocobre Salinas Grandes-Guayatayoc tenements are shown with a blue outline.



3.2.2 The Salinas Grandes tenement package

The Salinas Grandes tenements cover approximately 87,817 hectares in the provinces of Salta and Jujuy with tenements held by South American Salars SA the wholly owned subsidiary of South American Salar Minerals Pty Ltd. This is an Australian Registered company 85% owned by Orocobre Ltd and 15% owned by Argentine shareholders. All

properties are wholly owned by South American Salars S.A. with the exception of Mina Teresa which is still under purchase contract.

3.3 Environmental liabilities

The Salinas Grandes tenements are not subject to any known environmental liabilities. However, there has been ulexite/borax mining (in the west of the salar) and there is active salt mining within the boundaries of the tenement package, where salt is scrapped from the surface of the salar with a grader, harvested in piles and packed in bags for transportation. The borax and salt mining operations are limited to within five metres of the surface and it is assumed the workings will naturally reclaim when mining is halted, due to wet season inflows.

Property Name	Tenement ID	Area (Ha)	Status	Survey
Jujuy Tenements				
AGUADITA	148-Z-1996	300	In process	In process
ATENEA	817- I-2007	1,151	In process	In process
COLORADA II	1178-P-09	2,500	In process	In process
JORGE ENRIQUE	604-T-2006	500	In process	In process
JOSE Y HERNAN	788-M-2008	1,170	In process	In process
LA AGUADA I	1117-P-09	2,189	In process	In process
LAMA I	1204-P-2009	1,869	In process	In process
MAHOMA	183-Z-2004	494	In process	In process
TERESA	227-C-2004	2,600	In process	In process
Total Area Jujuy		12,773		

Table 3.1 Individual tenements of the Salinas Grandes project showing the areas in hectares. Co-ordinates in Gauss Krueger Zone 3, POSGAR94 datum. Table 3.1 (cont.). This table and Figure 3.2 exclude properties in the Guayatayoc project and Cateos under agreement with Borax Argentina.

Property Name	Tenement ID	Area (Ha)	Status	Survey
Salta Tenements				
CATEO	20002	5,941	Granted	Not applicable
CATEO	20003	8,664	Granted	Not applicable
CATEO	20339	4,463	Granted	Not applicable
ALCALINA GRANDE	19391	2,412	Granted	In process
ALDO	18199	500	Granted	In process
BAHIA BLANCA	67	100	Granted	Performed
CANARIA 02	19792	529	Granted	In process
CANARIA 03	19793	98	Granted	In process
CANARIA 04	19794	134	Granted	In process
CANARIA 05	19795	154	Granted	In process
CARINA ZULMA	18834	500	Granted	In process
CORDILLERANA	12790	200	Granted	Performed
CORDOBA	60	100	Granted	Performed
ELSA (Usuf)	1110	100	Usufructo with Remsa	Performed
ESTELA	1104	100	Granted	Performed
EUGENIA	17580	100	Granted	Performed
FLAVIO II	13699	100	Granted	Performed
GABRIEL I	18533	97	Granted	Performed
HILDA UNO	14329	100	Granted	Performed
JOAQUINA	18808	100	Granted	In process
LA AMERICANA	266	100	Granted	Performed
LA CANARIA	18183	2,778	Granted	In process
LA DESPRECIADA	1187	100	Granted	Performed
LA MARTANA I	19891	100	Granted	In process
LA PAMPA	62	100	Granted	Performed
LA PAYA	17681	400	Granted	Performed
LA PERDIDA	1190	100	Granted	Performed
LA PLATA (Usuf)	44	100	Usufructo with Remsa	Performed
LA PROMESA	8170	300	Granted	Performed
LAS TRES NIÑAS	17734	200	Granted	In process
LEONOR (Usuf)	1107	100	Usufructo with Remsa	Performed
LUCIA	18481	97	Granted	In process
MAR DEL PLATA NUEVA	18766	100	Granted	In process
MARIA LUISA	1112	100	Granted	Performed
MATEO	13487	100	Granted	Performed
MISIONES	57	100	Granted	Performed
NEUQUEN	68	100	Granted	Performed
NIÑA BONITA	17538	96	Granted	Performed
NTRA SRA DE LAS MERCEDES	1177	100	Granted	Performed
PAOLA	14589	100	Granted	Performed
PARANA	18924	300	Granted	In process
PARANA I	18925	100	Granted	In process
PARANA II	19206	869	Granted	In process
PRODE III	11577	100	Granted	Performed
PRODE IV	11578	100	Granted	Performed
PRODE V	11579	100	Granted	Performed
PRODE VI	11580	100	Granted	Performed
RAQUEL	1111	100	Granted	Performed
ROBERTO MATIAS	18833	200	Granted	In process

Table 3.1(cont.)

Property Name	Tenement ID	Area (Ha)	Status	Survey
ROMINA I	17321	186	Granted	Performed
ROSARIO	53	100	Granted	Performed
SALINITA I	19742	2,490	Granted	In process
SALINITA II	19743	2,500	Granted	In process
SALINITA III	19744	2,500	Granted	In process
SALINITA IV	19745	2,499	Granted	In process
SALINITA NORTE I- (Cateo 19889)	21012	3,000	In process	In process
SALINITA NORTE II- (Cateo 19889)	21013	3,000	In process	In process
SALINITA NORTE III- (Cateo 19889)	21014	2,996	In process	In process
SALINITA SUR I- (Cateo 19890)	21063	2,998	In process	In process
SALINITA SUR II- (Cateo 19890)	21064	2,072	In process	In process
SALINITA SUR III- (Cateo 19890)	21065	2,496	In process	In process
SALINITA SUR IV- (Cateo 19890)	21066	2,347	In process	In process
SALINITA V	19746	2,648	Granted	In process
SALINITA VI	19766	2,488	Granted	In process
SALINITA VII	19767	2,983	Granted	In process
SALINITA VIII	19768	2,987	Granted	In process
SALINITA X	19980	1,123	Granted	In process
SALTA	48	100	Granted	Performed
SAN ESTEBAN	203	100	Granted	Performed
SAN FRANCISCO	204	100	Granted	Performed
SAN FRANCISCO	1189	100	Granted	Performed
SAN JUAN	54	100	Granted	Performed
SANTA FE	63	100	Granted	Performed
SANTIAGO DEL ESTERO	50	100	Granted	Performed
SILVIA	1105	100	Granted	Performed
TRES ARROYOS	65	100	Granted	Performed
TUCUMAN	70	100	Granted	Performed
WALTERIO	206	100	Granted	Performed
WOTAN	86	300	Granted	Performed
YANINA	17744	500	Granted	Performed
Total Area Salta		75,044		
Total Area Salta and Jujuy		87,817		

3.4 Permits and agreements

Exploration and mining activities on *cateos* and *minas* are subject to a government approval of an environmental impact report (EIR).

Approvals of EIR's have been received for tenements which are located in Salta province. Drilling operations described in this report correspond to tenements located entirely within the province of Salta. Approval has not yet been received for work in Jujuy province.

There are no agreements with any surface rights owners in the project and no future obligations regarding surface rights.

There is an option to purchase agreement for the Mina Teresa Tenement. The amount remaining to be paid for Mina Teresa is US\$100,000 (USD 20,000 before August 3rd 2012; US\$20,000 before February 3rd 2013, US\$ 30,000 before August 3rd 2013 and US\$ 30,000 before February 3rd 2014).

The company has established a program of social assistance and capacitation with communities nearby the project. As the company activities have been within the province of Salta social assistance and capacitation programs have been concentrated in this province, with the communities of Cobres, Esquina de Guardi, Cerro Negro, Moreno, Tipan and Casa Colorada.

4 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

4.1 Accessibility, local resources and infrastructure

The Salinas Grandes 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.

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 40 leads north 55 km to a left turn to Cangrejillos and access to the south of the salar.

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. From this point the route previously known as Route 40 provides access south along the southern side of Salinas Grandes. The total drive distance between the City of Jujuy and the project area is approximately 155 km, and takes approximately 3 hours

A gas pipeline running from northern Argentina to Chile passes between the Salinas Grandes salar and the Guayatayoc salar to the north (discussed in the 2010 NI43-101 report). A railway crosses from northern Argentina into Chile approximately 80 kilometers to the south of the project site, providing potential access to a number of ports in northern Chile.

There are a number of local villages within 50 kilometers of the project site. These include the village of Cobres, located at the western end of the salar. There are a number of houses and sheds located along the paved highway leading to Paso de Jama, east of the Orocobre tenements. These dwellings are related to local salt harvesting operations on the salar. The regional administrative center of Susques (population 2000) is a one and a half hour's drive northwest of the project site.

Local accommodation is provided by a field camp established by Orocobre within several kilometers of drill holes in the west of the tenements. Further accommodation is provided by a basic hotel in the town of San Antonio de los Cobres, 1 hour's drive south of the project site.

4.2 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 Salinas Grandes project is located in the salar of the same name. (see Figure 4.3). The elevation at the surface of the salar is approximately 3400 m asl. The salar is a flat area and forms a composite closed basin, with internal (endorheic) drainage, where discharge occurs by evaporation.

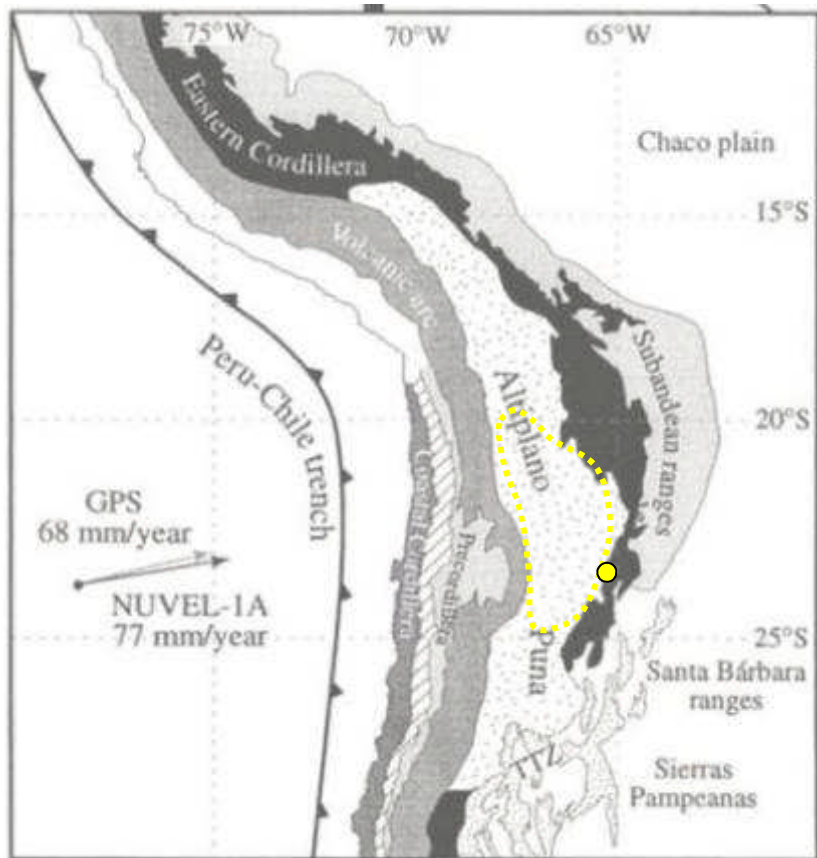


Figure 4.2 Physiographic and morphotectonic features of the Central Andes. The Altiplano-Puna Volcanic Complex (APVC) is shown in yellow and Salinas Grandes as a yellow dot.

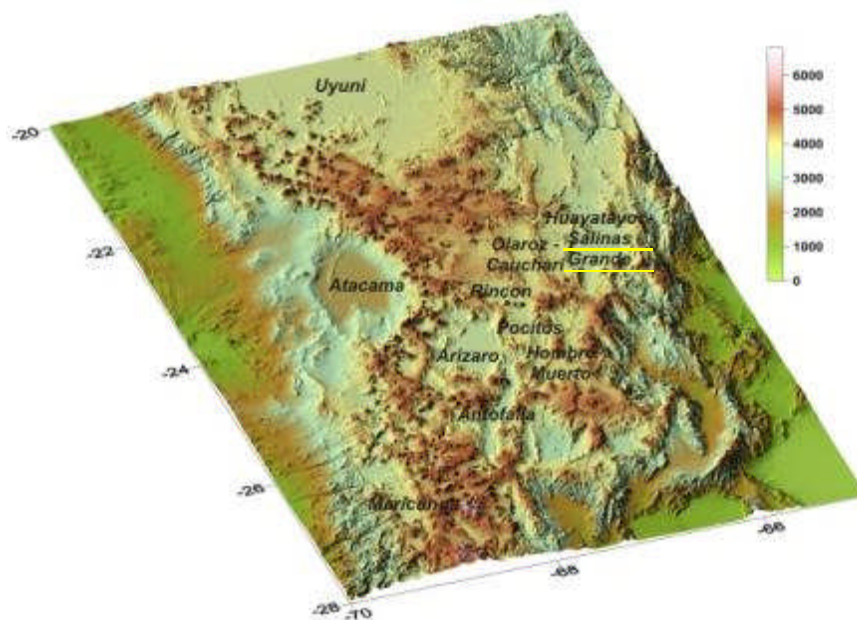


Figure 4.3 Digital elevation model of the Puna showing the location of various salars. Note the location of Salinas Grandes in the east of the Puna Plateau (from Houston, 2010).

The Salinas Grandes salar is unusual in the Puna area, in that it is aligned approximately east-west, whereas other salars are typically aligned north-south. This orientation suggests complex structural controls on development of the Salinas Grandes salar basin. Evidence presented in the following sections suggests Salinas Grandes is a young clastic salar, with very limited deposition of evaporite units.

Key physiographic observations regarding the Salinas Grandes salar include:

- The connection with the N-S aligned Guayatayoc Salar to the northeast, through which the River Miraflores flows before draining into Salinas Grandes.
- A large delta in the southwest of the Salinas Grandes salar, where the River San Antonio enters the salar basin, from the valley that extends west-southwest to the town of San Antonio de los Cobres. What are interpreted as permanent zones of seepage/springs are noted in the east of the delta, where the delta sediments are in contact with outcrops of Pre-Cambrian to Ordovician rocks which are interpreted to underlie the southern margin of the salar.
- The presence of an enormous alluvial fan in the north of the salar, immediately south of the Rio Las Burras, which enters Salinas Grandes where it joins with the Salar de Guayatayoc.
- Smaller alluvial fans in the southeast of the Salinas Grandes salar.

Water inflows into the salar include precipitation, runoff from the surrounding ranges and groundwater inflows. Salinas Grandes receives surface drainage inflows from the Miraflores River into the north of the Guayatayoc basin, the Burras River into the north of Salinas Grandes and the San Antonio River in the south. The total area of the basin is ~16,000 km², with the southern part of the basin occupying ~7,500 km². Within this area the Salinas Grandes salar (salt covered area) covers approximately 250 km². The drainage basin salar is shown in Figure 4.4.

4.3 Climate

The climate in the project area is severe, with daily temperature variations of up to 30°C. 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. Work can be conducted year round, except when high rainfall periods cause flooding in the salar.

The climatic conditions are considered attractive for solar evaporation processes, with conditions expected to be similar to Salar de Olaroz and Salar de Cauchari, 70 km west of the Salinas Grandes-Guayatayoc basin, although Salinas Grandes is expected to be wetter in the summer, resulting in overall lower evaporation potential.

Due to the remote location, there is limited historical climate data available for the project. To obtain local climatic data the company has established automated weather stations at the project camp site, on the southern border of the Salinas Grandes salar. Data from the Davis weather station is presented in the following figures.

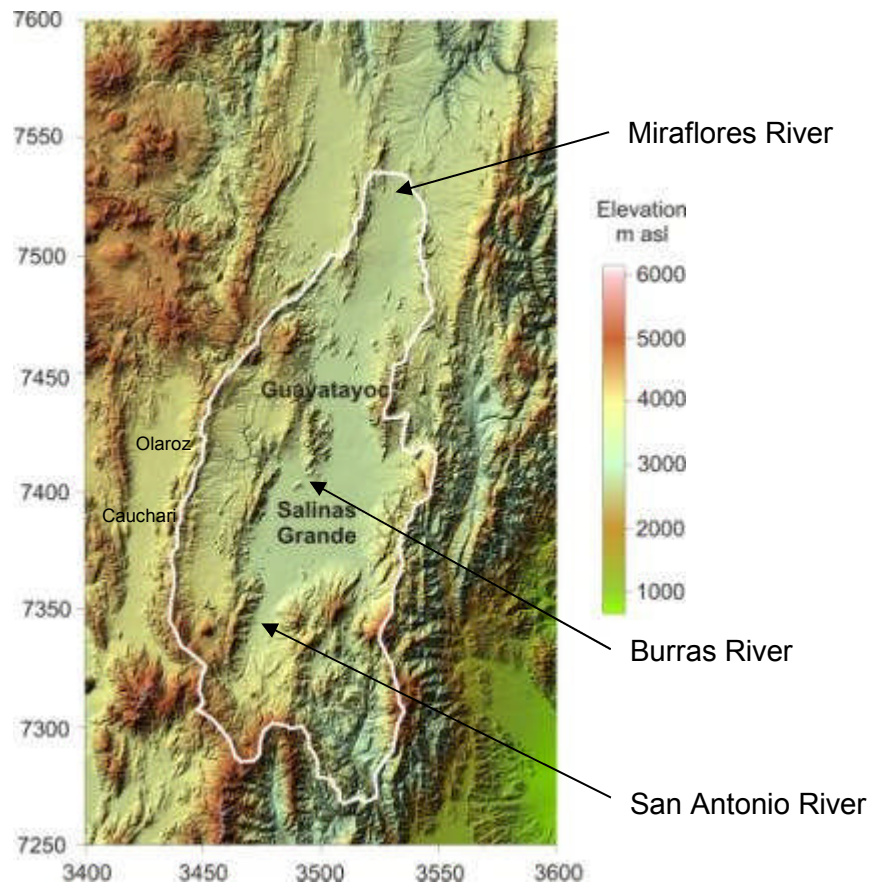


Figure 4.4 Salinas Grandes - Guayatayoc drainage basin

4.3.1 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. This can be observed in Figure 4.5, the iso-precipitation curves for NW Argentina. Significant control on annual rainfall is exerted by ENSO (El Niño-Southern Oscillation) (Houston, 2006a).

Information is generally not available on the solar salt surfaces, however, some records are available from 4 weather stations (Table 4.1, below) at small settlements in the adjacent area. These include, Susques (50 km west), La Quaica (160 km north), Mina Pan de Azucar (100 km north) and the Hombre Muerto salar (260 km south-southwest). 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.

A comprehensive weather station was established at the Cangrejillos camp site in Salinas Grandes in 2010. However, incomplete climate data is available, with incomplete collection of rainfall over the December 2010 to March 2011 period. During this very wet rainy season Salinas Grandes received approximately 300 mm of rain. Rainfall data is also incomplete for the period late December 2011/early January 2012. Recent data is supplemented by historical data collected between 1979 and 1990 at a weather station located very close by to the Salar in the sector named Cangrejillos. During this period an average rainfall of 469 mm per year was reportedly measured. Some years the wet season started as early as November and finished as late as March.

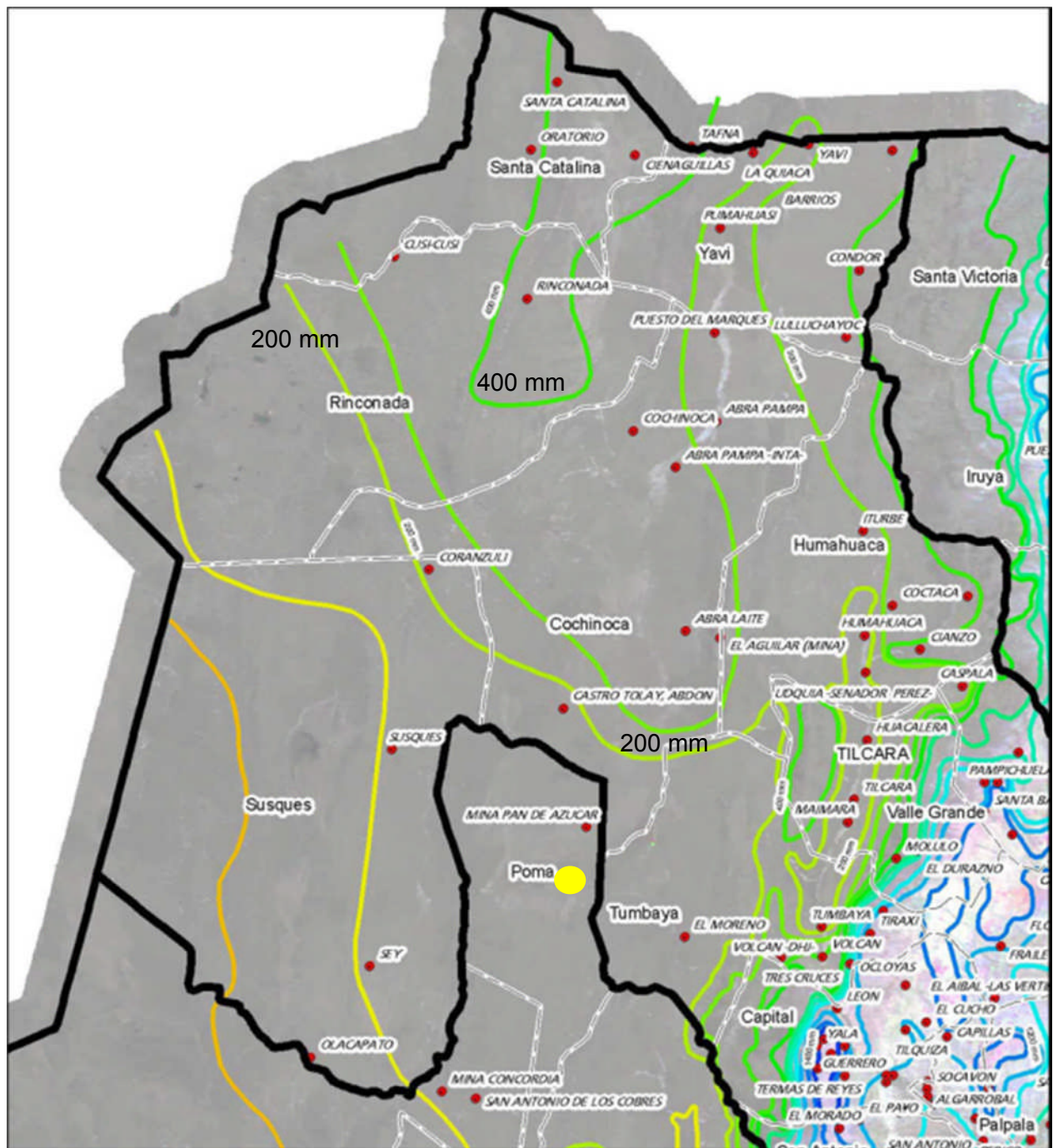


Figure 4.5 Lines of iso precipitation in Jujuy/Northern Salta
The location of the Salinas Grandes camp is shown as a yellow dot.

Olaroz project weather station, August 2008-September 2009												
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												
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, 35 km east 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, 185 km 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, 120 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

Table 4.1 Average monthly rainfall standardized over 1982-1990

4.3.2 Temperature

Historical temperatures were measured in Cangrejillos during 1979 and 1990. Average daily temperatures were 1 to 12°C. Other weather stations in the area at similar altitudes show similar temperature fluctuations. Records from the weather station at Susques (50 km west of Salinas Grande) and the Olaroz weather station (80 km west of Salinas Grande) include temperature (Table 4.2, below) in addition to rainfall. 2011 data is not available for February and March.

Cangrejillos Camp monthly minimum average Temp °C, South Side of Salinas Grandes 2011													Average
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Maximum	26.6	na	na	22.6	20.4	18.2	16.9	17.1	21.4	24.5	26.4	25.8	
Minimum	6.4	na	na	-1.9	-11.7	-12.2	-13.9	-12.9	-3.0	-7.1	-1.2	2.3	
Olaroz project weather station Temp °C, ~ 3900 m - August 2008-September 2009													
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
Median	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
Minium	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 °C, 35 km east of project 3675 m - 1972-1996													
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 mean** annual temperature data °C													
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 Cangrejillos and Olaroz weather stations (Orocobre data) and other weather stations in northwestern Argentina.

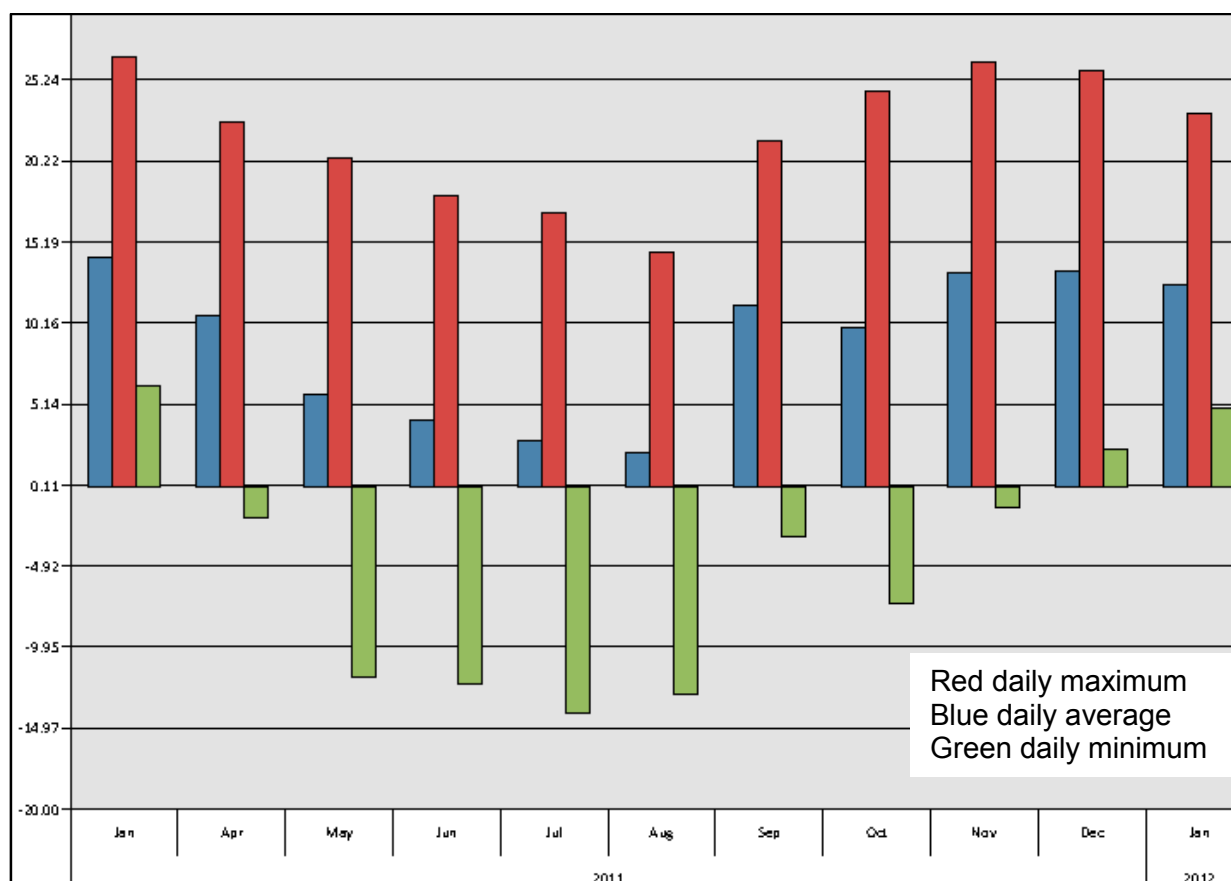


Figure 4.6 Average daily temperatures at the Cangrejillos camp site during 2011

An annual mean temperature of 8 degrees °C was registered in the locality of Catua, with 6°C measured in the Hombre Muerto salar during the 1979 - 1995 time period.

The average annual temperature at the project site is approximately 7° C, with extremes of 35° C and -30° C. The coldest months with temperatures below zero correspond to May through August. There are approximately 150 days on average without frost. This average temperature was calculated for the town of Susques (altitude 3675 m) near the project area (INTA – EEA – PROSIMA – NOA, 1993). Details are collated in Table 4.2, above. An annual mean temperature of 8°C was registered in the locality of Catua, with 6°C measured in the Hombre Muerto salar during the 1979 - 1995 time period.

4.3.3 Wind

Strong winds are frequent in the Puna, reaching speeds of up to 80 km/hr during warm periods of the dry season. 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. Site wind speed data is presented in Table 4.3 and dominant wind directions in Figure 4.7.

Localidad	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Cangrejillos	7	6	6	5	5	8	10	12	9	13	11	11	8
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 Olaroz and other areas of northwest Argentina (Orocobre draft EIS, 2009).

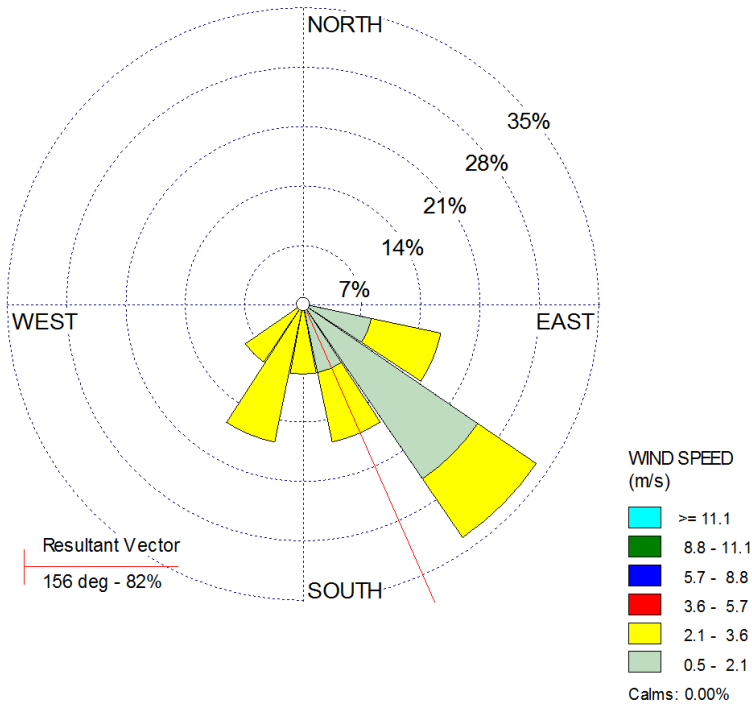


Figure 4.7 Direction from which the predominant wind blew during 2011

4.3.4 Evaporation

Average annual evaporation in the Salar Hombre Muerto is 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). Solar radiation measured at the Cangrejillos camp site is shown in Figure 4.8 below.

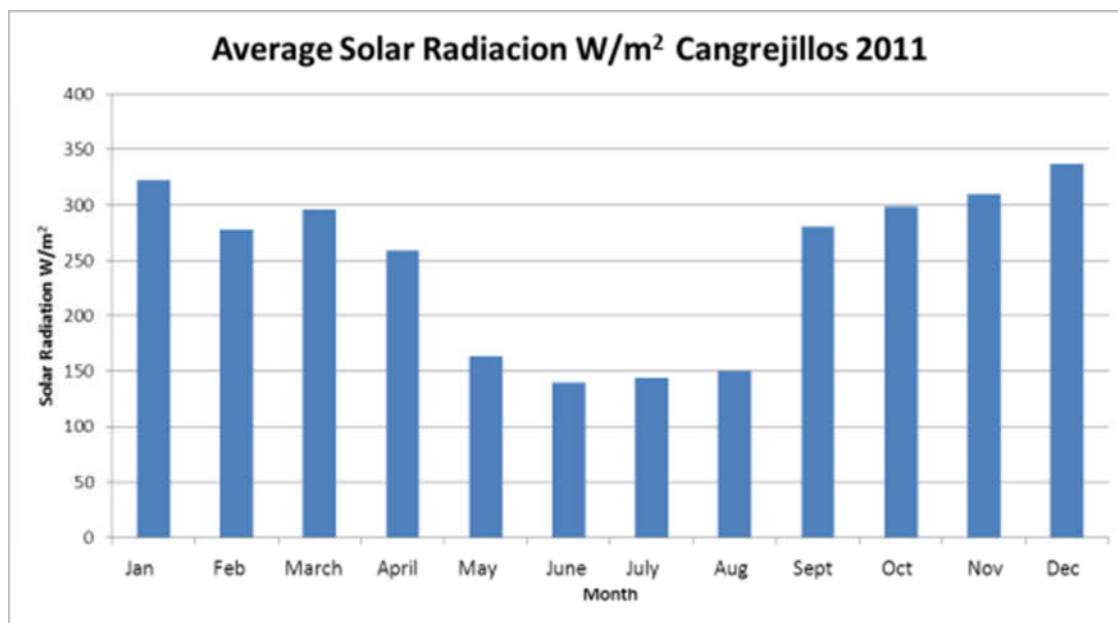


Figure 4.8 Solar radiation measured at the Cangrejillos camp site



Figure 4.9 Salinas Grandes weather station



Figure 4.10 Evaporation pans for brine (foreground) and freshwater (background)

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 (Figure 4.10) are monitored daily in conjunction with the solar radiation data recorded by the weather station.

The net evaporation rate during the first year of measurements at the Salinas Grandes camp site averaged around 2600 mm/year.

4.4 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 - 1.5m, 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.

4.4.1 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.

4.4.2 Mixed steppes

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

4.4.3 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-Orocobre

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 Salinas Grandes salar showed relatively high lithium and potassium values (0.044 and 0.51 wt% respectively). 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 this data.

Previous exploitation of borates has taken place locally in the Salinas Grandes tenements, with salt also extracted from the central part of the salar.

5.2 Orocobre exploration at Salinas Grandes

Orocobre applied for cateos at Salinas Grandes in 2009 and purchased a number of tenements in the salar during 2009 and 2010.

Initial pit sampling of the Salinas Grandes & Guayatayoc tenements began in March 2009, following the wet season, and is reported in the Orocobre April 2010 NI43-101 document. As part of that exploration program a north-south line of gravity and AMT surveying was undertaken, to evaluate the depth of the salar basin and the distribution of brine.

6 GEOLOGICAL SETTING

6.1 Regional

The Salinas Grandes salar is located near the eastern margin of the Puna Plateau. 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). 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 (Garzzone 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 Salinas Grandes (Figure 6.3).

Late Miocene volcanism at 5-10 Ma in the Altiplano-Puna Volcanic Complex (APVC) between 21°-24° 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-Olcapato-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 15 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 moving 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 Incaipillo caldera. The Altiplano-Puna Volcanic Complex (APVC), located between the Altiplano and Puna, 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.

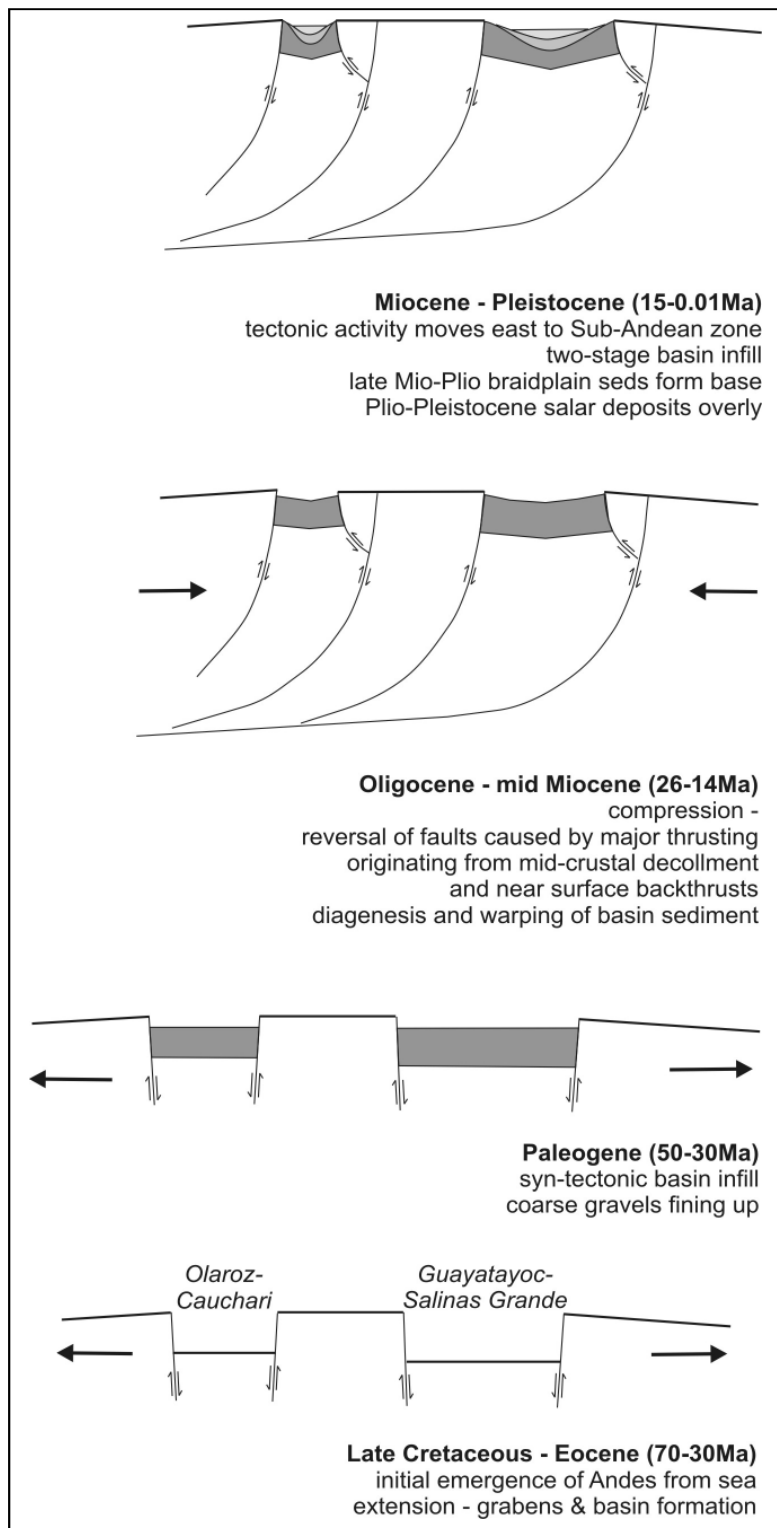


Figure 6.1 Generalized structural evolution of the Puna basins (Houston, 2010)

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.

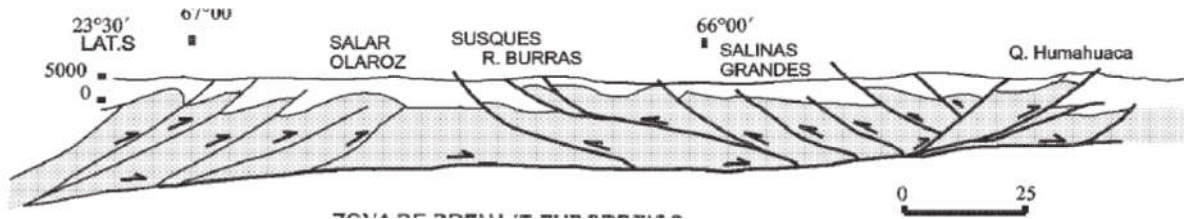


Figure 6.2 Structural cross section from the Chilean border through the Salinas Grandes salar. Note the development of a mid-crustal decollement with an east vergent, thrust fault and associated back thrusts creating the ranges bordering the salars, with Paleogene to Neogene deposits in the salar basins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

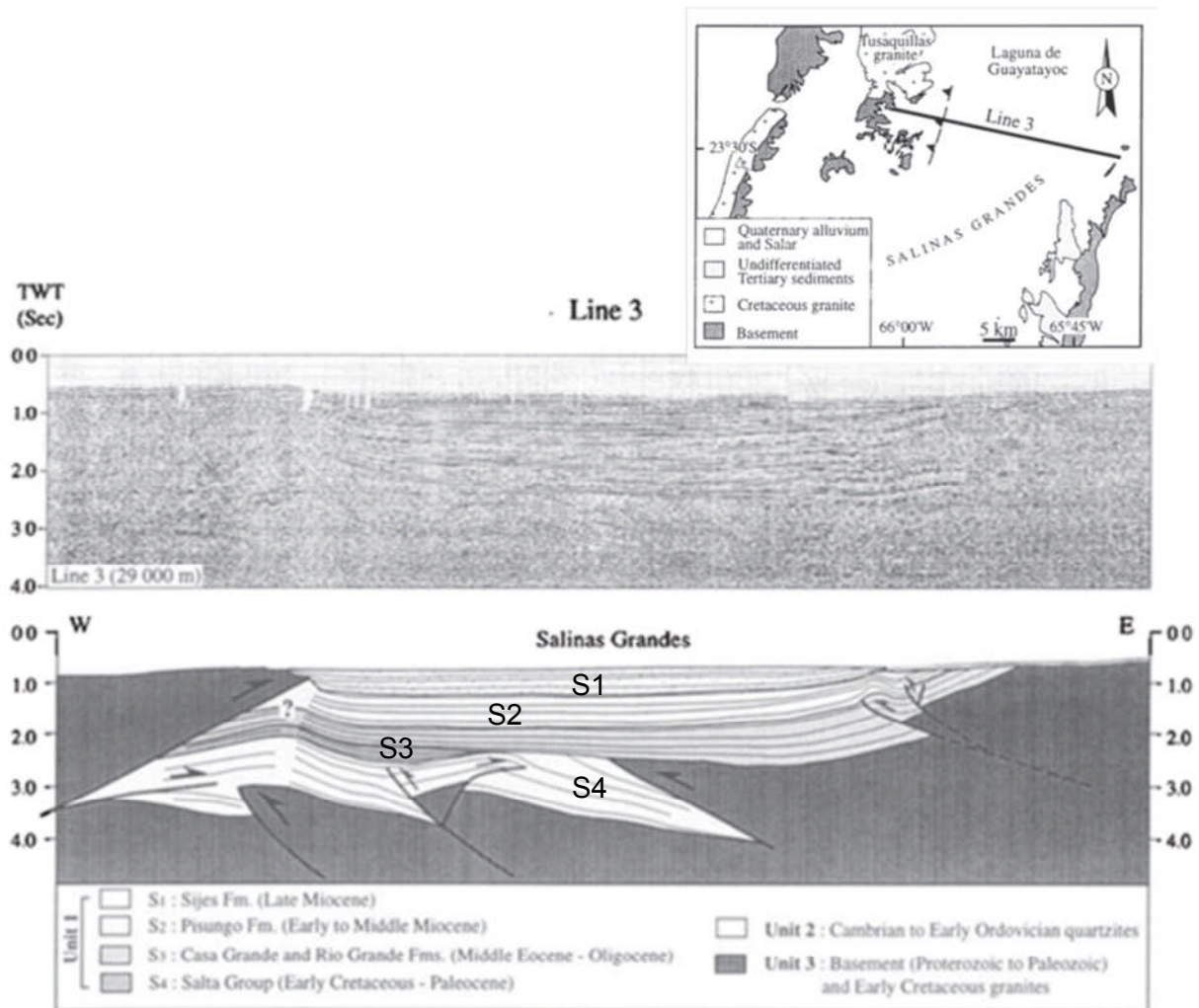


Figure 6.3 Seismic cross section through Salinas Grandes/Guayatayoc junction. The upper figure shows location and the lower shows the time-migrated seismic profile and its interpretation. Note the development of thrust faults verging inwards to the basin and creating uplifted ranges along the borders (from Kay et. al., 2008, modified from Coutand et. al., 2001).

6.2 The Salinas Grandes basin

Figure 6.4 shows the local geology in the Salinas Grandes area. The major stratigraphic units, their age and lithological relationships are shown in the accompanying stratigraphic column, Figure 6.5, which outlines correlations between units across the published geological maps that cover the project area.

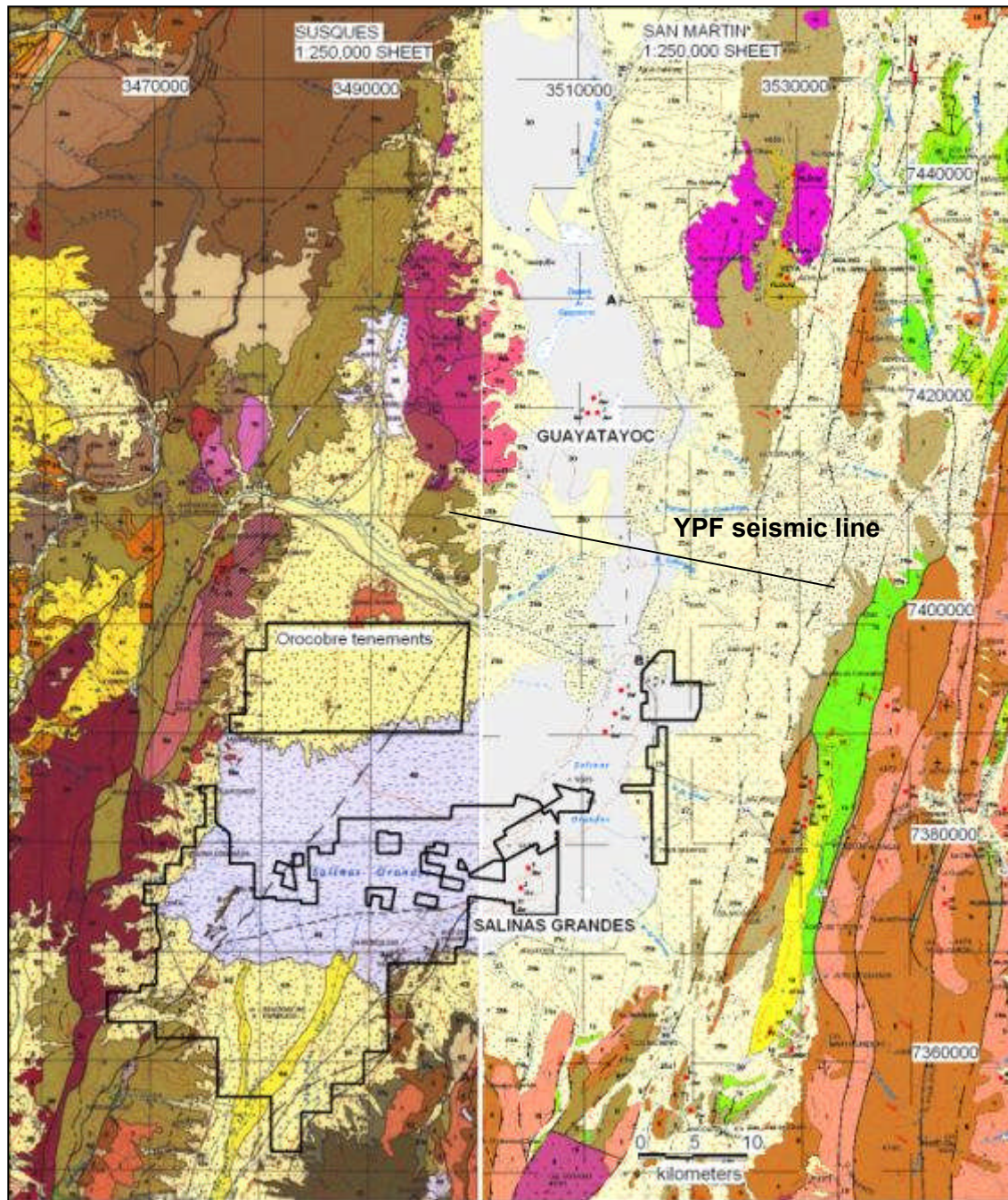


Figure 6.4 Published geology of the Salinas Grandes/Guayatayoc salar basins and the Orocobre tenements over these salars

Age period		Ma	Rocktypes	Geological environment	Tectonic events	1:250,000 Map Sheet	
						Susques (2366-III)	San Martín (23664)
Quaternary	Holocene	0.01	Alluvial deposits, salars	Closed basins, salars	Post Quechua deformation	Salar deposits, lacustrine, colluvial and alluvial sediments (40-44)	Salar deposits, lacustrine, colluvial and alluvial sediments (25-30)
	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		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	Maimar, Uquia and Jujuy Formations. Continental sediments - sandstone, conglomerate +/- mudstone (19, 22-24)
		5.3					
		Andesitic to dacitic volcanics	Volcanic complexes in continental sediments			Volcanic complexes (35)	Formations: Orán (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	Sijas Formation (32) ~7-6.5 Ma sandstones, mudstones and tuffs		
	Miocene	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		
					Vichacera Inferior (22a). Sandstones and interbedded claystones		
	23.8						
Paleogene	Oligocene	33.9	Continental sediments	Red bed sequences	Incaic Phase II - Compression, resulting in folding	Rio Grande Fm Superior (21b). Red aeolian sandstones	Casa Grande and Rio Grande Formations (18). Continental sandstones, conglomerates, siltstones and claystones
	Eocene					Rio Grande Fm 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
BASEMENT - PRE-TERTIARY 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, siltstones and diamictites. Silurian Lipeon & Barite Formations (9). claystones and diamictites
	Ordovician		Marine sediments	Marine delta and volcanic deposits/domes		Multiple Paleozoic intrusive suites (6-13)	El Moreno Formation (8). Porphyritic dacite
	Cambrian	540		Marine sediments		Ordovician sandstones (3-5), volcanoclastic sediments & Ordovician turbidites	Guayoco Chico Group (7) & Santa Victoria Groups (6). Marine sandstones, mudstones and limey units
		PreCambrian		Schists, slate, phyllite	Metamorphosed turbidites		Meson Group (2). sandstones and mudstones
						Puncoviscana Formation (1) turbidites	Puncoviscana Formation (1) turbidites - metamorphosed and intruded by plutons

Figure 6.5 Stratigraphic units in the Salinas Grandes/Guayatayoc basin and their correlation across different published geological maps

6.2.1 *Geology of the Salinas Grandes basin*

The oldest rocks in the Salinas Grandes basin consist of Precambrian to Cambrian metamorphosed sediments of the Puncoviscana Formation, siliclastic sandstones of the Meson Group, and sandstones and mudstones of the Santa Victoria Group. Cambrian intrusives of the Formation Queseara intrude these sediments. These units are exposed in the mountain ranges to the south and east of the salar, where a series of reverse fault bounded blocks generally have up- to-the-east movement against Holocene sediments of the salar basin.

The Cambrian intrusives of the Formation Queseara are spatially associated with a large magnetic high which underlies all of the Salinas Grandes salar. The magnetic body has a shape which is broadly mirrored by the shape of the salar itself. Other intrusives in the surrounding area (such as the Cretaceous granites and monzonites, located east and west of the Guayatayoc salar) are differentiated from this magnetic body by their more subdued magnetic signature.

Continental sandstones, siltstones, marls and carbonates of Cretaceous to Paleocene age (Pirgua, Balbuena, and Santa Barbara Subgroups and Oran Group) are in fault contact with the older Cambrian to Pre-Cambrian units in the mountains east of the salar.

Cambrian to Ordovician marine sediments, lavas and subvolcanic units outcrop in the mountain ranges to the west of the salar. These units are overlain by the sandstones of the Oligocene-Miocene Vizcachera Formation and clastic, evaporitic, and pyroclastic sequences of the Miocene Pastos Chicos Formation.

Quaternary clastic sediments – sands, gravels and siltstones – fill the topographic low of the salar basin, with the salar occupying the central part of the basin.

6.2.2 *Structural geology of the Salinas Grandes basin*

The east-west orientation of the Salinas Grandes salar basin is unusual in the Puna region, where the salars are predominantly aligned north-south. A number of seismic lines have been completed across the Guayatayoc and Salinas Grandes basin by YPF, the Argentine national petroleum company. Limited information available from these seismic lines (see Figure 6.3 above) suggests the basin at the junction of Salinas Grandes and Guayatayoc is bounded on the east and west by thrusts, with the salar sequence developed over the late Miocene Siques Formation. However, no seismic information is available to the company for seismic lines conducted over the Salinas Grandes part of the salar. A structural interpretation of the Salinas Grandes area by Segemar, based on the 1 km spaced Puna aeromagnetic survey and surface geology, is shown in (Figure 6.6).

Precambrian to Cambrian metamorphosed sediments outcrop on the south and north of Salinas Grandes. These units are interpreted by Segemar to be deformed along NE and EW trending faults. In contact with these metamorphosed sediments and underlying most of Salinas Grandes are interpreted Cretaceous to Tertiary sediments of the Pirgua and Balbuena subgroup (Figure 6.5), which outcrop east of the salar.

The Puna aeromagnetic survey shows a large (85 km long NE axis x 40 km long NW axis) magnetic body (magnetic high – shown as a blue unit in Figure 6.6) underlying Salinas Grandes, intruding the Precambrian to Cambrian sediments. Smaller bodies of Cretaceous intrusives are mapped outcropping immediately west of the salar.

The magnetic body is interpreted to have an important influence on the structural deformation of this area and the consequent shape of the Salinas Grandes salar. The

magnetic body is likely to form a large rigid block, relative to the sediments and metasediments in which it is emplaced. The overall NE to ENE orientation of the complex is thought to have influenced the development of faulting through Salinas Grandes.

The regional system of NS to 020° trending faults undergoes an eastward deflection through Salinas Grandes, before resuming a NS to 020° orientation in the Guayatayoc area to the north. This deflection is essentially a jog in the broad fault network through the intrusive complex. A complex network of EW to ENE and NNE faults is interpreted by Segemar underlying the salar. These faults may compartmentalize the salar basement into different blocks, with different thicknesses of the overlying salar sequence.

Of particular importance is the interpreted fault contact between the Cambrian/Precambrian units and the Cretaceous to Tertiary sediments. This EW trending contact is interpreted along the actual edge of the current salar (southern blue line in Figure 6.6), suggesting this is an active fault contributing to salar formation, with a down to the north movement sense. The orientation and movement sense on this fault is not clear. The presence of a fault along the southern margin of the salar is supported by the observation that stratigraphic units within the salar dip shallowly towards the south and the presence of the major organic-rich clay unit depocentre (Unit C) close to the southern boundary of the salar.

The northern boundary of the western part of the salar is also approximately EW trending. This boundary is defined by the base of the large alluvial fan extending from the salar to the Rio Burras in the north (parallel to the international road to Salar de Olaroz and the Jama Pass). The Segemar structural interpretation suggests this may also be a fault contact (blue lines Figure 6.6), although the movement sense of this possible fault is also unclear. Further east in the Salinas Grandes salar, crossing the border into the province of Jujuy, faults are interpreted to have the more regional NNE trend.

Orocobre has completed one gravity and AMT line across the salar. Details of the geophysics undertaken are provided in section 9. The gravity line (section 9) is interpreted to show an asymmetric nature to the basin, with a possible steeply dipping northern side to the basin (interpreted to coincide with a fault) and a shallowly dipping southern margin to the basin suggesting a half graben geometry. However, this interpretation is being revised with actual density data from samples taken during the drilling program.

Geological and seismic surveys of the Salinas Grandes salar basin suggest it is structurally controlled on the east and west by bounding reverse faults (section 9). Gravity and AMT data from one north-south line across the salar suggests the large alluvial fan in the north of the salar contributed coarse sediment to the salar basin, which may be >400 m thick (section 9). Drilling subsequent to the initial pit sampling has been completed to a depth of 180 m, without intersecting the salar basement.

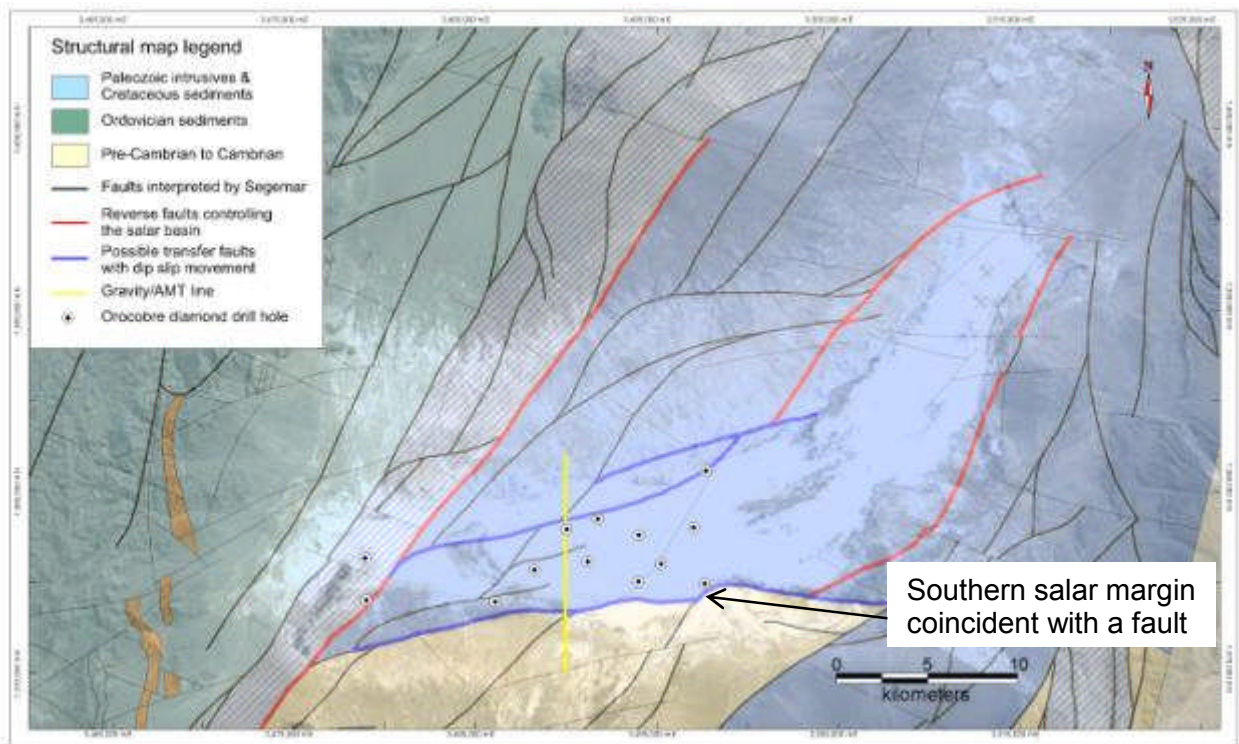


Figure 6.6 Structural interpretation of the Salinas Grandes salar basin

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 Salinas Grandes salar can be referred to as a lithium and potassium brine deposit. However, the important elements of a brine deposit are the contained elements and chemistry of the brine 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 decreasing rapidly with depth.
- In these salars the brine resources 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).
- 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.
- In the centre of salars, where evaporation is generally highest, deposits consist of carbonate, sulphate and finally chloride evaporites.
- 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 Salinas Grandes to date has not intersected evaporite deposits (with the exception of the surficial salt crust) and the basin history (to the depth drilled) has been dominated by clastic sedimentation, rather than evaporite deposition. Salinas Grandes is at a lower altitude than most other salars (at 3400 m asl) and the lack of evaporites suggests Salinas Grandes has only recently developed as a salar.

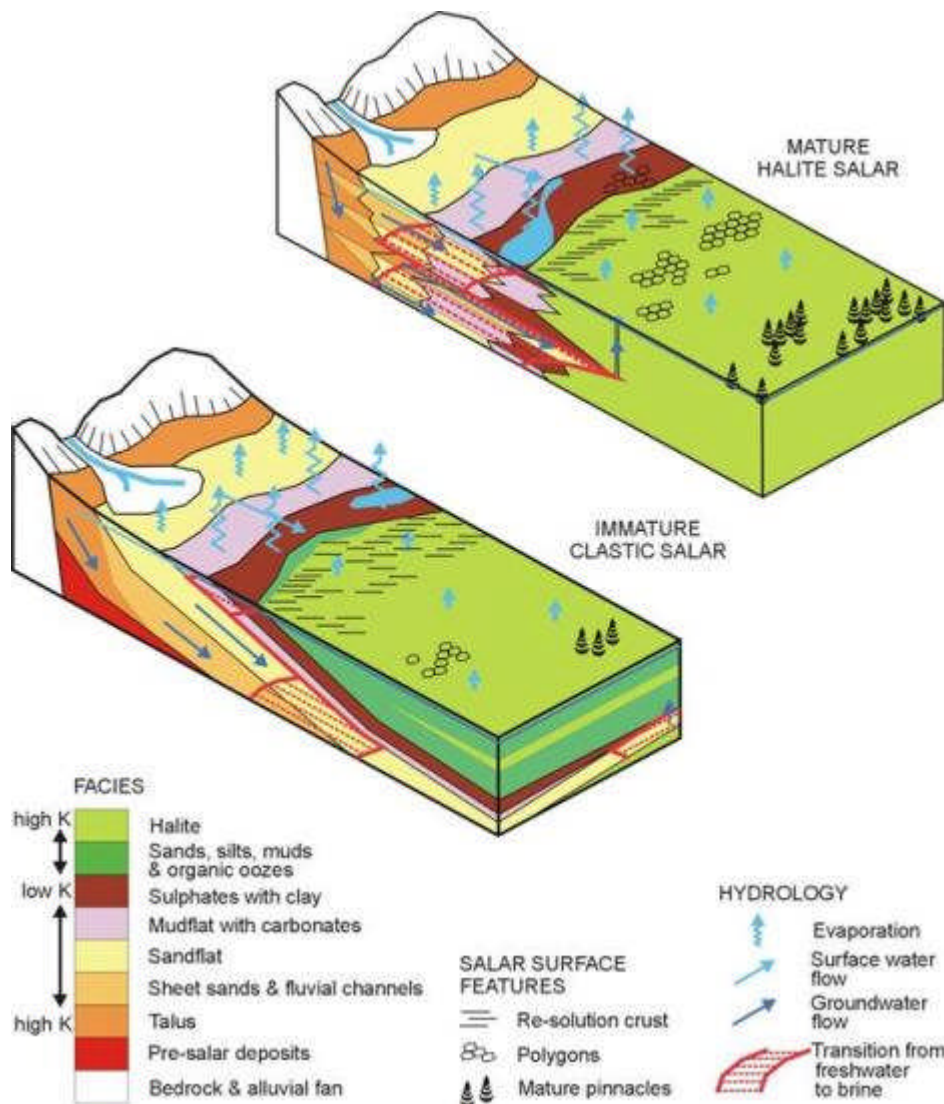


Figure 7.1 Model showing the difference between mature and immature salars (From Houston et. al., 2011)

7.2 The salar and associated post-Miocene deposits

The Salinas Grandes salar is a structurally complex basin which, unlike the great majority of Puna salars, has a broadly EW orientation. The southern margin of the basin is bounded by an EW trending, possibly reverse, fault. A single NS gravity profile has been completed over the salar (see section 9). This suggests the salar is in excess of 400 m deep, but the gravity profile has not identified the northern margin of the basin, hence the salar sequence may be considerably thicker.

The following Post Miocene units are noted in Figure 7.2:

- A very large low angle alluvial fan (black stipple) on the northern margin of and possibly pro-grading over the salar basin (A). The Burras River crosses the alluvial fan north of the salar, entering the salar where Salinas Grandes and Guayatayoc join.
- A large delta where the San Antonio River (B) enters the south of the salar basin.
- Smaller alluvial fan deposits (C) are present in the south and east of the salar.
- Within the salar there are several areas of slightly elevated topography (D), which correspond to probable older salt crust.
- Wind-blown sand is present on the borders of the salar, forming hummocky mounds less than half a metre tall (E).

The alluvial fan north of the salar covers an area of $\sim 900 \text{ km}^2$. Drilling has not been conducted in the fan, with drilling restricted to the salar to the south. The large area of the fan and the sandy surface texture suggests this area is a major source of inflow to the salar from shallow groundwater flow. Satellite imagery shows the southern border of the fan has a high reflectance, indicating precipitation of salts. Immediately north of the high reflectance areas high moisture content is detected in the fan sediments (in satellite images). The seasonally wettest part of the salar is the western part of the northern margin of the salar, where areas of high moisture content are shown closest to the salar margin.

Drill hole HCJ007D intersected a sequence of fine to coarse sand, with some gravel, from 70 to 180 m depth in the middle of the salar. This coarse material is interpreted as a coarse phase of the northern fan, prior to a lower energy period in which silts and clays were deposited in the centre of the salar.

The delta to the south of the salar is developed where the San Antonio River enters the salar basin. This river drains the catchment from the vicinity of the town of San Antonio de los Cobres 60 km to the south-southwest of the salar. In the vicinity of the town water is seasonally observed flowing in the river channel. However, closer to Salinas Grandes the river channel broadens and surface flow is not generally observed.

Approximately 1.5 km north of the Orocobre camp a spring is developed in the delta alluvium adjacent to outcrops of Cambrian or Precambrian metasediments. The spring water flows above ground to the margins of the salar, providing a perennial addition of water to the salar. Dry weather satellite imagery suggests there may be other dispersed springs along the southern margin of the salar in the vicinity of the EW salar boundary fault. Drill holes HCJ008D and HCJ010D were drilled on the southern limit of the salar. Drilling encountered silts and clays, with some interbedded fine to medium sands, with sand and fine gravel in the upper 5 metres.

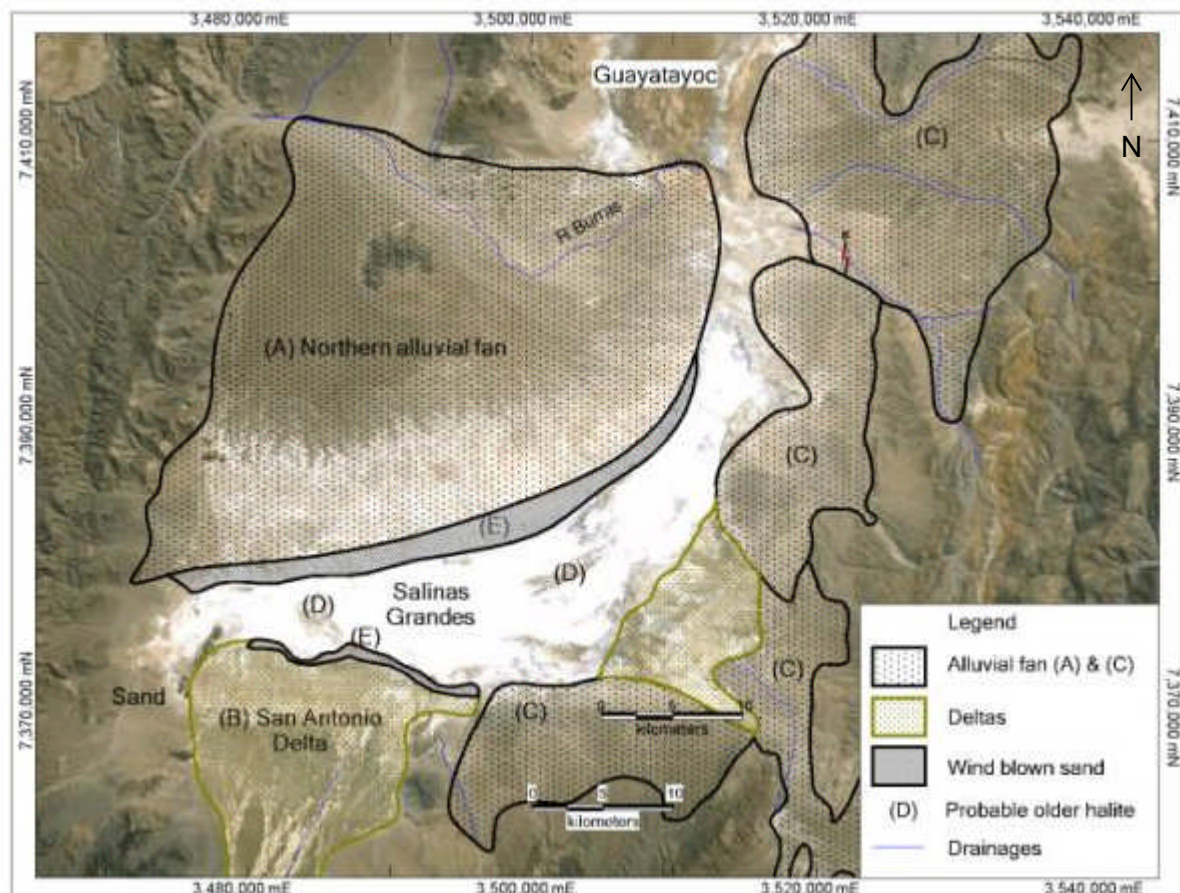


Figure 7.2 Salinas Grandes geomorphology

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 thin surficial halite layer less than 0.5 m thick
- Unit B - An upper gypsiferous sand, and brown to red sand/silt/clay unit – This is the primary host of the shallow brine unit
- Unit C - A major black organic mottled green/grey clay and silt unit
- Unit D - A red/brown unit with fine sand, silt and clay with artesian pressures and brackish water intervals
- Unit E - Green to brown silt and clay with minor sand
- Unit F - Fine to coarse sand and gravel, encountered in the deeper holes HCJ007D and HCJ009D to the base of hole.

Within the salar sequence there are three horizons where elevated gamma log responses are interpreted as volcanic tuffs. These are labeled as T1 through T3 and have been used correlating units between drill holes. A full petrological evaluation of these units is planned. An EW cross section (looking north) is shown based on the auger and diamond drilling (Figure 7.3), with a NS cross section shown in Figure 7.4.

7.3.1 Unit A - Salt crust and upper gypsiferous sand

The salar nucleus (salt pan) is covered by a thin layer of halite, which reaches a maximum thickness of 0.5 m in the centre of the salar (Figure 7.6). The dominant halite crust texture in

the salar is represented by contractional polygons of various sizes (Figure 7.5). This type of halite crust is noted by Houston (2011) to represent recent (2-5 year old) halite at the salar de Olaroz to the west.

In the case of Salinas Grandes it is noted that the salar was extensively flooded in January through March 2011. Salinas Grandes is also harvested on an annual basis for commercial quantities of salt. Mechanical graders are used to shave a layer of salt up to several cm thick from the top of the salar. This is replaced by precipitation of salts following seasonal flooding of the salar. When the wet season inflows are minor there is reportedly limited new salt growth in the salar. Based on these observations the contractional polygons at Salinas Grandes are considered a young morphological feature, which can represent halite less than 1 year old. The standing water level in the centre of the salar is within 10-20 cm of the salar surface.

7.3.2 Unit B – Reddish brown sand and silt/clay

Underlying the halite crust in many locations is a layer of gypsum-bearing sand that may locally reach ~1 m in thickness, but which is more typically half a meter thick. This sand is suggested to have high transmissivity locally, based on inflow observations to pits and depending on the degree of cementation in the sand. The gypsiferous sand forms the upper part of Unit B, beneath Unit A – the halite crust.

Beneath the gypsiferous sand there are units of reddish brown sand, and grey to green or brown silt and clay. The thickness of the unit varies from less than 1 to approximately 10 metres thick (Figure 7.6). Fine to locally medium and coarse sand in this unit is largely restricted to the northern edge of the salar, close to the extensive northern fan. 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 depocentre for this unit appears to be in the northwest to central west of the salar, with the thickness of the unit increasing towards the west and north in the salar, suggesting this may be the direction from which the sediment was sourced. There are local layers of green to black clay within this unit, suggesting the deposition of organic material in layers locally.

The upper boundary of the unit is defined by the base of the halite unit, or the surface, where the halite is absent in holes HCJ008D, HCJ009D and HCJ010D. The lower boundary is defined by the appearance of black organic sediments and the start of a distinctive series of peaks in the porosity log.

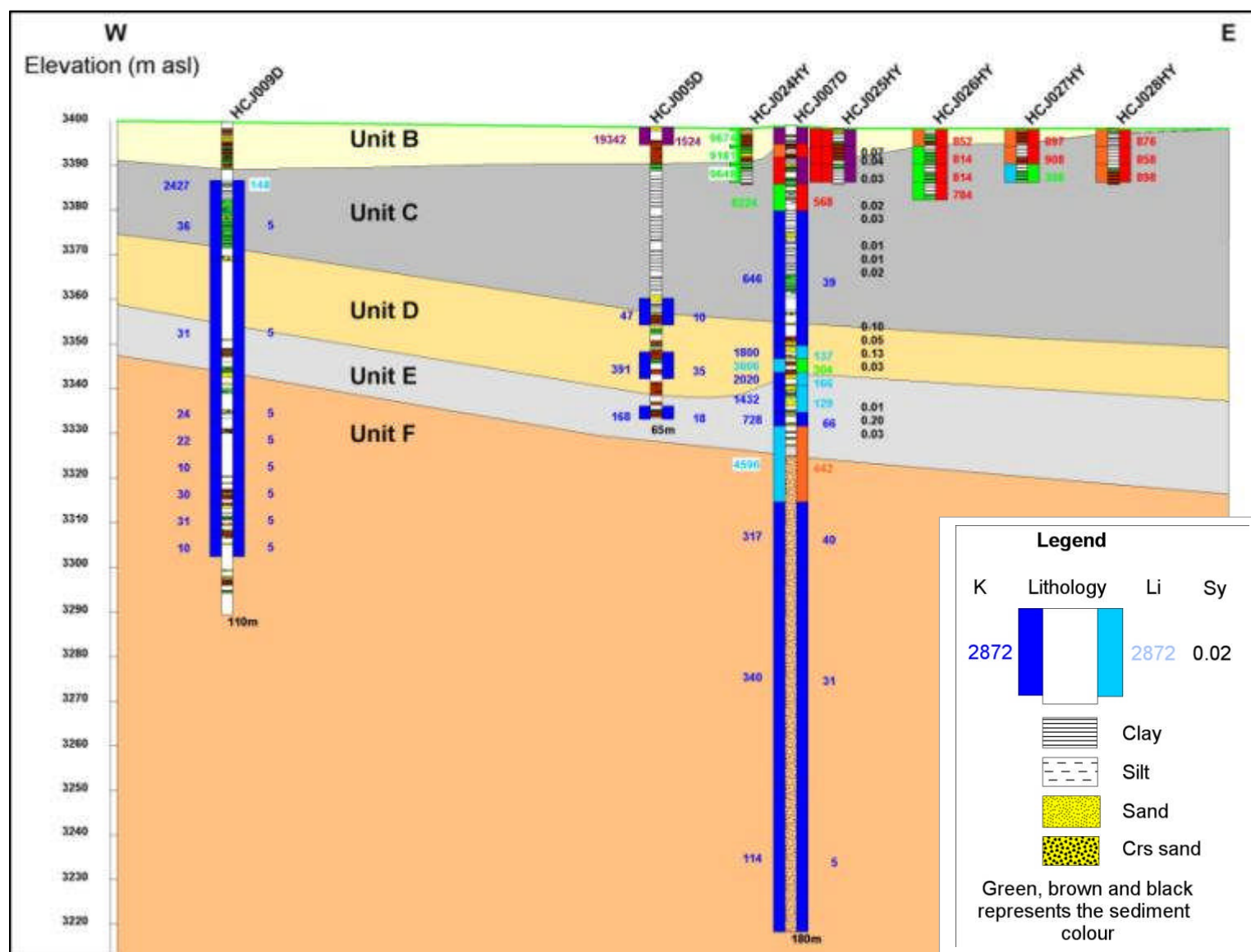


Figure 7.3 EW cross section through Salinas Grandes, showing the geological units

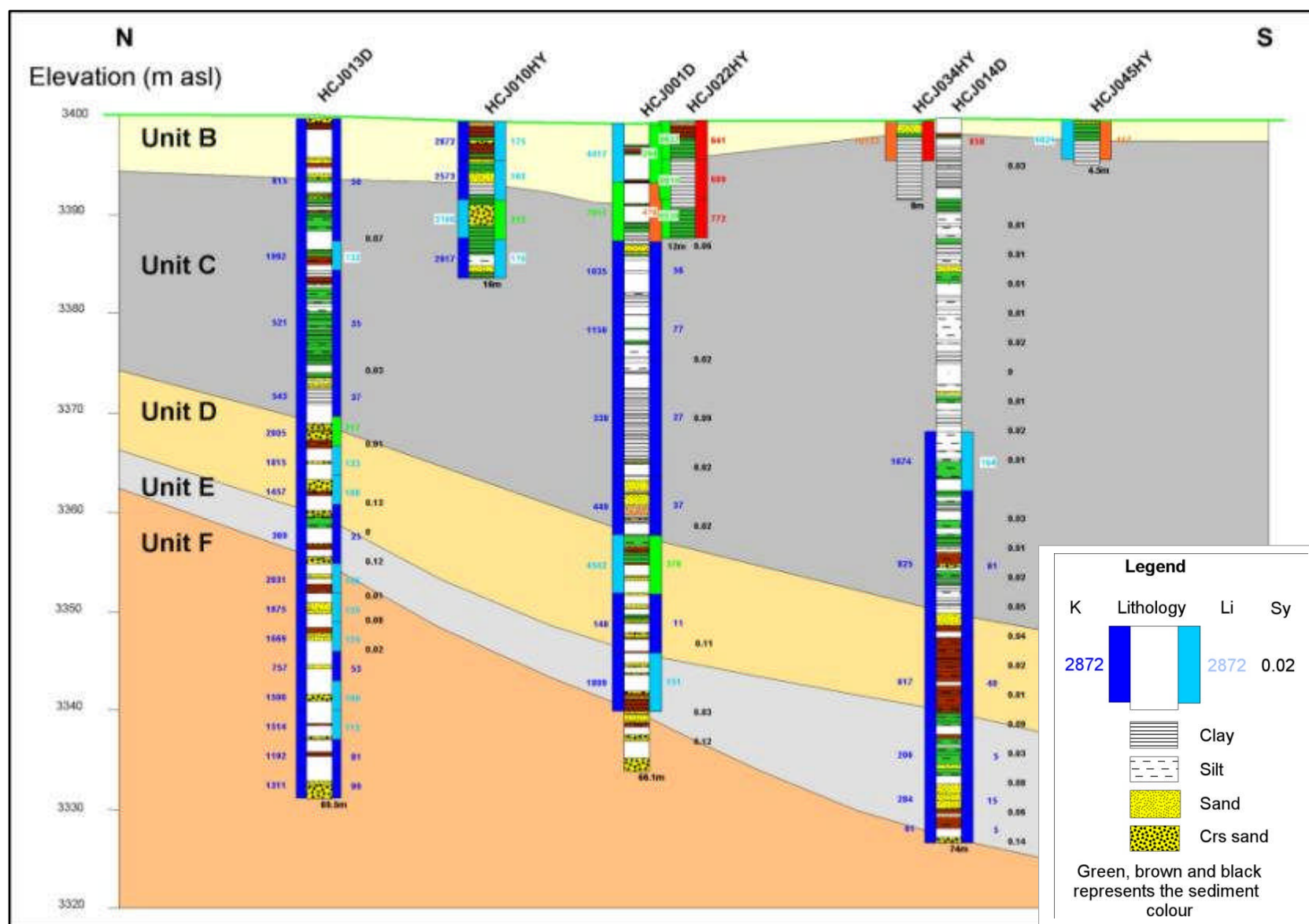


Figure 7.4 NS cross section through Salinas Grandes, showing the geological units



Figure 7.5 Polygonal salt surface at Salinas Grandes, with areas of salt harvesting in the background

7.3.3 Unit C – Black to green grey clay and silt

This is the most extensive unit encountered in the drilling carried out in the salar. This unit displays an upper and lower transitional zone, where black clay and silt is mottled and mixed with medium to dark green clay. The centre of this unit is generally homogeneously black highly organic clay and silt (Figure 7.7). The unit is interpreted in all of the diamond holes drilled. However, in the holes HCJ008, 9 and 10D on the salar margin the black organic content is minor, and the unit is typically grey. Thin sand partings are locally present in this unit but it does not generally contain any significant sand units except near the base of the unit. The base of the unit corresponds with a change in peak intensity in the porosity logs.

The strong organic content in this unit suggests deposition in a strongly reducing lake environment, with limited addition of coarse sediment. Halite is not noted within this unit, suggesting conditions were not hypersaline at this time and that there was significant vegetation surrounding the salar to contribute to this organic unit.

The depocentre for Unit C is in the southeast of the salar, reaching thicknesses of over 50 m in the diamond drilling (Figure 7.8). The unit is considerably thinner in the north and west of the salar, where the overlying Unit B red silts, clays and sands thicken up. The distribution of Unit C suggests this unit dips south, where a fault is interpreted to control the southern margin of the basin

7.3.4 Unit D – Black to Grey/brown or red fine sand to silt

This unit underlies the extensive organic silt and clay unit and has been intersected in all the diamond holes drilled. The unit consists of reddish to brown or greenish grey sand, silt and clay. The lower boundary of this unit is defined by the upper tuff unit T1 and is often coincident with a peak in the porosity geophysical log. In the east of the salar in drill holes HCJ014D, HCJ001D and HCJ006D a black silt unit is correlated with the fine sand present to the west. This suggests lower energy conditions may have prevailed in the east of the salar during deposition.

The unit varies between 4 and 18 m thick, with a typical thickness around 12 m (Figure 7.8). The unit thins and shallows towards the north, with a similar distribution pattern to Unit C. This unit may represent a period of coarse sedimentation associated with a fluvial event.

Groundwater in sands within this unit is under semi-artesian to artesian pressures conditions, with the overlying Unit C silt and clay sequence acting as an extensive confining layer. The groundwater in Unit D is brackish and considerably less saline than units with elevated lithium values.

7.3.5 Unit E - Brown/red clay to silt with sand layers

This underlies the red-brown Unit D and shows a broad transition from clay in the south of the salar to more silt dominated in the north of the salar. The sands vary from fine to coarse grained and there is also a greater sand content towards the north of the salar. The red-brown colour suggests a more oxidized (potentially drier) environment, lacking significant organic material.

The unit varies from 4 to 17 m thick, although typically around 10m (Figure 7.9). Within this unit there are intervals of up to several metres comprised of green clays. Contours show the greatest thickness of this unit in the central southern part of the basin; however these contours do not show the complete thickness, as some drill holes terminated in this unit. The base of this unit is defined by a second tuff unit T2 and a peak in the porosity log.

7.3.6 Unit F - Fine to medium brown/red sands to gravel

Drill hole HCJ007D was drilled to a depth of 180 m, with drilling from 71.5 m as a rotary hole. This intersected a continuous sequence of fine to coarse red to brown sand and minor gravel, with intervals of silt and clay. The unit is notable for containing a significant component of medium sand, which is a distinguishing feature. The depth to the top of Unit F is shown in Figure 7.9.

Comparison of the location of the diamond drill holes with the single Audiomagneto Telluric (AMT) geophysical line measured NS across the salar (see Figure 9.6) shows that at a depth of around 70 m the drill hole entered a lower conductivity zone. This low conductivity zone extends beyond the base of the drill hole at 180 m, and is coincident with the coarse sediments intersected and the low salinity (<20 mS) groundwater hosted in this unit.

The AMT line suggests that this coarser grained unit underlies the salar, dipping shallowly to the south. The coarse sediment suggests this unit corresponds to alluvial fan deposits, possibly sourced from the north of the basin, although sediment input from the San Antonio delta to the south cannot be ruled out.

Drilling has not been conducted outside the margins of the salar basin (holes HCJ008D, HCJ009D, HCJ010D) through the surrounding fan deposits and the San Antonio delta. It is notable that in holes HCJ008D, 9D and 10D on the margins of the salar this unit contained brackish water in sand units under artesian pressures. Drilling suggests there are multiple levels with sandy aquifers under artesian pressures through the basin.

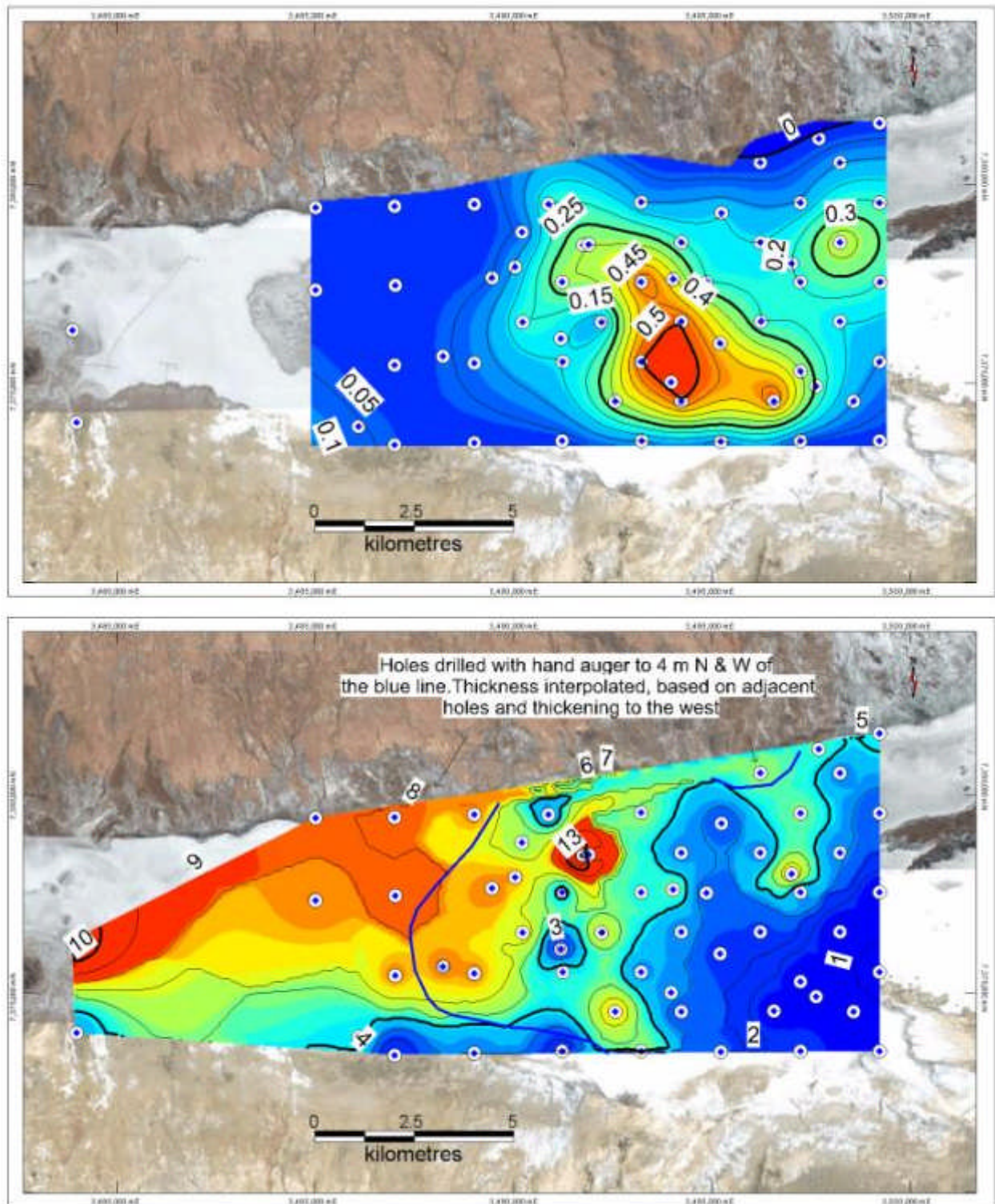


Figure 7.6 Contoured thicknesses of units A (above) and B (below)
 Note that thickness has been interpolated for hand auger holes not drilled beyond 4 m depth.



Figure 7.7 Black organic rich Unit C clay and silt, with an area of mottled green/grey clay at the top

7.4 Basin development over time

Salinas Grandes is a structurally controlled basin that may have only recently acquired the characteristics of a salar (halite, brine). The basin is interpreted to be bounded by reverse faults, with more complex fault geometry in the western part of the basin. Quaternary basin fill is interpreted to be at least 400 m thick. Drilling suggests the deeper part of the basin is filled by sand and gravel units. These higher energy clastic deposits are overlain by low energy sediments interpreted to have formed in a shallow subaerial to subaqueous basin.

In the deeper Unit F it is unclear the respective sediment contributions from the San Antonio River delta and the northern alluvial fan. An ~ EW fault is interpreted forming the southern boundary of the salar (Figure 6.6). The San Antonio delta is in the interpreted up-thrown fault block immediately south of the salar, and consequently would have contributed sediment to the salar.

Low energy depositional conditions associated with Unit E, interspersed with local deposition of sand units (in a relatively dry environment), gave way to the basin wide deposition of Unit D during what was probably a period of wetter conditions. At this time conditions in the basin appear to have been reducing, with deposition of black sands and silts. Unit D is thickest in the central southern part of the basin.

Unit C is interpreted to have been deposited in a quiescent lacustrine environment, under probable fresh to brackish water conditions, reflecting the high organic content of this unit. The depocentre of this unit may reflect north side down movement on the southern salar basin-bounding fault with inflow of fine sediment from the San Antonio delta. This unit may correlate with unit B defined at Olaroz, although lacking halite.

Unit B at Salinas Grandes is interpreted as a return to drier/higher energy conditions, similar to unit E, with sediment sourced from the north of the basin. Drier conditions have led to the deposition of Unit A with evaporite deposits at the salar surface and gypsiferous sand.

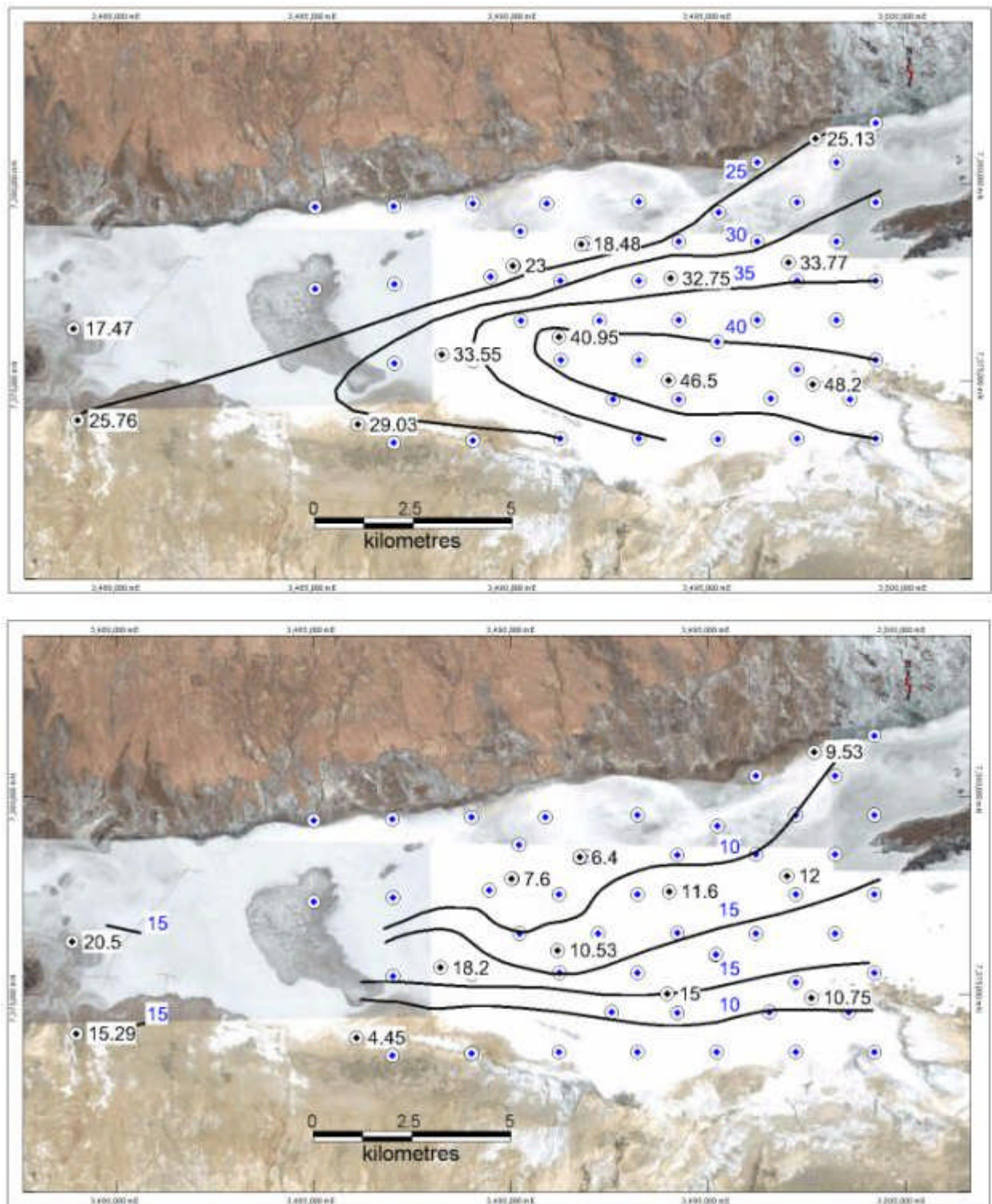


Figure 7.8 Contoured thicknesses on units C (above) and D (below)
Diamond holes are shown as black points.

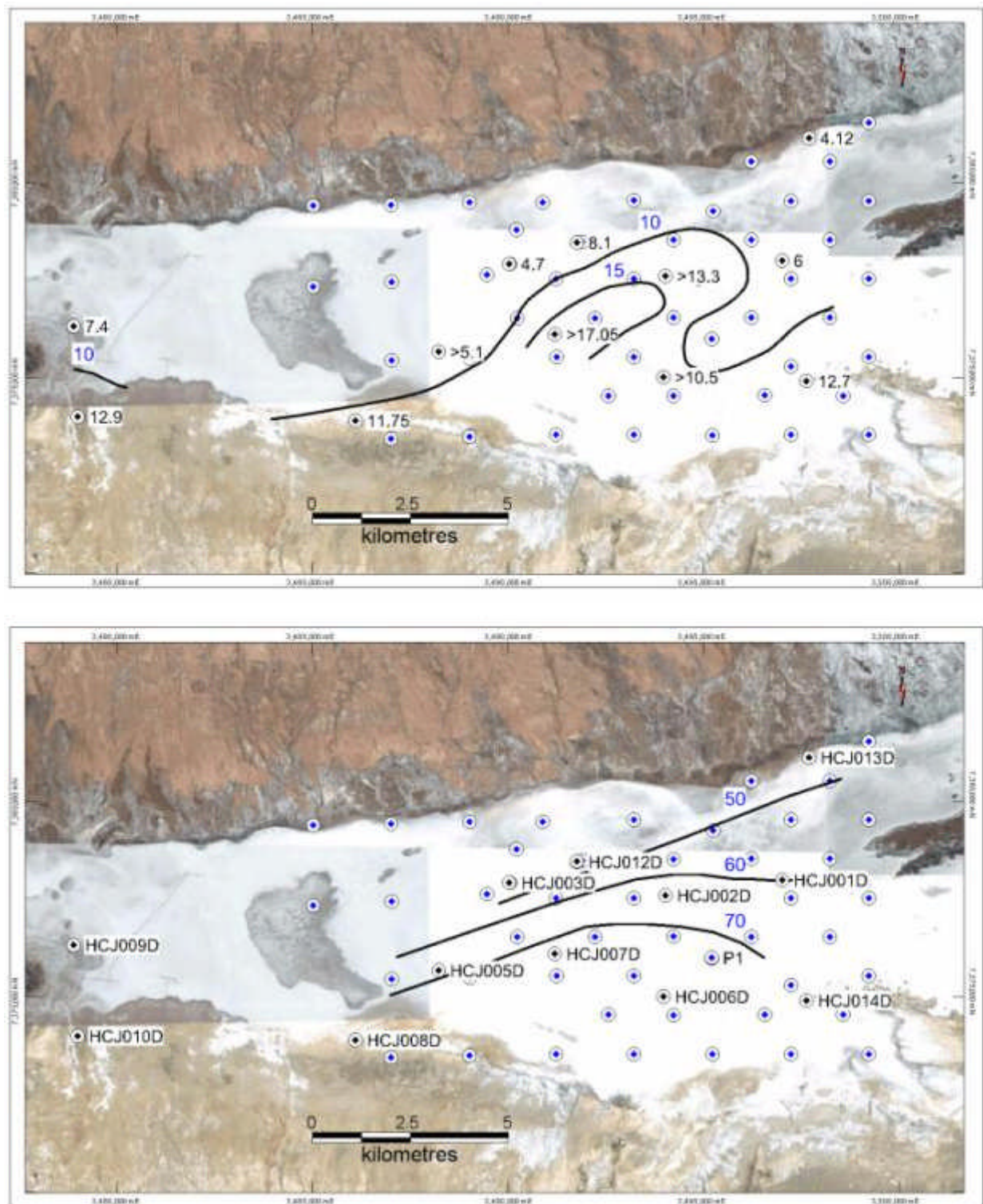


Figure 7.9 Contoured thickness of Unit E (above) and depth to the top of Unit F (below)
Diamond holes are shown as black points.

7.4.1 Geological interpretation

The Salinas Grandes salar sediments occupy an area of ~ 250 km² in an EW to NE orientation (“banana” shape) with a long axis extending approximately 40 kilometers EW to NE and a short axis up to 8 kilometers across. The salar consists of bedded fluvial and lacustrine sediments that comprise silts, clays, gravels and sands. Halite is restricted to a surface cap over sediments. The thickness of the cap varies from several centimetres up to 50 centimetres. No halite layers have been intersected in drilling beneath this surface layer.

The sedimentary sequence in the salar is dominated by organic silts and clays. The silts are typically black, reduced and sometimes smell of hydrogen sulfide. The clays vary from black to light green and often contain green mottles. Within the silt and clay sequence are thin (generally sub meter thick) sand and gravel layers which may represent channel deposits within the overall sedimentary package.

A better sorted, cleaner, fine to medium sand is associated with a brackish aquifer in Unit D that has been identified in drill holes across the salar basin. This unit appears to dip to the south, suggesting it has been sourced by ingress of coarser sediments from the current or a former equivalent of the alluvial fan in the north of the salar.

7.5 Lithostratigraphic unit porosity and permeability

The Salinas Grandes basin consists of multiple aquifers and confining layers, with Units A, B, D and F representing the most permeable lithologies. Units C and E have lower permeabilities, considering their higher clay content, and act as major confining layers within the salar. Units may interdigitate and vary locally in thickness, depending on the conditions at the time of deposition and variations within the basin.

The more permeable deeper confined units D and F host brackish water (with EC of 1 to 50 mS), while Units A, B and the upper part of Unit C host the shallow brine body. As artesian or semi-artesian pressures were detected in all the diamond holes these were capped or cemented and decommissioned. Pressure gauges were installed on a number of the capped wells. Pressure readings show similar pressures in holes HCJ010D and HCJ008D on the southern margin of the salar, with a decrease in pressures further north and east in the salar.

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 Orocobre, with measurements of total porosity and specific yield made at the British Geological Survey (BGS) sedimentological laboratory. Further details of procedures for measurements are provided in Section 12.

Because lithological units generally contain mixtures of sand, silt and clay the porosity measurements can be quite variable from sample to sample in the same unit. For this reason it is necessary to define the porosity based on the dominant grain type (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 higher Sy, as water is more readily released from pores during pumping. Values for Pt determined in the Salta office are consistently lower than those determined by the BGS, with the values determined

by the latter used in preference (Table 7.1). The average of the Sy samples (117 in total), from each lithology type, are shown in Table 7.1.

# Samples	Lithology	Average Liquid Resaturation Porosity %	Average Sy %
59	Clay	47.1	2
41	Silt and mixes	40.8	4
19	Sand	38.2	16

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

The portions of sand, silt and clay in the auger drill holes are shown in Figure 7.10 (with the values sum at a point to 1 = 100%). To calculate the shallow resource the BGS Sy values have been applied to the portions of sand, silt and clay in the auger drill holes, to define an averaged Sy value for each hole.

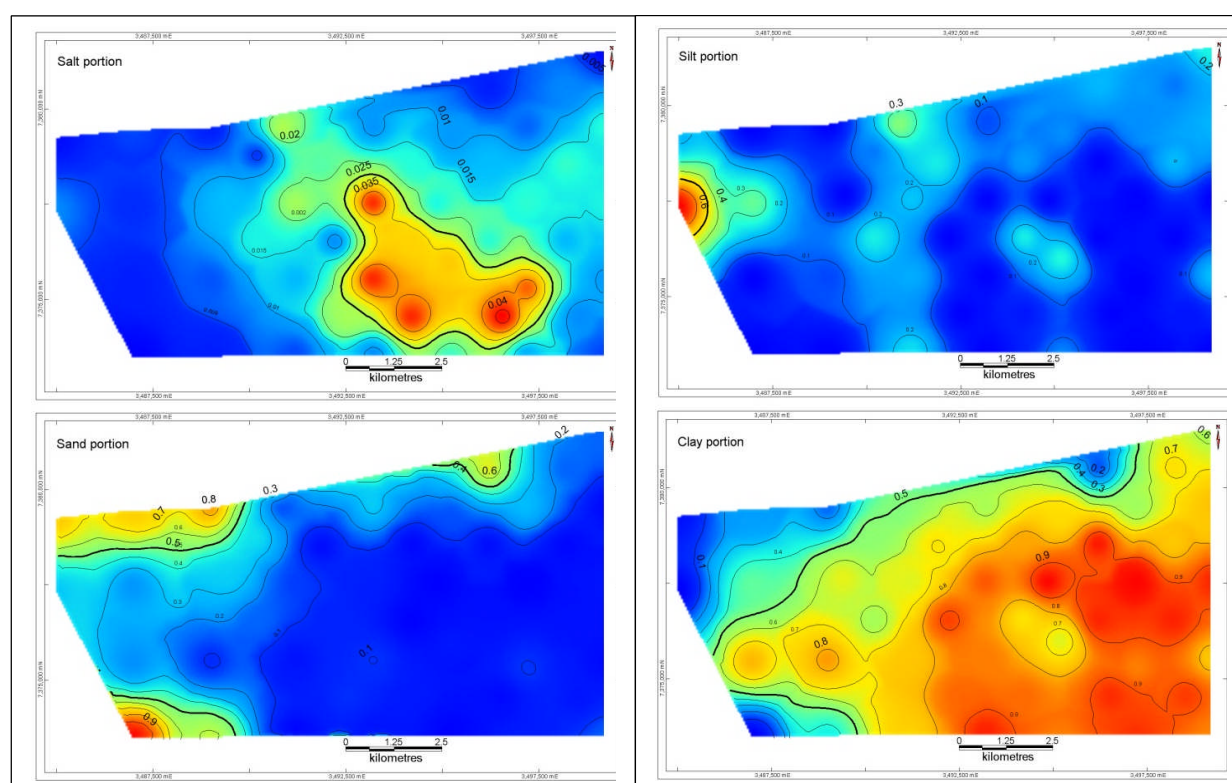


Figure 7.10 Halite, sand, silt and clay portions across the area of auger drilling
Contours are every 0.1 (10%). Sand is thicker on the northern and southern margins of the salar.

7.5.2 Permeability

So far, permeability testing in the salar (Figure 7.11) has been limited to 10 short duration (several hours to < 1 day) and low flow rate (typically 1 l/s) pump tests (summarised in Table 7.2). The pump test holes were chosen on the basis of a) having the same type of well screen pipe with machine cut slots, to minimize any differences due to well construction, and b) selecting a distribution of wells to test the variation in permeability in different parts of the salar.

The short duration pump tests show the Salinas stratigraphic units are relatively low permeability (averaging 3 m/d, excluding the high permeability hole HCJ009HY). These permeabilities measured at Salinas Grandes are encouraging and justify additional evaluation of the project, supported by the attractive brine chemistry.

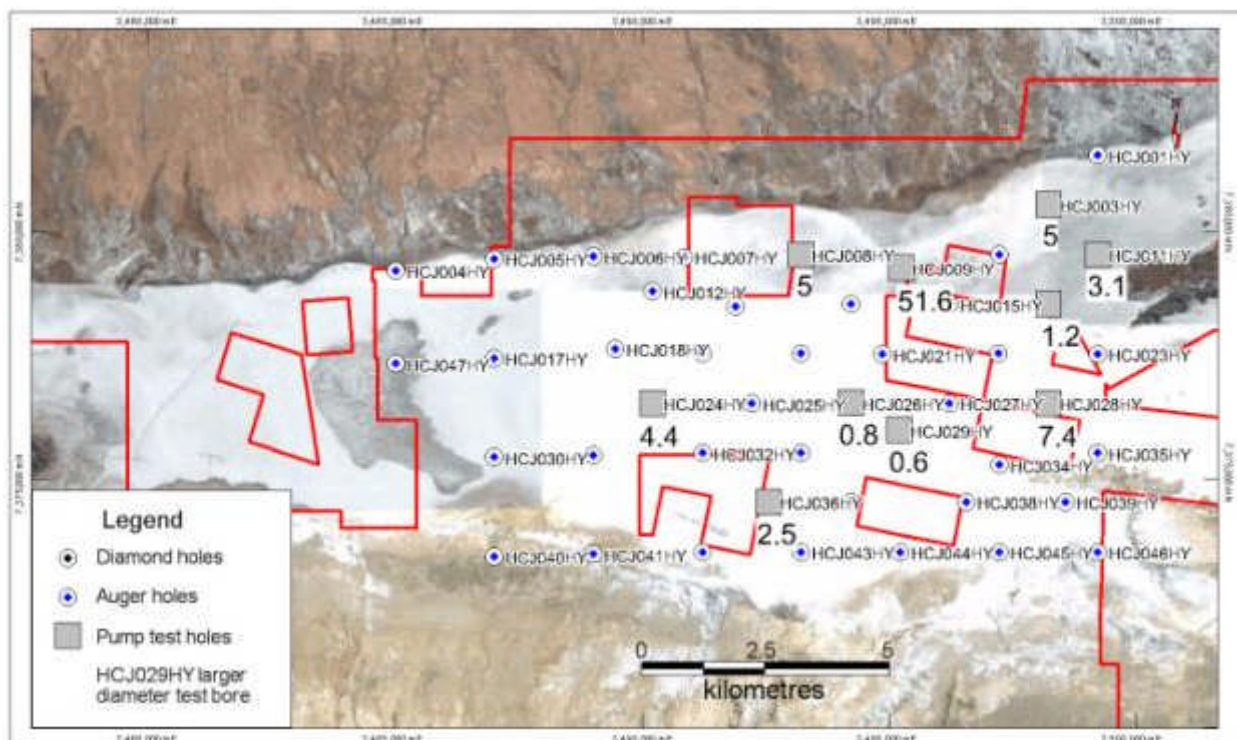


Figure 7.11 The location of short duration pump tests

These initial pump test results appear to confirm the observations from shallow auger drilling that lithologies can vary significantly laterally in the shallow stratigraphy, with resulting differences in permeability values and the possibility of local higher permeability channel deposits. The company is currently planning extended duration pump tests (over a period of many months) on bores in the project, to evaluate whether pump rates can be sustained over time and whether there are appreciable reductions in lithium concentrations during pumping caused by inflow from the underlying brackish waters.

Test hole number	Predominant lithology	Activity	Screened depth	Total Depth	Pump depth	Pump rate l/s	Average T m ² /day	Average K m/day	Pump time mins	Recovery measured mins	Method
HCJ003HY	Clay with a total of 3 m with sand	P&R	0-12.5	12.5	8.0	1.07	63	5.0	261.0	546.0	CJacob P&R, Theis P&R
HCJ008HY	Clayey silt and clay with 3.5 m containing sand.	P&R	0-8	8	6.0	1.5	40	5.0	360.0	2019.0	CJacob P&R, Theis P&R
HCJ009HY	Clay with 3.5 m of sandy silt and fine sand	P&R	0-8	8	6.0	0.9	412	51.6	1800.0	75.0	CJacob P&R, Theis P&R
HCJ011HY	Clay with 2 m of silty clay and 20 cm of sand below the halite crust	P&R	0-11	11	6.0	1.01	34	3.1	360.0	75.0	CJacob P&R, Theis P&R
HCJ016HY	Clay, with 4 m of clayey silt	P&R	0-12	12	6.0	0.8	14	1.2	330.0	150.0	CJacob P&R, Theis P&R
HCJ024HY	Clay with 1 m sand below the halite crust and 1 m sand around 6 m	Recovery only	0-12	12	8.0	1.4	53	4.4		209.0	Theis R
HCJ026HY	Clay with 8 m of silty clay to clayey silt	P&R	0-16	16	6.0	0.8	13	0.8	1320.0	120.0	CJacob P&R, Theis P&R
HCJ028HY	Clay with 0.5 m sand below the salt crust	P&R	0-12	12	8.0	1.55	88	7.4	428.0	1013.0	CJacob P&R, Theis P&R
HCJ036HY	Clay with 1 m sand below the salt crust	P&R	0-12	12	8.0	0.97	30	2.5	121.0	601.0	CJacob P&R, Theis P&R
HCJ029HY	Clay with 0.6 m sand below the salt crust and 2 m sandy silt around 9 m	P&R	6-35	29	25.0	2.4	18	0.6	1080.0	300.0	CJacob P&R, Theis P&R
HCJ029HY	Clay with 0.6 m sand below the salt crust and 2 m sandy silt around 9 m	P step test	6-35	35		2.4	10	0.3	520.0		
Mean							34	3			
AVERAGE excluding HCJ009HY							33	3			

Table 7.2 Pump test permeability (K) and transmissivity (T) values

8 MINERALIZATION

8.1 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 11. A description of QA/QC procedures is provided in section 12.

Three sets of fluid sample data were obtained during the drilling investigations at Salinas Grandes. A summary of the analytes of interest (Li, K, Mg, B) in fluid samples are presented in Table 8.1, with the three data sets consisting of:

- Samples collected from bailing fluid during diamond drilling (Analysed by Alex Stewart Assayers (Argentina) S.A.);
- Fluid samples extracted by centrifuging diamond drilling core samples (analysed by the British Geological Survey); and
- Composite fluid samples from brine in auger holes, with a maximum depth of 20 m.

Diamond Drilling Bailer Samples						
	B	K	Li	Mg	Mg/Li	SO4/Li
# Samples	109	109	109	109	109	109
Average mg/l	96	3,955	317	858	3.1	10.6
Std Dev	118	5,084	419	1,204	1.8	9.9
Max	438	19,628	1,761	5,329	15	66
Min	5	32	5	15	0.6	2.0
Diamond Drilling Brine Extracted Samples						
	B	K	Li	Mg	Mg/Li	SO4/Li
# Samples	140	140	140	140	140	140
Average mg/l	39	1,881	154	471	7.7	23.9
Std Dev	102	2,670	261	741	8.9	40.8
Max	706	15,000	1,281	5,167	33	236
Min	<5	17	<5	1	0.3	0.7
Auger Drilling Bailed Samples						
	B	K	Li	Mg	Mg/Li	SO4/Li
# Samples	120	120	120	120	120	120
Average mg/l	245	10,040	830	2,234	2.6	7.3
Std Dev	112	3,761	345	1,100	0.5	17.2
Max	530	19,412	1,670	5,198	5	166
Min	18	131	10	38	1.2	1.7

Table 8.1 Summary geochemical data from the three data sets

The results (Figures 8.1 to 8.3) show that there is a broad spread in analytical results for samples from the diamond drilling and the auger drilling. However, in the case of the diamond drilling results the distribution of samples is strongly weighted (positively skewed) towards samples with lower analytical concentrations, with a long tail of higher concentration samples. This reflects the stronger near surface distribution of higher values, with values declining with depth. In contrast to the diamond drilling samples the auger sampling show a more typical normal distribution, with near zero skewness, that suggests a more homogeneous sample population in the upper 20 m of the salar.

The auger drilling samples show the lowest average Mg/Li and Mg/SO₄ ratios, with higher ratios for the diamond drilling, and particularly the brine extraction samples, which have notably lower analyte concentrations.

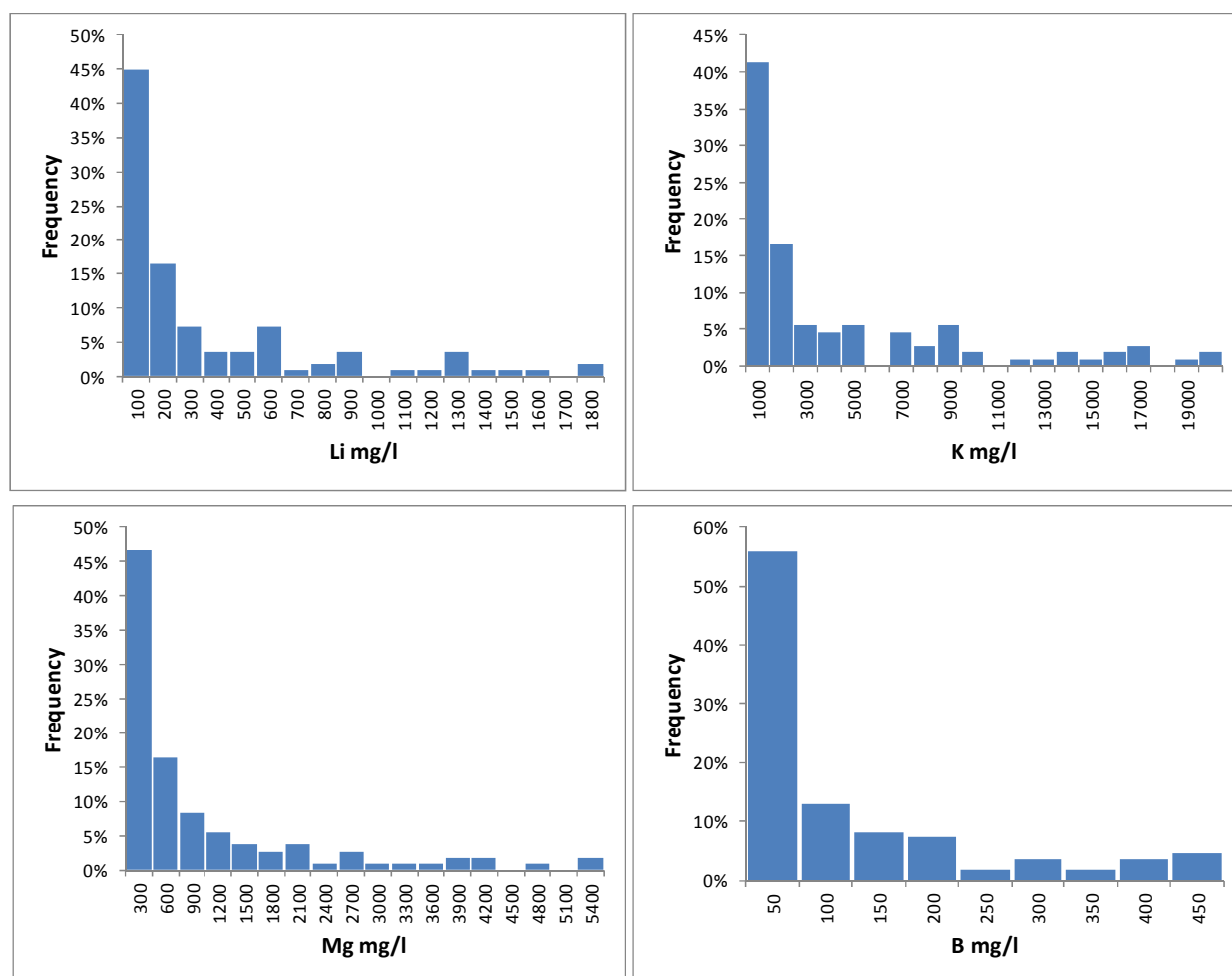


Figure 8.1 Chemistry results for bailed fluid samples from diamond drilling

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 10 through 12) 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.

Significant variations were also noted between composite samples in the shallow auger drilling and between the nearest diamond holes within the same lithological unit. As no brine injection was used in the auger drilling process it is suggested there is considerable vertical and lateral variation in analyte concentrations within the salar lithological units and such variation may explain much of the variation observed in the different sampling sets.

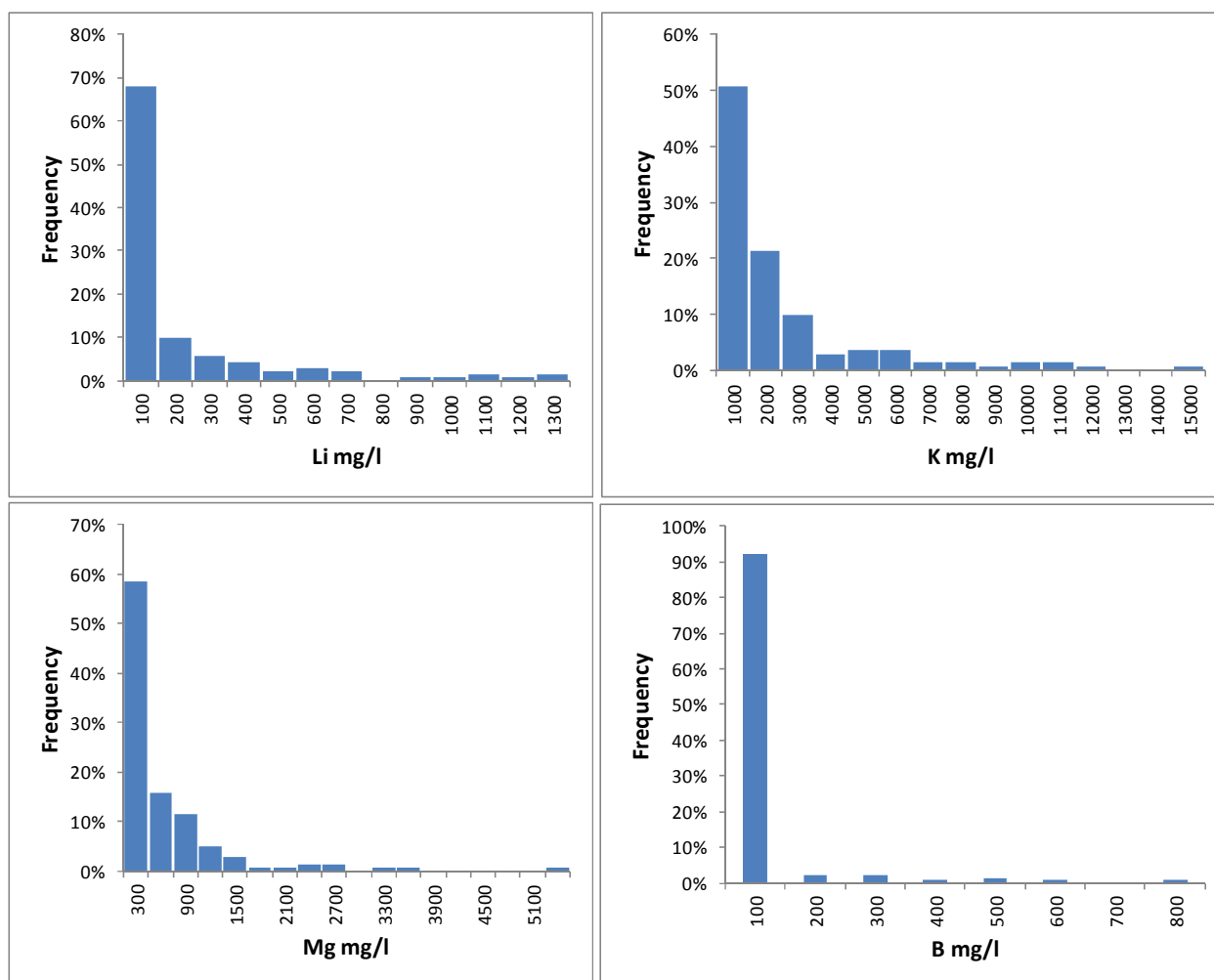


Figure 8.2 Core extraction geochemistry from diamond core samples

8.2 General fluid characteristics – Salinas Grandes

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

- The pH of brine is generally weakly alkaline, with the brackish water in artesian/semi-artesian zones characterized by pH values in excess of 8.5 with a consistently higher pH than brine layers.
- Density values in most diamond holes show high surface values, with densities decreasing below the upper 10-15 m of the salar.
- Density is closely correlated with elevated electrical conductivity and with high lithium (Figure 8.4), potassium and boron values.
- The brackish units are characterized by high pH, low electrical conductivity (< 30 mS), and a density of approximately 1 g/cc, with high levels of dissolved oxygen (over 50% in some samples).
- The brackish units are characterized by low values of lithium (generally < 30 mg/l), potassium and boron.

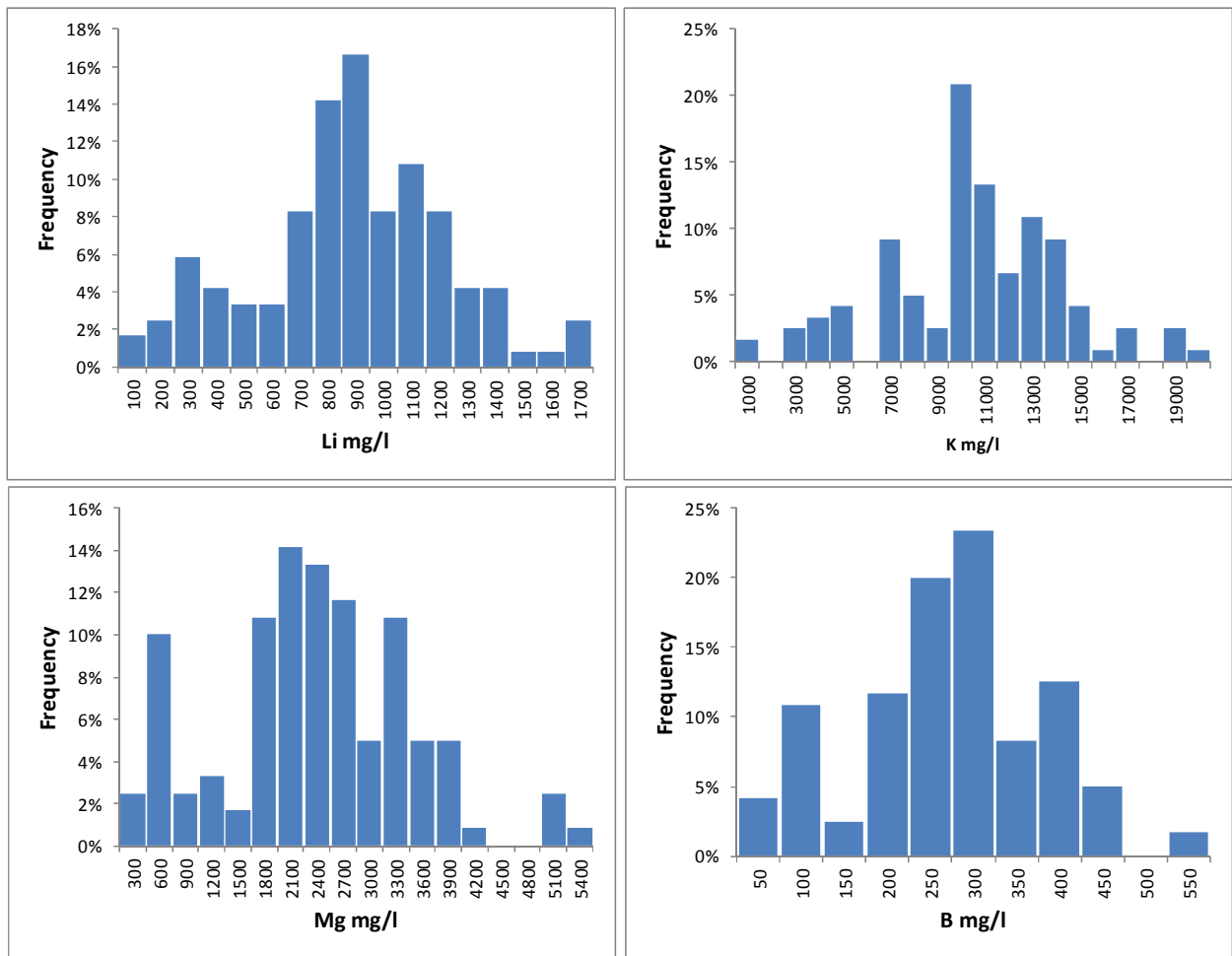


Figure 8.3 Chemistry results from bailed composite fluid samples from auger sampling from 0-20 m. Most samples correspond to depths of 12 m or less.

8.3 Analyte concentrations by unit

It is noted that there is a considerable spread in the analytical values, with substantial variation in values between and within units. As previously discussed Units F and D are host to fresh- brackish water, with units A through C of primary interest as potential sources of lithium, potassium and boron. The values of Li, K, B and Mg from the auger drilling 0-12 m (12 m is the typical drilling depth) are presented below in Figures 8.4 and 8.5, showing the distribution of these elements.

When plotted versus depth Li, K and B values show a general decline below 10-15 m (Figure 8.6), which represents the upper zone of brine and underlying lower brine densities and brackish water. There are a number of exceptions, such as hole HCJ006D and HCJ002D, which are discussed in Section 12. The deepest composite brine sample data from Auger drilling has been used for the resource estimate of the shallow units (A and B).

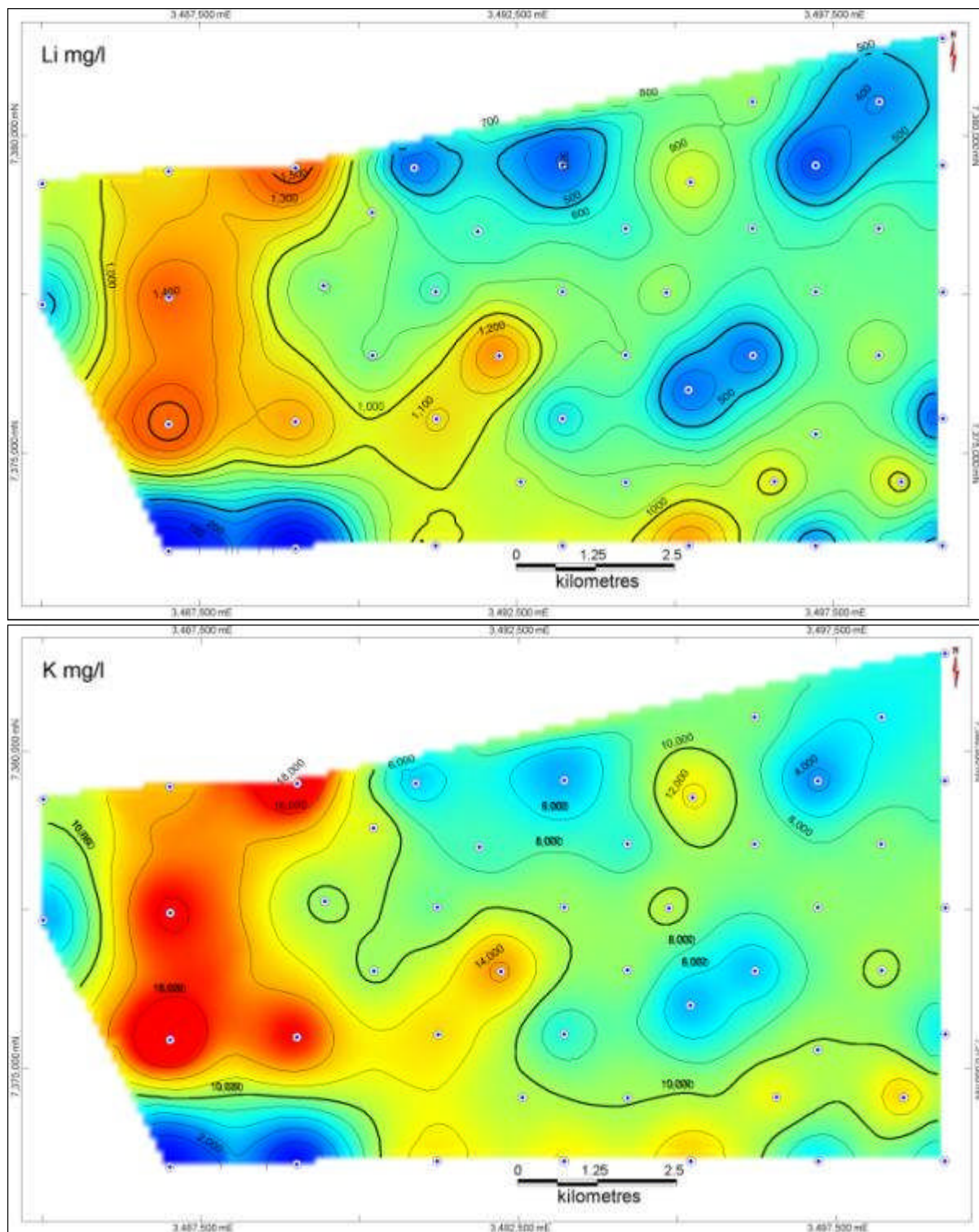


Figure 8.4 Li and K concentrations in auger composite samples
Composites are 0-12 m samples, except where holes are shallower in the west and south

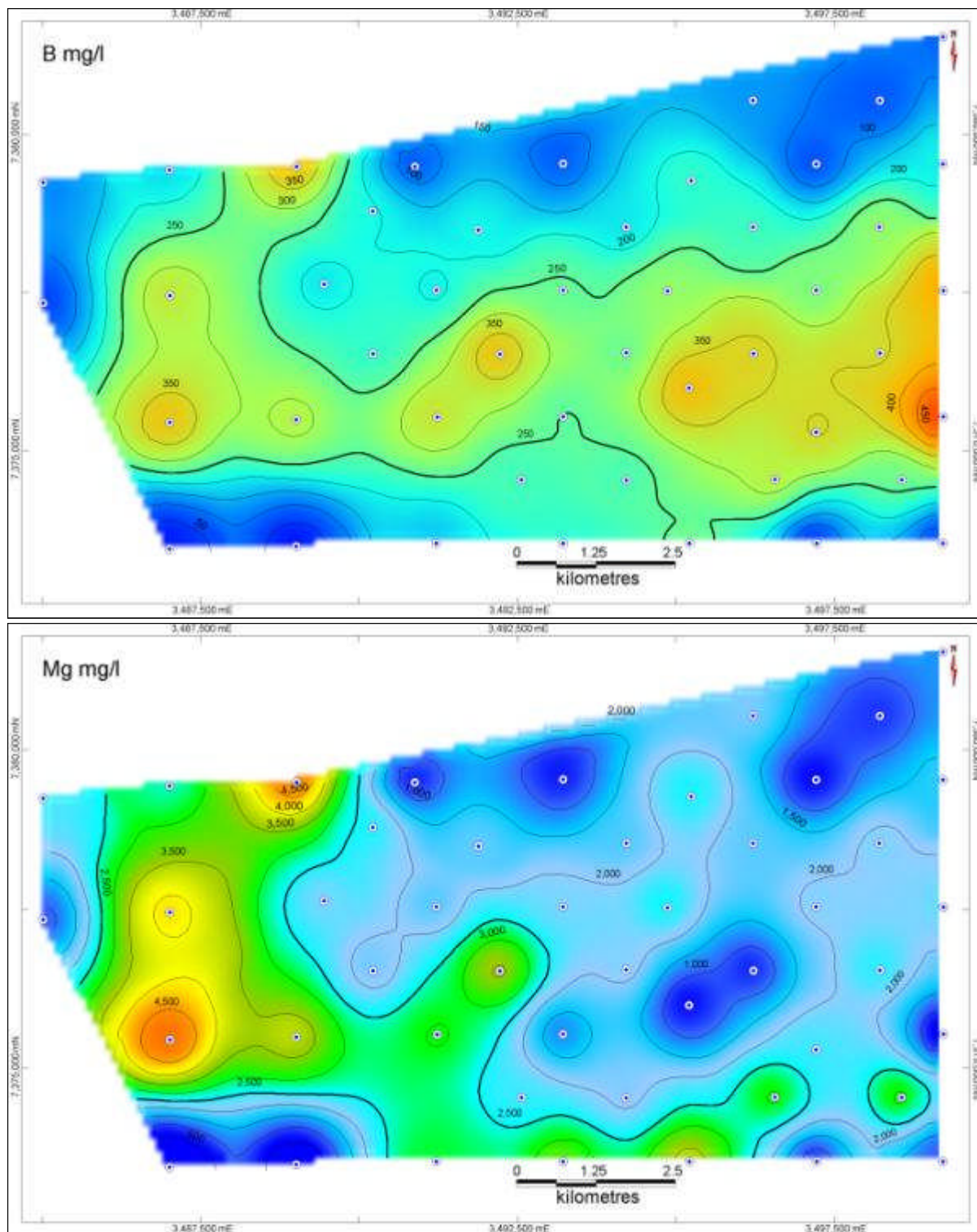


Figure 8.5 B and Mg concentrations in auger composite samples
Composites are 0-12 m samples, except where holes are shallower in the west and south

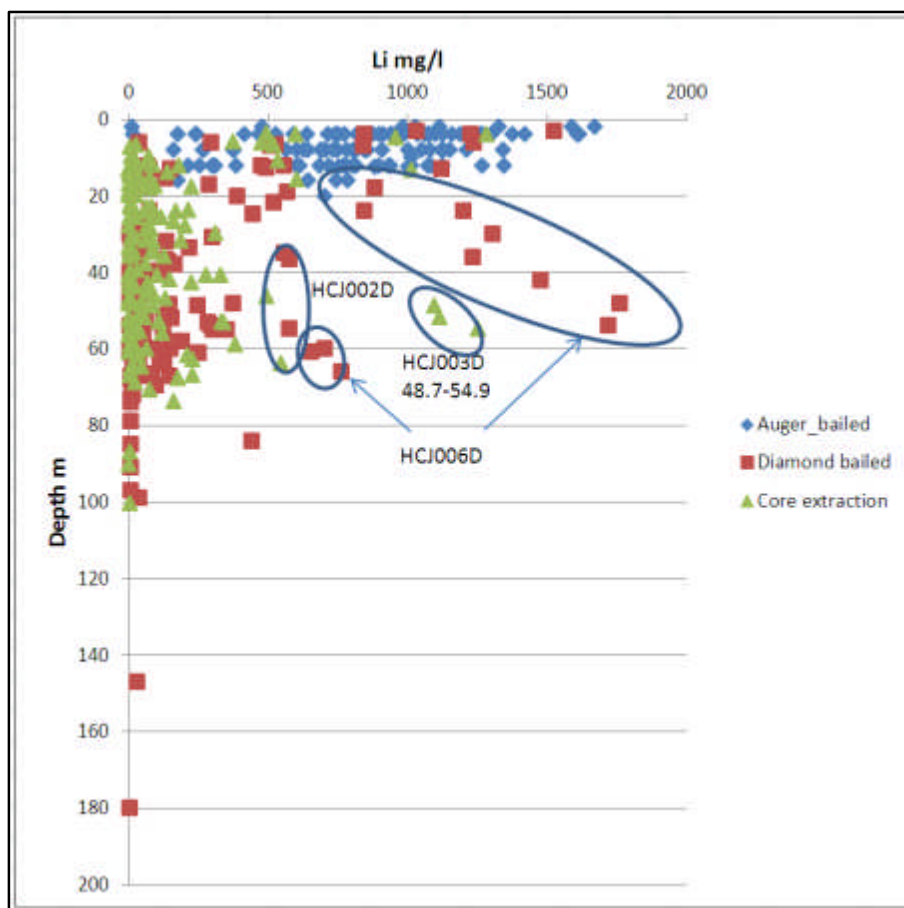


Figure 8.6 Lithium concentrations versus depth for the three geochemical data sets
The lithium concentrations show a decline below 10-15 m, with the exception of several holes in the centre-south of the salar, such as HCJ002D and HCJ006D

8.4 Brine characterization and evolution

Analysis of the Salinas Grandes brine was undertaken by plotting the average composition (from historical pit data) on a Janecke projection (Figure 8.7). 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 Salinas Grandes brine is located in the silvite (KCl) field as it has low SO_4/Mg ratios, with minor calcium and alkalinity in some samples.

Natural brine concentration in the salar involves the fluid passing through a number of evolutionary divides (Hardie and Eugster, 1970; Houston, 2011). The first divide in the evolutionary path occurs when calcite saturation is reached, with the precipitation of calcite (Figure 8.8). As carbonate is taken out of solution the brine becomes enriched in calcium. The following divide is the level at which gypsum precipitates, removing Ca from the fluid with sulphate (Figure 8.9). In the event brine reaches high enough concentrations (Figure 8.8) [TDS concentrations of at least 280 g/l – densities of approximately 1.22 g/cc -, Houston et. al., 2011] halite saturation will be reached, resulting in halite precipitation. The data suggests a relatively immature brine that has generally not reached saturation with respect to either gypsum or halite

The Salinas Grandes brine is not saturated with potassium chloride, so when the brine is evaporated first halite (NaCl) will crystallize, followed by silvinite (KCl.NaCl) and carnallite ($\text{KCl} \cdot \text{MgCl}_2 \cdot \text{H}_2\text{O}$) crystallization, which is the raw material for the potential production of

potassium chloride. Further evaporation will lead to bischofite ($\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$) and finally lithium carnalite ($\text{LiCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$) crystallization.

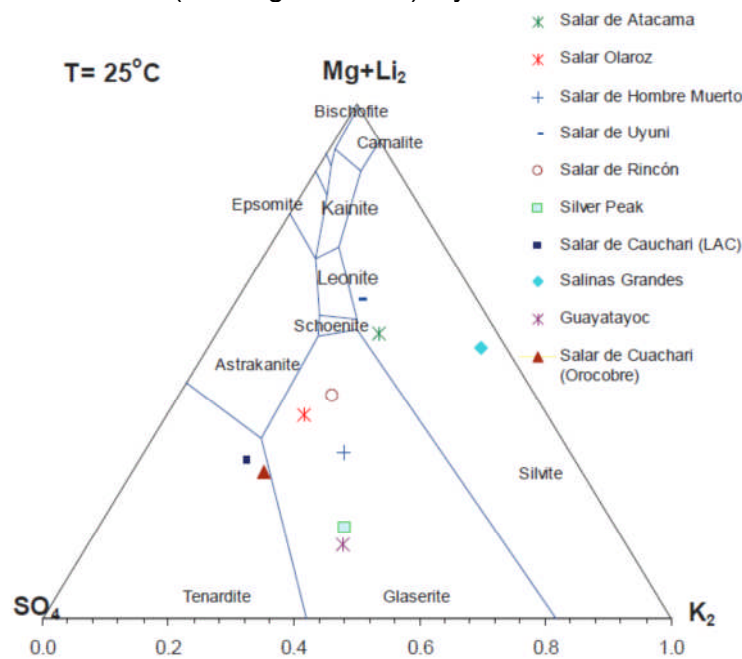


Figure 8.7 The Salinas Grandes average brine concentrations shown on a Janecke phase diagram

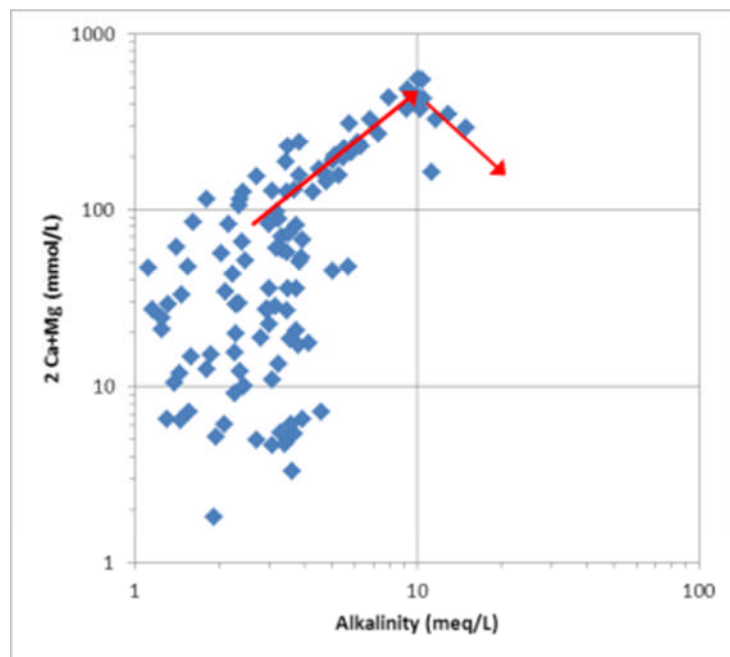


Figure 8.8 Plot of calcium and magnesium to alkalinity

This figure shows the interpreted evolutionary pathway, with calcite precipitation at high concentrations, decreasing the Ca and Mg concentration

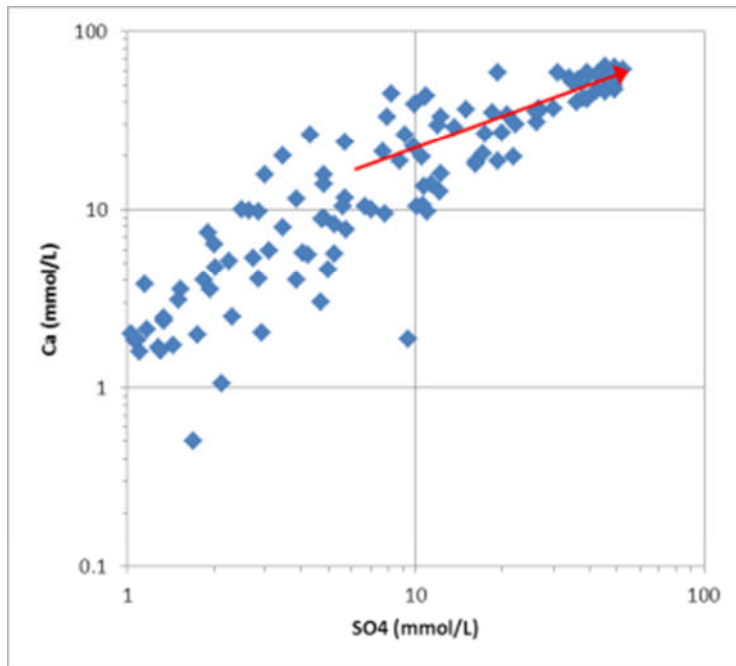


Figure 8.9 Plot of Ca and SO₄

This suggests that sulphate concentrations are too low to precipitate gypsum, although minor gypsum is present within a metre of surface

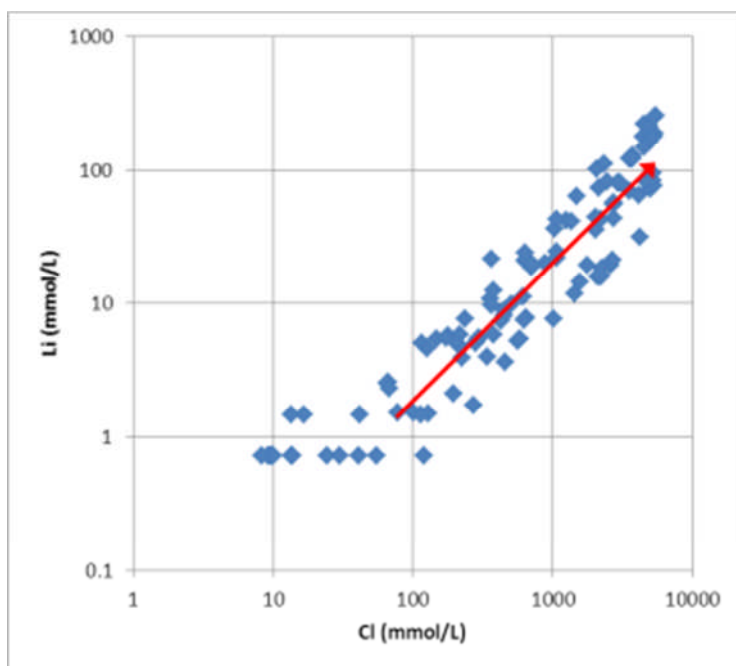


Figure 8.10 Plot of Na and Cl

Although Na and Cl have reached high concentrations halite saturation of the brine has not yet occurred.

The lithium can be concentrated until 6% and then be sent to the lithium carbonate plant, where it can also provide feed stock for potassium chloride production. In other words, the brine is fully adaptable to the process applied by SQM and Chemetall at the Salar de Atacama, with the advantage that it has much lower Li/Mg ratio and very low SO₄/Li ratios, which will result in higher overall recoveries.

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

9 EXPLORATION

Exploration carried out to date consists of the following stages:

- Surface pit sampling and surface geophysics (reported in the April 30 2010 NI43-101 report) – with a geophysical interpretation provided in this chapter,
- A diamond drilling program (see Section 10),
- A shallow auger drilling program (see Section 10) and
- Initial pump testing (see Section 7)

9.1 Geophysical exploration

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

Orocobre Ltd contracted Wellfield Service Ltda to undertake a gravity and audio-magnetotelluric (AMT) survey on one north-south line across Salinas Grande. 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 9.1. All coordinates and elevations are referred to the Gauss Krueger Projection, Zone 3, and the reference system Posgar 94.

9.2 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).

9.2.1 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 Salinas Grande, 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 mGal.

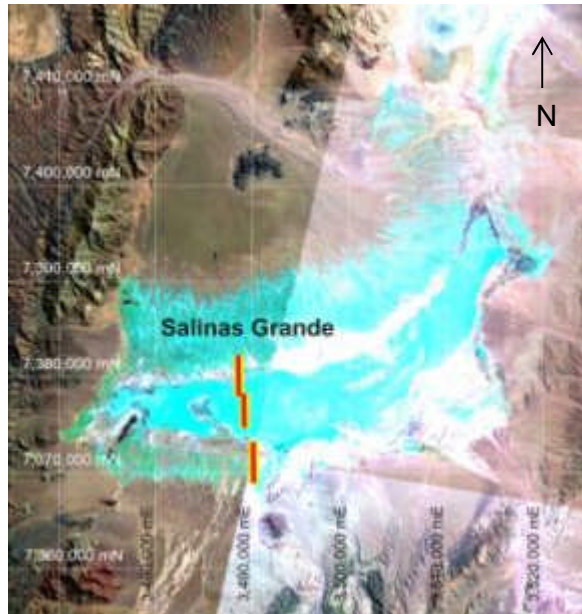


Figure 9.1 Location of the Salinas Grades gravity (yellow) and AMT (red) line

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.

9.2.2 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.

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:

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

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



Figure 9.2 Gravimeter base station

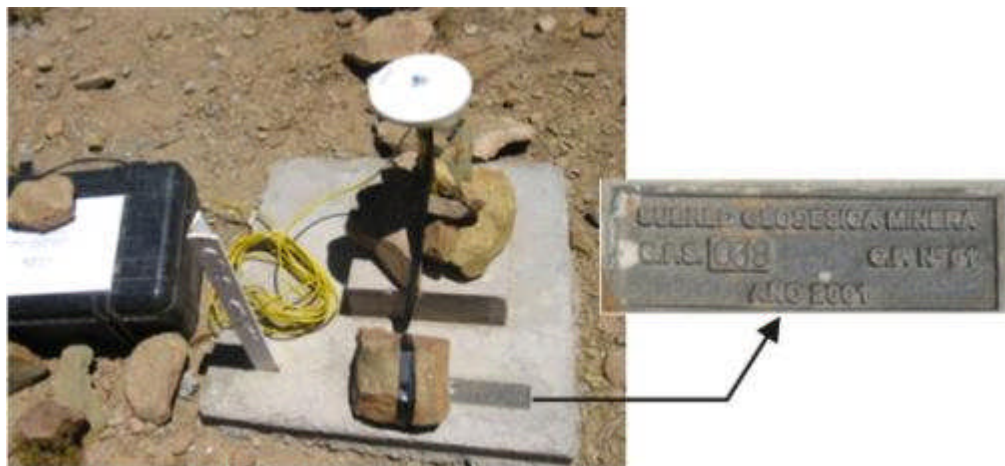


Figure 9.3 GPS base station

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.

9.2.3 Gravity data modeling

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 to three layer models was developed, representing salar and probable Neogene deposits overlying bedrock. Subsequent to the surveying drilling was carried out in late 2010 and April-May 2011. Density measurements were subsequently made on samples of drill core and basement rocks bordering the salar. It is planned to remodel the 2D gravity line across the salar with these measurements (Table 9.1) and data from drilling to improve the gravity model.

Salar Unit	Density used in modelling (g/cc)	Density measured from Salinas samples
Salar deposits	1.6	1.75
Clastic sediments	1.8	1.71
Basement 2	2.6	2.58-2.62
Basement 1	2.7	

Table 9.1 Bulk rock density values used in the gravity interpretation (2D inversions – Figure 9.4) and collected from core and rock samples

The Bouguer anomaly was inverted using Talwari software 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 warrant more complex interpretations. Boundary conditions are not well established at this stage and will require further analysis in due course.

The original interpretation of the gravity data, prior to obtaining density measurements from core samples and from down hole geophysical logs, is shown in Figure 9.4. Drilling in this program has shown the salar is dominated by clastic and fine sedimentary units and does not contain significant thicknesses of halite or evaporites to the depths drilled. Drilling shows the gravity model requires refining, to reflect fine grained salar sediments overlying clastic sediments, rather than partitioning of clastic and salar deposits in different parts of the basin.

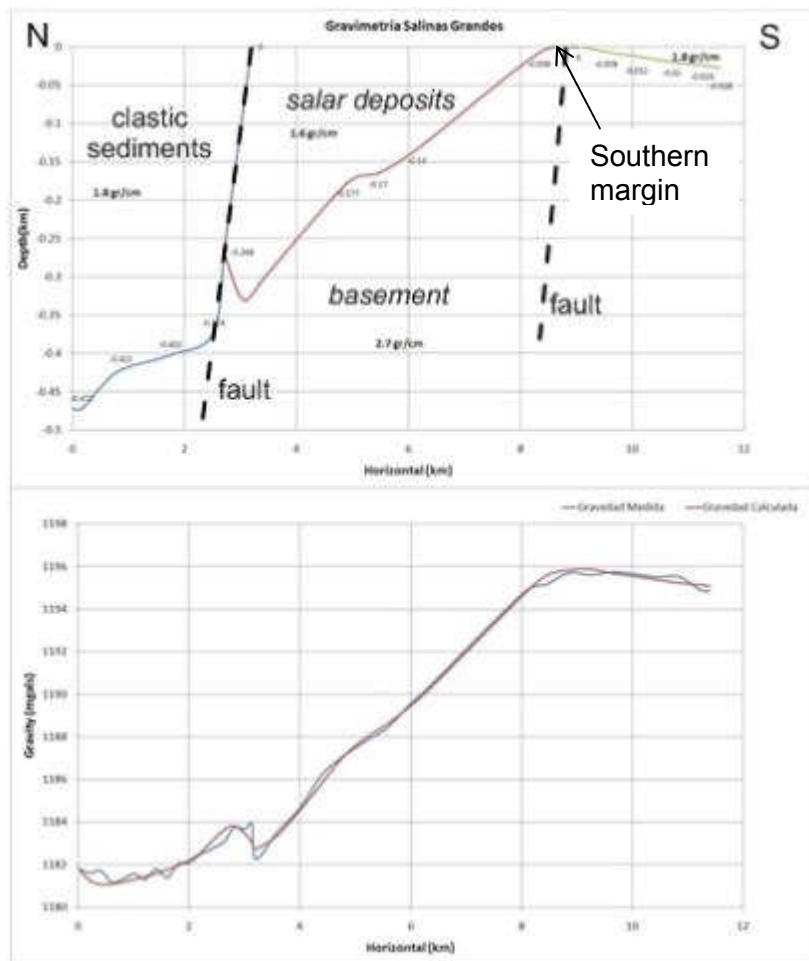


Figure 9.4 The original interpretation of the Salinas Grandes Bouguer anomaly and model fit to data

The original fitted model suggests faulting in the central and southern parts of the basin, with clastic sediments dominating towards the north and salar deposits in the central southern section. Subsequent drilling suggests there may be significant fault movement along the southern margin of the salar and the southern part of the salar (area labeled salar deposits in this original figure) may be considerably thicker than the 180 m maximum depth of drilling. The basin may be over 400 m deep.

9.3 Audio magnetotelluric

9.3.1 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.

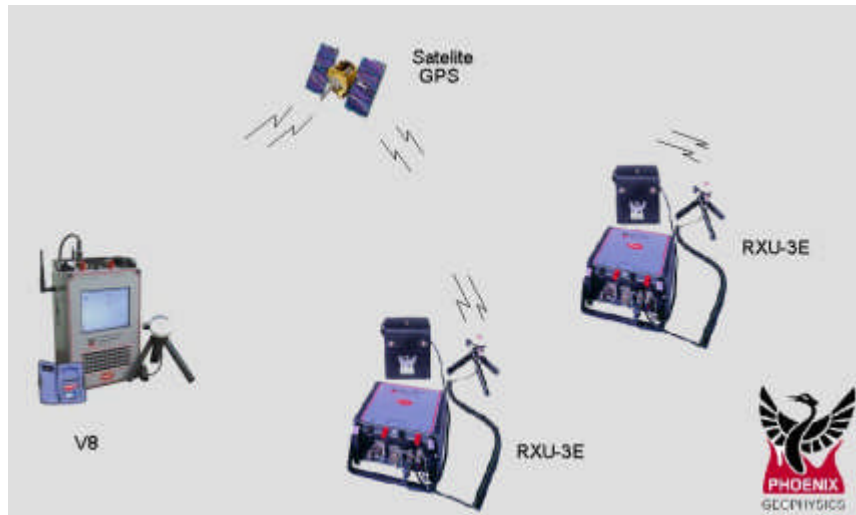


Figure 9.5 Schematic of AMT equipment arrangement

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.

9.3.2 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.

9.3.3 Model output and interpretation

The 2D model results for the section at Salinas Grandes are presented below in Figure 9.6. There appears to be a major change in resistivity on the southern margin of the salar, where a fault (of unknown orientation) is interpreted. This is approximately coincident with a fault interpreted by SEGEMAR along the southern boundary of the salar (Figure 6.6). The presence of a fault along the southern margin of the salar is also suggested by the thickness of units within the salar, with the depocentre of the thickest upper salar unit (Unit C) close to the southern salar margin, with contours suggesting an abrupt southern contact. This

suggests that the southern salar boundary may have a down to the north sense of movement.

The darkest blue zone at the top of the AMT line represents brine and more saline fluid within the salar to depths of approximately 50 m, which correspond to the thickness of Unit C. Brackish water in coarser sand underlies brine within the salar sand, silt and clay sediments. The AMT profile suggests fresher water enters the basin from the alluvial fan immediately north of the salar. Drilling confirms the brackish artesian aquifer (Unit D) shallows to the north, and was probably sourced by sediment from the alluvial fan. Drill hole HCJ007D, to 180 m, intersects sands to gravels hosting fresh to brackish water, confirming coarse sediment (from the northern fan?) underlies the salar basin.

The contribution of brackish water from the San Antonio River, where it infiltrates into sediments south of the salar, is unknown. However, there are areas of surface discharge adjacent to basement rocks on the south side of the salar which are believed to represent discharge from this groundwater source.

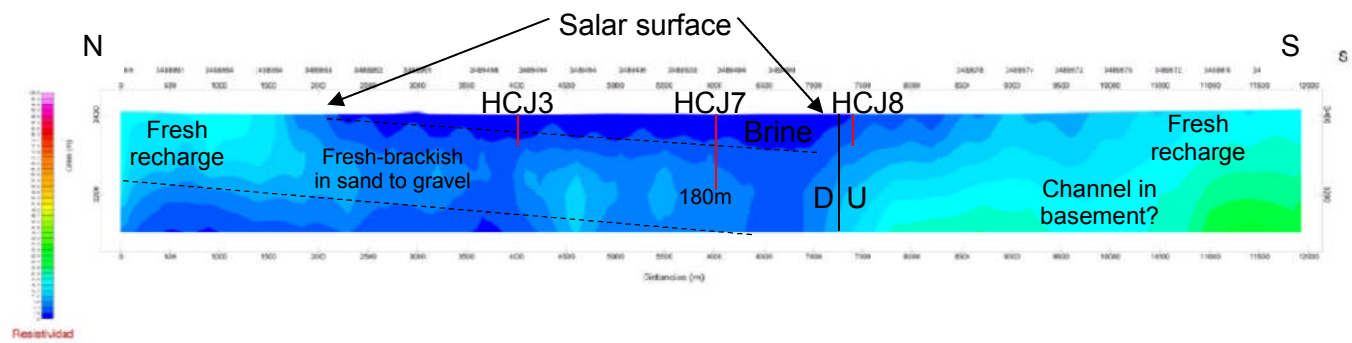


Figure 9.6 Resistivity profile for Salinas Grande (See Figure 6.6 for location), with interpreted geological and hydrogeological features. Hole names have been shortened to fit on the figure. Note the upper dark blue low resistivity zone corresponding to brine

10 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 the company 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 Major Perforaciones S.A. to undertake drilling at the Salinas Grandes project. Major Perforaciones S.A. is the Argentine subsidiary of Major Drilling Group International Inc., one of the largest international drilling companies servicing the mining industry. The company has extensive drilling experience and has been involved in drilling on a number of salars in the Argentine Puna.

For this project Major provided a UDR 200 track mounted drilling rig, to facilitate access within the salar. Drilling was undertaken using both PQ (123 mm external diameter) and HQ (96 mm external diameter) drilling rods. Further details of the drilling project are included in section 18 (drilling).

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 margins of and south of the salar. Excavation of material was approved under the conditions of an environmental approval to the company for drilling on the project. An auger drilling program has been carried out across the salar with holes on a grid with an approximate spacing of 2 km. Holes were typically drilled to 12 m, with one hole drilled to 20 m.

10.1 Drilling density

A total of 12 vertical diamond holes have been drilled in the Salinas Grandes salar, with an average spacing of 3.26 km (excluding holes HCJ009D and HCJ010D). The diamond drilling has been followed up by a program of shallow auger drill holes to depths between 4 and 20 m, but typically reaching 12 m. These holes have been drilled with a 1.65 km spacing, with hole locations planned on a 2 km grid, modified due to tenements not held by Orocobre within the salar.

The area of the salar within the Orocobre tenements used for the inferred resource is 116.2 km² (refer to Section 17). For the resource zone this corresponds to a density of 2 km² per drill hole.

10.2 Diamond drilling and testing program

10.2.1 Core drilling

Orocobre undertook a diamond drilling program with Major Drilling using a track mounted UDR200 drill rig between October 2010 and January 2010, before the program was terminated due to rain. This program recommenced in April 2011 with completion of the diamond drilling in May 2011. The 12 vertical HQ and PQ diamond core holes were drilled for a total of 965.7 m, comprising 638.34 m PQ, 201 m HQ and 126.36 m drilled with a tricone bit (no core recovered). Drill hole collar locations were determined by handheld GPS measurements. Drill hole locations have subsequently been surveyed with a differential

GPS, showing collar coincide almost exactly with the elevations 3400 m. Drill hole locations are shown in Figure 10.1.

Diamond drill holes were drilled to an average depth of 71.4 m (Table 10.1). Only 2 holes in this program (HCJ007D and HCJ009D) were drilled to depths below 100 m. A summary of the drilling details are provided in Table 10.1 below.

Diamond drilling was carried out with Lexan 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 brine with additives to aid drilling in the unconsolidated sediments. Where possible the brine was sourced from a pit approximately 2 m deep at each drill site. However, in some cases pit inflows were not sufficient to provide brine for casing installation and brine was sourced from a pit within several kilometers.

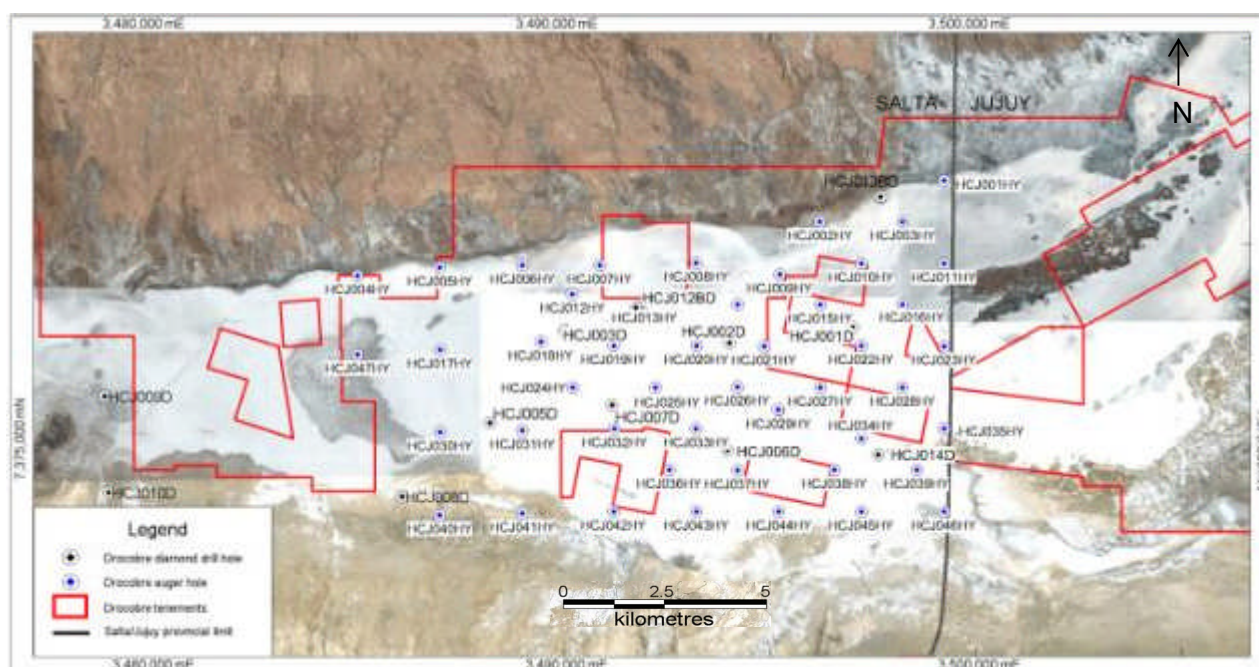


Figure 10.1 Hole locations. Diamond holes in black, auger holes in blue

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 core samples were centrifuged by the British Geological Survey. Brine extracted from pore spaces was analysed by the British Geological Survey and compared with the bailed samples (see Section 11).

10.2.2 Interpretation of drilling results – Geological logging

Core recoveries were variable during drilling, with an average core recovery of 66.6%. The relatively low core recovery is attributed to the poorly consolidated nature of the salar units and loss of sand and other weak/poorly consolidated layers during drilling. Clay and silt units generally displayed a high core recovery, while the sand layers proved more difficult to recover, with sand jamming the inner core tube within the core barrel, requiring the rods to

be retrieved from the hole to clean the core barrel. Orocobre designed a number of innovative core catchers with flaps and wire in order to retain sand in the Lexan tubes. These design changes contributed to an overall increase in core recovery.

On site Orocobre 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, minor halite (restricted to the upper 0.5 m of the salar) and ulexite (borate), with significant intervals recorded as no recovery/lost core.

Hole_ID	Drilled	Core loss (m)	% Recovery
HCJ001D	63	31.61	49.83%
HCJ002D	63.7	2.5	96.08%
HCJ003D	73	28.88	60.44%
HCJ005D	65	23.5	63.85%
HCJ006D	76.5	14.44	81.12%
HCJ007D*	71.14	22.55	68.30%
HCJ008D	61.5	11.5	81.30%
HCJ009D ⁺	110	65.81	40.17%
HCJ010D	69	25.05	63.70%
HCJ012DB	60.5	19.93	67.06%
HCJ013DB	69.5	34.55	50.29%
HCJ014D	74	16.95	77.09%
Total	856.84	297.27	
Average	71.40	24.7725	66.60%

Table 10.1 Diamond drilling hole depths and recoveries
Note these holes include intervals drilled by tricone

10.2.3 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 six of the twelve Salinas Grandes drill holes. Logging of the other holes was prevented by the unavailability of the geophysical contractor.

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. However, 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 and units such as volcanic tuffs, of which three intervals (labeled T1, T2 and T3) have been identified in the Salinas Grandes geophysical logs. Volcanic tuffs provide very important stratigraphic markers that assist correlating between drill holes in the salar.

Neutron logs are tools which measure hydrogen ions in the formation at different distances from the logging tool, of which two are used with different spacings. 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.

10.2.4 Well head installation

Monitoring wells were not installed within the holes drilled, as holes intersected brackish water with semi-artesian to artesian pressures in the deeper units D to F during drilling. Wells were capped at surface and pressure gauges were installed on a number of wells across the salar. The well pressures are monitored and have been essentially constant since holes were capped.

10.3 Auger hole drilling and testing

10.3.1 Auger drilling

Auger drill holes were carried out by Orocobre using a solid stem auger rig capable of reaching maximum depths of 16 and 20 m, depending on the lithologies encountered. In areas of soft terrain where access for the auger rig was not possible hand augers were used to obtain samples at depths of up to 5.6 m. Lithological samples were recovered from the augers, geologically logged by the geologist on site and stored in plastic chip trays for reference. Slotted 110 mm casing was installed in the drill holes to the base of the hole, or the maximum depth allowable, (in the event of hole collapse) following completion of drilling.

Brine samples were obtained by bailing from the open hole at intervals of 4, 8, 12 and for the few deeper holes 16 and 20 m. In a number of holes drilled to only 4 m by hand or with the auger rig (with collapsing sand preventing deeper drilling) the first sample was taken at 2 m below surface.

The brine samples represent composite samples, with the sample at 4 m representing inflows from surface to 4 m, and those at subsequent depths from surface to the maximum hole depth at that point. The composite brine sample is influenced by the most permeable units encountered in the hole as these contribute brine more rapidly than low permeable units. A summary of auger drill hole data is provided in the following section (Table 10.2).

10.3.2 Pump testing of auger holes

The auger holes were converted to monitoring wells by the installation of 110 mm diameter slotted pipe, with hand slotted pipe installed in some wells during the campaign when machine slotted pipe was not available. Gravel pack was not originally installed, due to a lack of space between the hole diameter and well screen. Gravel pack was retrospectively

fitted in holes selected for pump testing during airlifting of those holes, which cleaned the annulus of the hole and allowed the installation of clean fine gravel from surface.

Pump testing was carried out on the wells using a variety of pumps, to achieve the maximum possible pumping rate. A small electrical surface pump, connected to a PVC riser set at a depth of 6 m in some holes achieved flows of around 1 l/s. Sustained flow rates of up to 1.6 l/s were achieved with submersible pumps at depths of 8 m. Flows were measured by timing flows to fill buckets and tanks of known volumes. Water from the tests was discharged several hundred metres from each test hole, to minimize the possibility of recycling water to the pump test. Water levels in monitoring wells were monitored with dippers and with Solinst loggers. Tests were analysed with standard methods, such as outlined in Fetter (1994) and Kruseman and de Ridder (1990).

10.3.3 Pump testing of test production well

In addition to testing nine of the monitoring wells installed in auger holes a test production well was installed by the drilling company Valle. This well is located at the site of auger hole HCJ029HY and was installed to a depth of 35 m. A step test with 4 steps was completed on the well. Following recovery in water levels an 18 hour constant rate test was conducted, but terminated prematurely for logistical reasons. Water levels were monitored in an array of 5 monitoring wells around the pump bore.

Hole ID	From	To	Intersection (m)	K mg/l	Li mg/l	Mg mg/l	Mg/Li
HCJ001HY	0	12	12	6,336	548	1,223	2.2
HCJ002HY	0	4	4	10,887	1098	2,698	2.5
HCJ003HY	0	12	12	8,958	684	1,700	2.5
HCJ004HY	0	4	4	10,284	962	2,319	2.4
HCJ005HY	0	4	4	13,872	1107	2,620	2.4
HCJ006HY	0	4	4	18,553	1601	4,889	3.1
HCJ007HY	0	8	8	4,289	257	494	1.9
HCJ008HY	0	8	8	7,910	558	1,249	2.2
HCJ009HY	0	12	12	12,647	1049	2,632	2.5
HCJ010HY	0	16	16	2,888	181	338	1.9
HCJ011HY	0	12	12	7,894	599	1,648	2.8
HCJ012HY	0	12	12	13,831	1117	3,008	2.7
HCJ013HY	0	16	16	8,342	752	2,103	2.8
HCJ014HY	0	12	12	7,946	733	2,119	2.9
HCJ015HY	0	12	12	9,398	714	1,790	2.5
HCJ016HY	0	20	20	9,251	744	2,104	2.8
HCJ017HY	0	4	4	17,959	1546	4,691	3.0
HCJ018HY	0	4	4	9,378	775	2,042	2.6
HCJ019HY	0	8	8	9,711	747	2,079	2.8
HCJ020HY	0	12	12	9,994	822	2,168	2.6
HCJ021HY	0	13	12.5	10,827	868	2,587	3.0
HCJ022HY	0	12	12	7,187	539	1,498	2.8
HCJ023HY	0	13	12.5	10,072	809	2,409	3.0
HCJ024HY	0	12	12	9,502	784	1,763	2.2
HCJ025HY	0	12	12	14,735	1356	3,714	2.7
HCJ026HY	0	16	16	9,804	816	2,148	2.6
HCJ027HY	0	12	12	8,852	705	1,744	2.5
HCJ028HY	0	12	12	10,434	878	2,396	2.7
HCJ029HY	0	12	12	8,472	702	1,775	2.5
HCJ030HY	0	4	4	18,459	1608	5,034	3.1
HCJ031HY	0	12	12	15,906	1243	3,625	2.9
HCJ032HY	0	12	12	13,049	1136	3,123	2.7
HCJ033HY	0	12	12	10,990	969	2,590	2.7
HCJ034HY	0	8	8	10,133	858	2,292	2.7
HCJ035HY	0	12	12	6,702	343	496	1.4
HCJ036HY	0	12	12	11,638	1043	2,631	2.5
HCJ037HY	0	12	12	9,450	759	1,744	2.3
HCJ038HY	0	12	12	12,846	1089	3,313	3.0
HCJ039HY	0	12	12	13,282	1079	3,259	3.0
HCJ040HY	0	2	2	131	10	38	3.7
HCJ041HY	0	4	4	333	15	80	5.4
HCJ042HY	0	4	4	12,664	1035	2,961	2.9
HCJ043HY	0	13	12.5	11,896	992	3,223	3.2
HCJ044HY	0	4	4	13,070	1267	3,605	2.8
HCJ045HY	0	4	4	6,024	417	806	1.9
HCJ046HY	0	4	4	6,862	467	934	2.0
HCJ047HY	0	2	2	4,103	478	916	1.9
Average shallow body			9.6	9,950	825	2,226	2.7

Table 10.2 Auger composite brine sample results

11 SAMPLING METHOD AND APPROACH

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 author has, where possible, applied the sampling methodologies developed and tested on the Olaroz project.

11.1 Porosity sample program design and sampling

Lithological samples were recovered by drilling PQ or HQ 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 British Geological Survey and an adjacent 10 cm section of core for testing of total porosity in the Salta office of Orocobre.

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 119 samples were analysed by the British Geological Survey for total porosity and specific yield from 10 core holes drilled in 2010 and 2011.
- A total of 98 samples from 6 core drilled in 2011 were analysed for total porosity in the Orocobre Salta office.
- The samples analysed by the BGS had an average spacing of 4.7 m.
- The samples analysed in the Salta laboratory had an average spacing of 3.7 m.

11.2 Fluid sampling program design and methodology

Fluid (brine or brackish water) sampling was undertaken in three different ways during the program, to compare the sampling methods and results as follows:

11.2.1 Diamond hole bailer sampling

During diamond drilling sampling was undertaken with a steel bailer in the diamond drill holes. Samples were taken every 6 metres, at multiples of 6 metres during drilling from October-December 2010 and in 3 m multiples in drilling during April and May 2011. The frequency of sampling was increased to every three metres in the latter part of the program, to obtain additional information on variations in brine concentration.

There is artesian (upward water pressure) associated with many of the deeper aquifer layers and the sample is not considered a point sample, representing a broader interval (3 or 6 m extending upwards from the sample depth assigned at the base of the hole).

Once the rods were drilled the 3 or 6 metres to take a sample, the casing was reamed into position 3 or 6 meters above the base of the hole. The drill rods were then pulled back 1.5 metres, so that the bailer reached the back of the drill bit and did not stir up sediment from the bottom 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.

11.2.2 Auger hole bailer sampling

Fluid samples were collected from auger holes by drilling to the base of each respective sample interval (4, 8, 12, 16 or 20 m) and bailing the hole dry, prior to bailing the sample from the hole with a single valve stainless steel bailer.

11.2.3 Diamond core brine extraction

The second sampling methodology with the diamond drilling involved the use of a centrifuge by the British Geological Survey 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 12. Samples were collected at the base of intervals that correspond to bailed brine samples, in order to evaluate the correlation between samples.

11.2.4 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. However, as drilling intersected units with semi-artesian to artesian water flows towards the base of drilling the installation of monitoring wells was not possible.

11.3 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. Where it was 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 and any airspace was removed. 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 when completed with sample information were stuck to the bottle with transparent tape.

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 was 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 Salta office, from which they were sent by Courier to the Alex Stewart (Assayers) Argentina S.A. (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 the laboratory.

At total of 109 primary fluid samples from diamond drilling bailer sampling and a further 120 primary fluid samples from auger drilling were submitted to ASA in Mendoza. In addition 75 standards and 28 duplicates were sent with the diamond hole and auger hole bailed samples.

11.4 Drill hole brine sampling supervision

Sample collection at Salinas Grandes was conducted by Orocobre geologists, who also conducted the on-site geological logging of the drill cores. Brine samples were collected from the sample bailer and pump 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.

11.5 Sample security

The 150 ml samples were transported by company vehicle to the company office in Salta. From Salta the samples were sent by courier to the ASA 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.

12 SAMPLE PREPARATION, ANALYSES AND SECURITY

12.1 Porosity samples

12.1.1 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 Salta porosity laboratory. An additional 20 cm long lexan tube was taken immediately above the 10 cm tube every 6 m during drilling in 2010 and every 3 m during drilling in 2011. These sections of lexan core were cut immediately following recovery of the core from the core barrel. The cores were fitted with tightly fitting caps, sealed with tape and labeled.

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 Salta office.

Samples were sent from the Salta office to the 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.

12.1.2 Total porosity analysis in Salta

Lexan Cores were received in the 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°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°C can convert gypsum to anhydrite, with a corresponding loss of water which would incorrectly influence the calculation of total porosity (although there appears to be limited amounts of gypsum in cores). 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 precipitation corrected 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 Salinas Grandes. Uncorrected results are presented in Figure 12.1.

Analysis of samples from cores collected in late 2010 was delayed by several months, with likely associated drying of cores. Subsequent evaluation of the data from cores HCJ001D, 6D, 8D, 9D and 10D suggested that results were of poor quality and these were discarded from subsequent analysis.

12.1.3 Core sample analysis at the BGS laboratory – Wallingford UK

Core recovery and core quality from the salar sediments even after traveling considerable distances were generally good considering the variable nature of the sediments which often means core loss or disruption can be significant. Since most lithologies in the salar deposits are poorly cemented and excessive core handling will modify the physical structure of the core and effect porosity and drainage measurements, it was important to keep core handling to a minimum.

Once the cores were received at 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 and (as an option) 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 on 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 characterise variations in lithology and, where possible, to identify any lithological boundaries within the core. This task was simplified for samples tested for specific yield when coding followed the basis of 1. halite, 2. sand, 3. silt and mixed lithologies and 4. clay.

Moisture Content (drying) determination

One set of sample plugs was tested to duplicate moisture content drying as undertaken on-site in Argentina, using conventional ovens at 60°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 Salinas Grandes), 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 evacuated 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 (S_1) and saturated weight immersed in saturant (S_2). 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:

$$\begin{aligned}\rho_b &= (w\rho_f)/(S_1-S_2) \\ \rho_g &= (w\rho_f)/(w-S_2) \\ \phi &= (S_1-w)/(S_1-S_2)\end{aligned}$$

Samples did not contain significant halite (NaCl), although examination of the matrix has not been conducted as yet. For samples with halite content 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. Porosity results are presented in Figure 12.1.

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 (w_1). 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 (w_2).

A centrifuge speed is selected to produce a suction on the samples equivalent to 3430 mm H₂O. 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 12.2.

Specific yield is then calculated as follows

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

Where A is sample area and L is sample length.

12.1.4 Porosity QA/QC procedures

Values of total porosity from samples analysed by the BGS and those analysed in the Salta laboratory were plotted to assess differences between the two laboratories, excluding samples from the holes drilled in 2010, for which Salta laboratory analyses were considered unreliable.

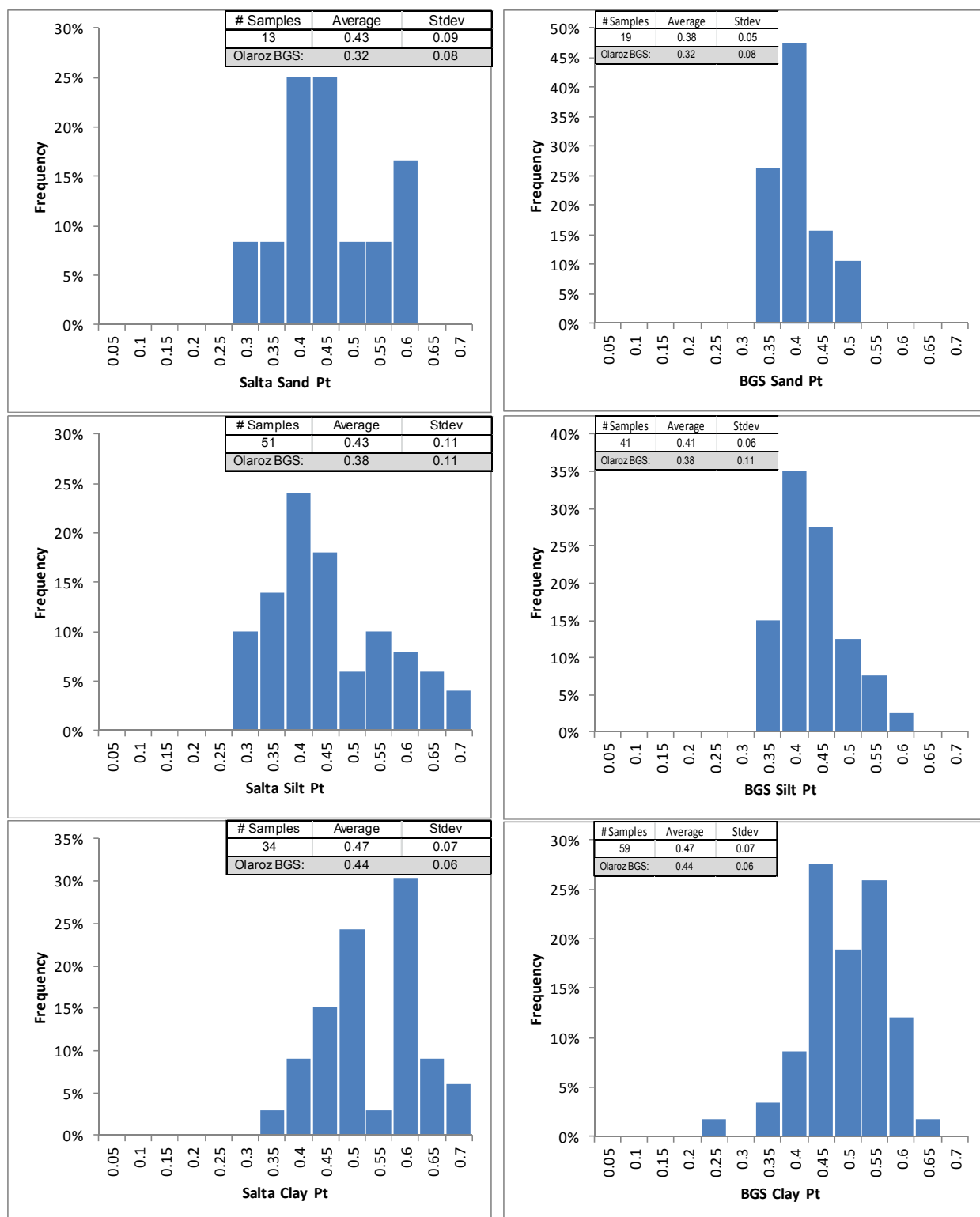


Figure 12.1 Salinas Grandes total porosity measurements (Pt) Salta laboratory and the BGS laboratory on adjacent samples. Note that although samples were taken from adjacent intervals in holes, the Salta data omits holes drilled in 2010.

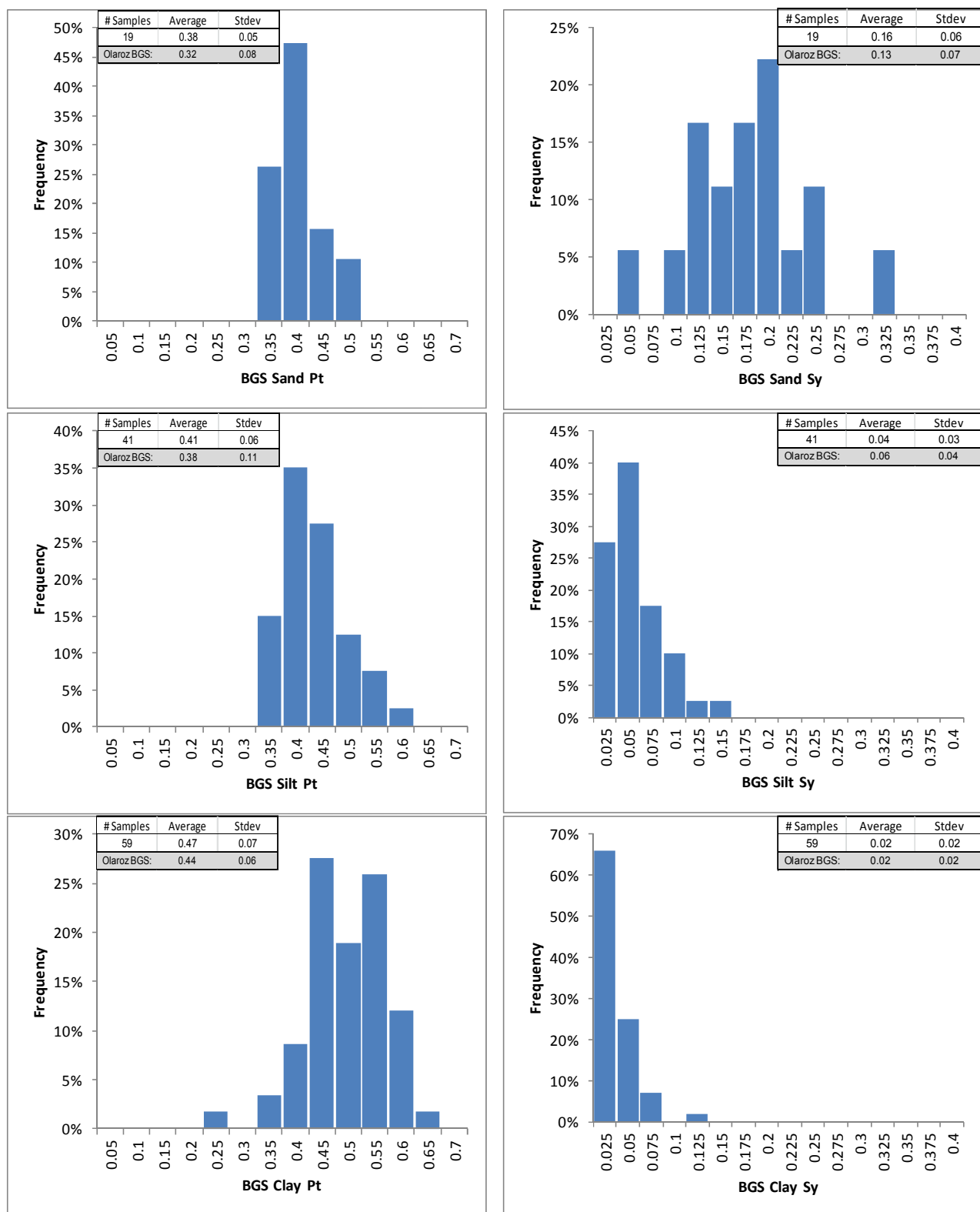


Figure 12.2 Salinas Grandes BGS total porosity measurements and specific yield measurements
BGS total porosity measurements (left) and specific yield measurements (right) for the same collection of samples

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 analytical errors. However, it is noticeable that there is a semi-systematic difference in the values between the laboratories (Figure 12.3), with the values from the Salta laboratory systematically lower than those from the BGS laboratory. This suggests the samples experienced some drying before measurement or did not dry completely prior to porosity calculation. The BGS total porosity data corresponds with ranges published in industry texts (Figure 12.4) such as Fetter (1994) and is considered the more reliable data set, which has been applied to the resource estimate.

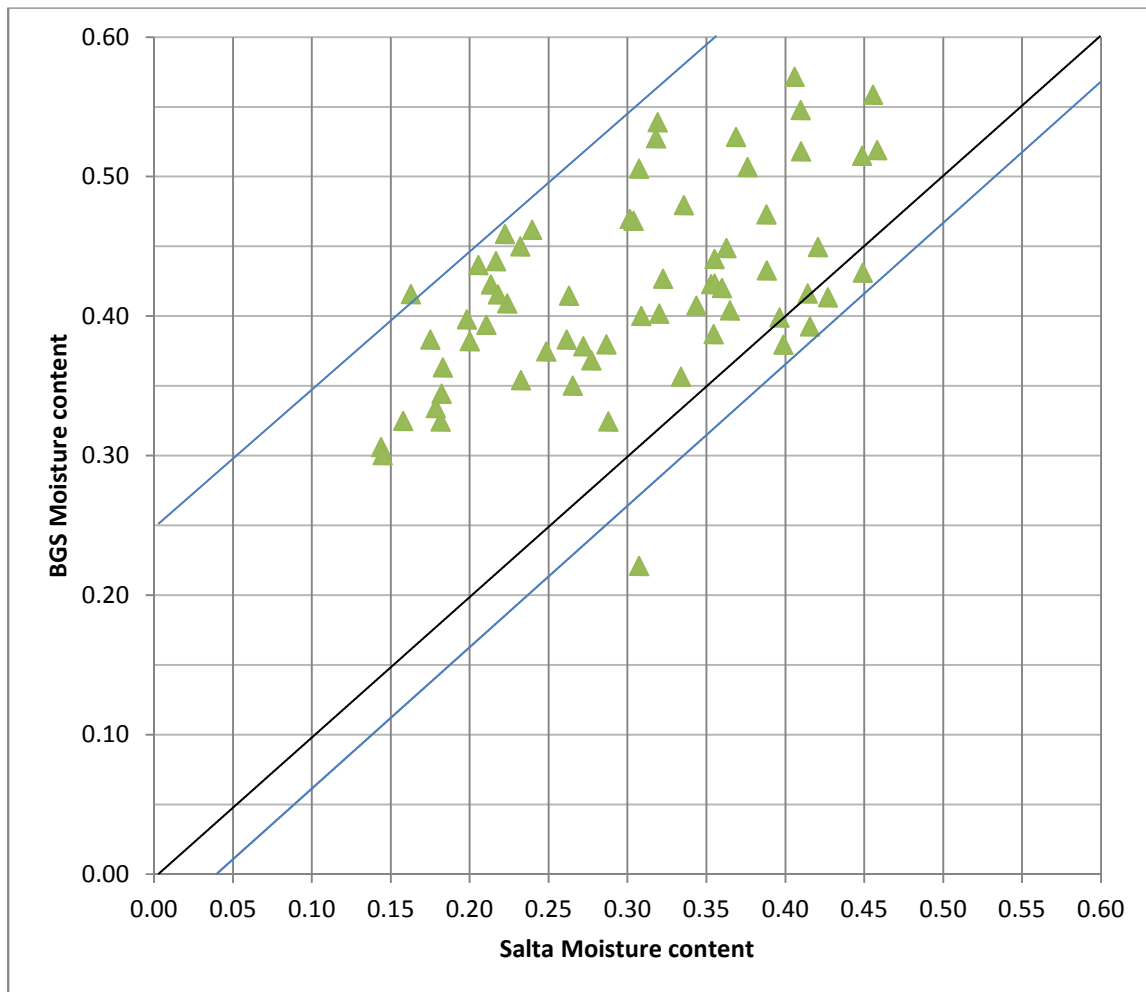


Figure 12.3 Comparison of BGS and Salta laboratory values for total porosity

Repeatability of laboratory measurements at the BGS was assessed by conducting two tests on samples of coarse sand, shown in Table 12.1. These show RPD's of up to 18% in total porosity and 13.1% in specific yield between the samples.

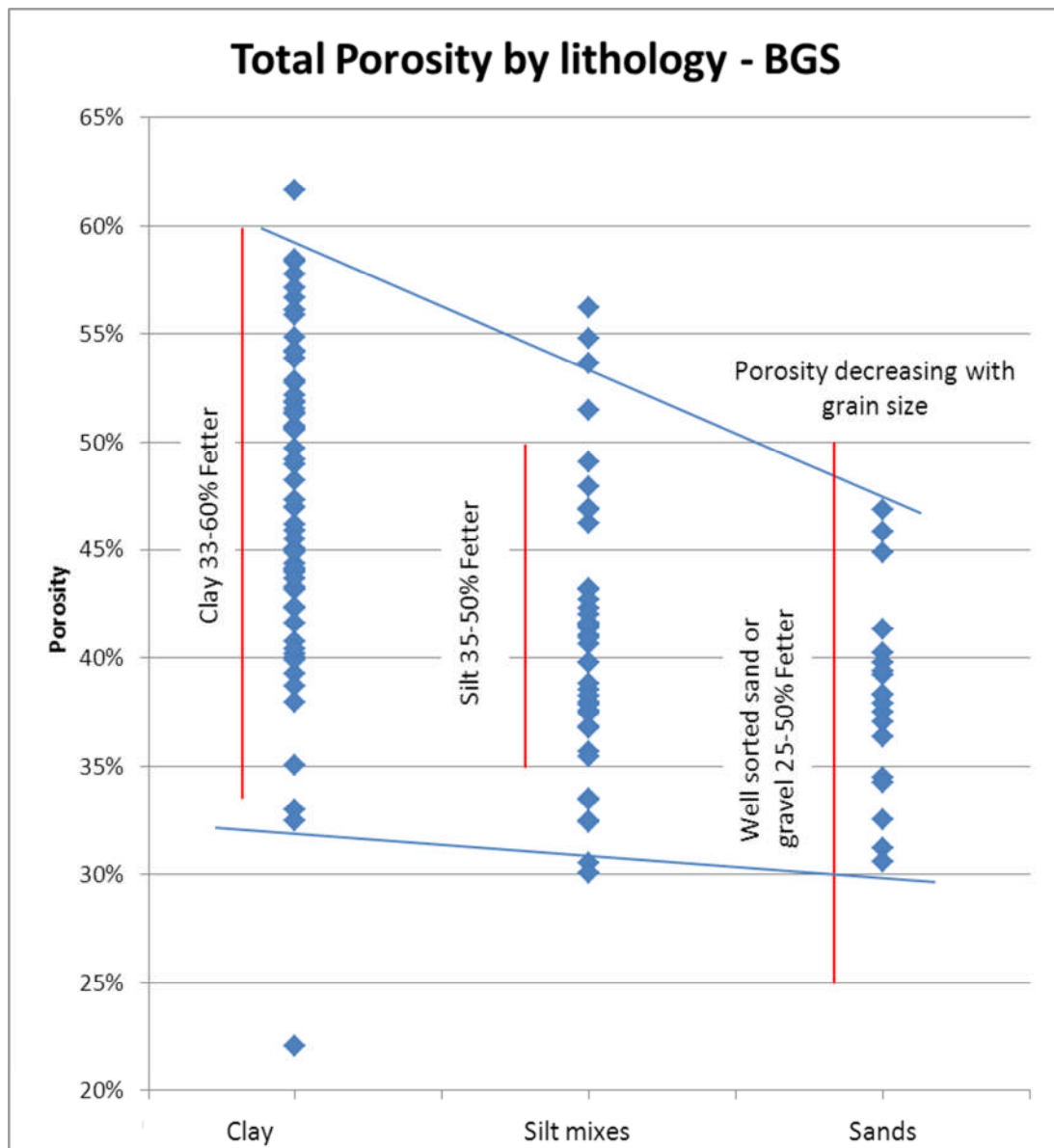


Figure 12.4 BGS total porosity data by lithology type, compared with literature values
 Note that the silt mixes can contain both clay and sand, hence the broad range of this lithology type.
 Reference values used are from Fetter (1994)

Sample	Sample Depth	Liq Resat Porosity (Pt %)	Sy %	Sy plug description
3D-48.9 A	48.9	47%	20%	Brown-dark grey coarse sand
3D-48.9 B	48.9	39%	18%	Brown-dark grey coarse sand
RPD%		17.7%	11.5%	
Std Dev		5%	2%	
7D-63.9A	63.9	39%	20%	Brown-dark grey coarse sand
7D-63.9B	63.9	41%	17%	Brown-dark grey coarse sand
RPD%		4.7%	13.1%	
Std Dev		1%	2%	

Table 12.1 BGS repeat sampling of coarse sand units

12.1.5 Porosity data by lithology

The relationship of total porosity and specific yield values have been evaluated by comparing values within the simplified classifications of clay, silt mixes and sands (no halite material was tested, as this is restricted to the upper 50 cm or less of the salar, and is not volumetrically significant).

Histograms were plotted to evaluate the statistical distribution of porosity values. A summary of the data is provided in Table 12.2. The scatter graph (Figure 12.4) shows the distribution of total porosity values by lithology, compared to data from Fetter, a standard industry text.

# Samples	Lithology	Average Liquid Resaturation Porosity %	Std Dev %	Average Sy %	Std Dev %	Olaroz Average Pt (BGS) %	Olaroz Std Dev %	Olaroz Average Sy %	Olaroz Std Dev %
59	Clay dominant	47%	7	2%	2	44%	6	2%	2
41	Silt and mixes	41%	6	4%	3	38%	11	6%	4
19	Sand dominant	38%	5	16%	6	32%	8	13%	7

Table 12.2 Average BGS porosity (by liquid resaturation) and specific yield (by centrifuge), classified by lithological type (Olaroz results from Houston, 2010a)

12.1.6 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 this data has been applied to the resource estimation.

12.2 Fluid chemistry sample analyses - Diamond and auger drilling bailed samples

12.2.1 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.

12.2.2 Sample analysis – Alex Stewart Assayers (Argentina) S.A.

The drilling and pump test samples from the Salinas Grandes salar were analyzed by Alex Stewart Assayers (ASA) of Mendoza, Argentina. This ASA laboratory has extensive experience analyzing lithium bearing brines. The ASA 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 the ASA laboratory using the Inducted Coupled Plasma spectrometry (ICP) method. Certificates of analysis and excel data sheets were received by Orocobre 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 12.3 lists the suite of analyses requested from ASA. 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.

12.2.3 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 = $\text{ABS (value 1-value 2) / AVERAGE (value 1, value 2)}$

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.

12.2.4 Alex Stewart Assayers standard analyses

A number of laboratory standards prepared by ASA were used as part of the QA/QC program on the Salinas Grandes project. Results are presented in Table 12.4. Additionally two field “standards” (not prepared in the laboratory) were used during the program. These consisted of:

- Brine collected from Olaroz Pit 7, a brine pool of known concentration at the Olaroz salar, used at the beginning of the program as a non-laboratory standard.
- Brine from Salinas Grandes pit 1314, used as a non-laboratory brine standard, replacing that of Pit 7. A bulk sample of pit 1314 brine was collected for use as this non-laboratory standard throughout the drilling program. The standard sample results are shown in Table 12.5 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	°C
Total solids	SM-2540-B-Gravimetry Drying at 180 °C	10 mg/l
Anions		
Chloride (Cl)	SM-4500-Cl-B Determination by argentimetry	5 mg/l
Sulfates (SO ₄)	SM-4500.SO ₄ --C Gravimetric determination	10 mg/l
Alkalinity	SM-2320-B: Total Alkalinity	10 mg/l
Nitrates (NO ₃)	SM-4500-NO ₃ ⁻ : 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 12.3 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 Salinas Grandes involved submitting 73 laboratory and non-laboratory prepared standards as part of the 425 samples submitted for analysis (17%) in the drilling and pump testing program. Statistics regarding analysis of standards are presented in Table 12.4, with data plots presented in Figures 12.5-12.7. This included:

Samples of laboratory prepared standards submitted for analysis included:

- 2 samples of the standard 1A,
- 4 samples of the standard 2A,
- 4 samples of the standard 3A
- 18 samples of the Salinas Grandes 1SG standard
- 24 samples of the Salinas Grandes 2SG standard

Samples of non-laboratory prepared standards submitted for analysis included:

- 4 non-laboratory standard Olaroz Pit 7 (previously used during the Salinas Grandes pit sampling and at Olaroz) and
- 17 non-laboratory standard Salinas Pit 1314

Values for most elements exceed 10% in one or more standards. It is important to note that these RPD values are prepared using the minimum and maximum values returned for any standard, so one analysis can result in a large RPD value for an analyte. Scatter plots of analytes is presented in Figures 12.5 and 12.6, showing the variation in the standard analytes. It is noted that:

- Boron RPD values are particularly high, due to the low B concentrations in the standards used, with RPD values decreasing for standards 1SG and 2SG, Pit 7 and Pit1314, where B values are higher.
- Potassium RPD values are ~19% for standards with the higher sample populations and higher at 24% for the non-laboratory standard Pit1314.
- Lithium RPD values average 14.1% for the larger sample populations of standards 1SG, 2SG and Pit1314, with lower RPD values for the other standards.
- Magnesium RPD values reach 14.2% for the standard 1SG and 18.4 for Pit1314, with the exception of one value causing an elevated RPD for the standard 2A.
- Sodium RPD values reach 17.8% for standard 2SG and 21% for Pit1314.
- Sulphate RPD values are high for standard 2SG, averaging 17% and 51% for Pit1314.
- Chloride RPD values reach a maximum of 30.3% in standard 1SG. This elevated value is related to the first 1SG standard submitted to the laboratory, which if removed from the analysis decreases the chloride RPD value to 7.2%.

Standard	B_mg/l	Ca_mg/l	K_mg/l	Li_mg/l	Mg_mg/l	Na_mg/l	Sulfates_mg/l	Chlorides_mg/l
Standard 1A	50	80	600	60	180	16000	18000	13000
# Samples	2	2	2	2	2	2	2	2
Average	56	81	631	59	171	16,848	18,814	13,037
Std Dev	0.1	0.2	25.6	2.2	3.7	389.0	227.0	361.5
RPD%	0.3%	0.4%	5.7%	5.2%	3.1%	3.3%	1.7%	3.9%
Standard	B_mg/l	Ca_mg/l	K_mg/l	Li_mg/l	Mg_mg/l	Na_mg/l	Sulfates_mg/l	Chlorides_mg/l
Standard 2A	40	100	600	60	10	11,000	5,000	14,000
# Samples	4	4	4	4	4	4	4	4
Average	30	76	640	60	37	11,157	5,612	13,810
Std Dev	15.3	29.3	11.6	2.0	55.6	447.7	357.7	321.5
RPD%	102.6%	79.1%	3.7%	6.5%	312.1%	9.2%	14.1%	5.6%
Standard	B_mg/l	Ca_mg/l	K_mg/l	Li_mg/l	Mg_mg/l	Na_mg/l	Sulfates_mg/l	Chlorides_mg/l
Standard 3A	50.00	50.00	400.00	120.00	10.00	5000.00	2000.00	6500.00
# Samples	4	4	4	4	4	4	4	4
Average	58	45	419	127	11	5,363	2,379	6,717
Std Dev	1.0	1.2	15.3	5.9	0.1	138.9	116.7	250.7
RPD%	3.5%	5.1%	8.2%	10.1%	11.1%	4.6%	9.3%	7.0%
Standard	B_mg/l	Ca_mg/l	K_mg/l	Li_mg/l	Mg_mg/l	Na_mg/l	Sulfates_mg/l	Chlorides_mg/l
Standard 1SG	20	1,000	9,000	1,000	1,735	80,000	1,000	143,556
# Samples	18	18	18	18	18	18	18	18
Average	20	1,164	8,952	953	1,779	88,542	21,259	132,843
Std Dev	3.4	129.2	501.0	37.9	75.4	3437.2	643.2	8663.7
RPD%	76.9%	39.2%	19.2%	14.1%	14.2%	13.6%	10.7%	30.3%
Standard	B_mg/l	Ca_mg/l	K_mg/l	Li_mg/l	Mg_mg/l	Na_mg/l	Sulfates_mg/l	Chlorides_mg/l
Standard 2SG	80	200	6000	600	1301	90000		149869.1881
# Samples	24	24	24	24	24	24	24	24
Average	74	349	5,945	568	1,243	113,558	61,271	140,532
Std Dev	5.1	47.7	278.1	23.7	39.6	6075.4	1715.9	3615.7
RPD%	23.5%	51.6%	19.0%	14.0%	12.5%	17.8%	17.0%	6.8%

Table 12.4 Evaluation of standard samples used on the Salinas Grandes project

Standard	B_mg/l	Ca_mg/l	K_mg/l	Li_mg/l	Mg_mg/l	Na_mg/l	Sulfates_mg/l	Chlorides_mg/l
PIT7								
# Samples	4	4	4	4	4	4	4	4
Average	831	591	9,015	909	2,491	118,980	11,816	181,349
Std Dev	19.8	9.5	199.2	28.2	141.5	2952.9	419.0	3464.7
RPD%	4.6%	3.2%	5.1%	6.6%	13.8%	4.6%	6.3%	3.7%
Standard	B_mg/l	Ca_mg/l	K_mg/l	Li_mg/l	Mg_mg/l	Na_mg/l	Sulfates_mg/l	Chlorides_mg/l
PIT1314								
# Samples	17	17	17	17	17	17	17	17
Average	400	2,286	18,109	1,521	4,463	88,874	4,085	179,492
Std Dev	15.9	87.4	1095.2	68.3	227.8	5564.2	610.7	7730.1
RPD%	15.6%	12.4%	24.6%	14.1%	18.4%	21.0%	51.8%	15.3%

Table 12.5 Field standard results for the Pit 7 and 1314 brine standards

It is noted that at Salinas Grandes there are large differences in concentrations between adjacent samples of brine and brackish water obtained from drilling. However, values returned were generally within +/-10% of standard values.

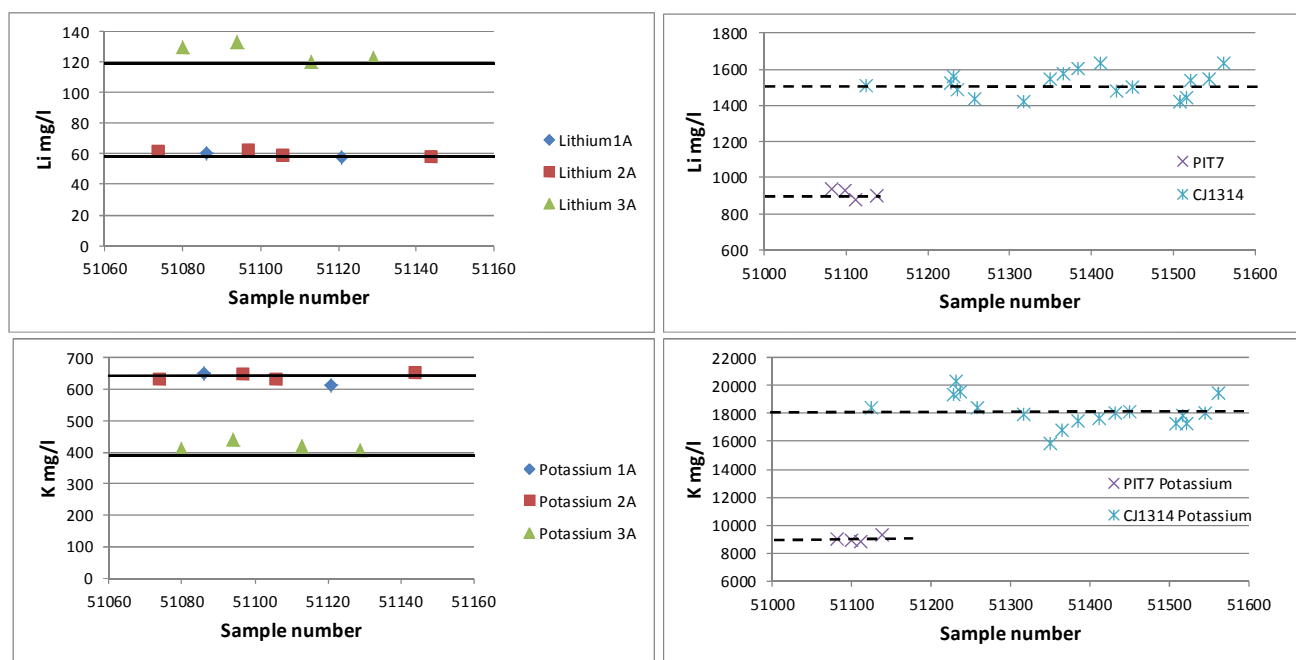


Figure 12.5 Plots of standard data for Salinas Grandes

12.2.5 Alex Stewart Assayers 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 12.8 to 12.10.

For Salinas Grandes:

- 28 duplicate samples were included in the 425 samples submitted in total (6.6 %). Results are presented below in Table 12.6. below; and
- 41 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 12.7.

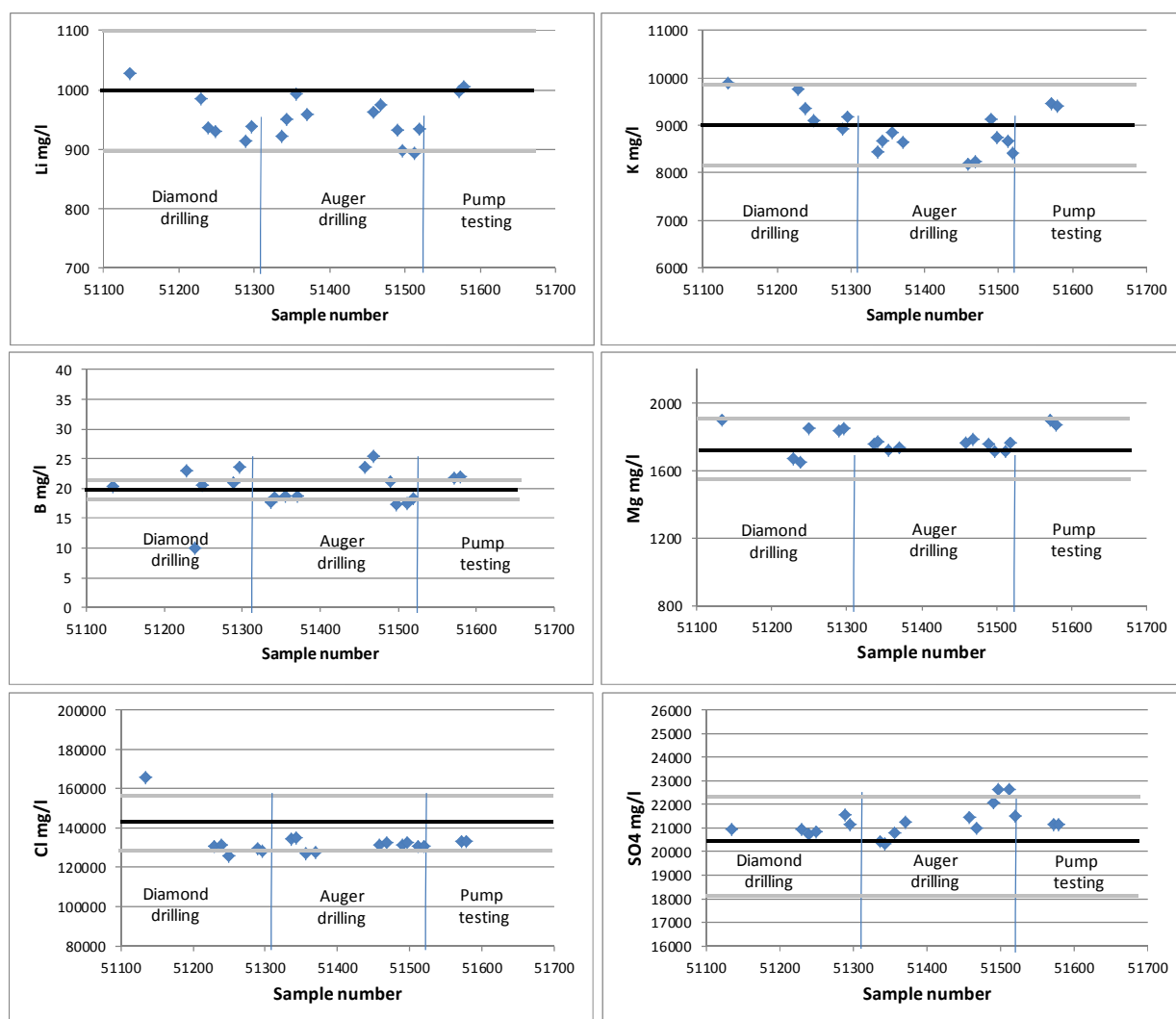


Figure 12.6 Standard analyses for the Salinas Grandes 1SG sample over time
The periods of diamond drilling, auger drilling and pump testing are shown.

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 12.6 and 12.7). When original and duplicate samples are plotted it is apparent that samples generally fall well within the $\pm 10\%$ and error bounds, with high graphical r^2 values. However, a very minor number of outliers were identified as follows, with 5 sample outliers in Orocobre duplicates and 3 in ASA duplicates (2 in alkalinity, 1 in sulphate), comprising:

- Sample 51501 from auger hole HCJ035HY has Li, K and Mg values slightly outside the 10% level. This drill hole is on the eastern margin of the auger drilling grid.
- Samples 51301 and 51252 from drill holes HCJ013D and HCJ007D have sulphate levels slightly exceeding 10% in the duplicate samples as do auger sample 51367, from HCJ029HY. Sample 51372 from auger hole HCJ033HY has a duplicate value slightly below the -10% level.
- Sample 51230 has a total alkalinity duplicate value slightly outside the 10% range.

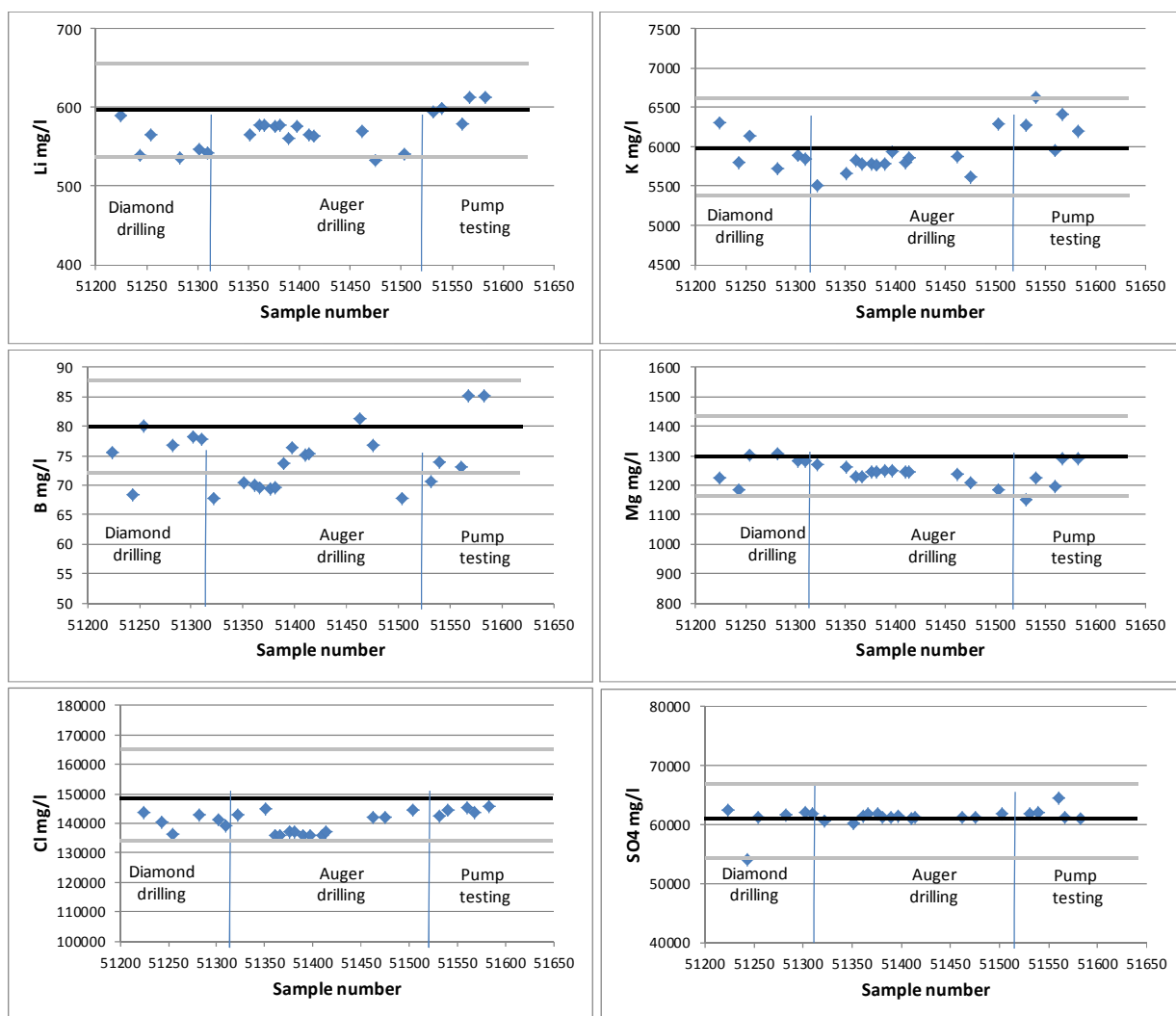


Figure 12.7 Standard analyses for Salinas Grandes 2SG sample over time
The periods of diamond drilling, auger drilling and pump testing are shown.

	B		K		Li		Mg	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
# Samples	28	28	28	28	28	28	28	28
Average mg/l	220	223	8,488	8,676	699	693	1,874	1,865
Std Dev	142	148	5,031	5,175	429	423	1,272	1,267
Graph r^2	0.996		0.997		0.998		0.993	
RPD%	1.4%		2.2%		0.8%		0.5%	
	SO4		TDS		Density		pH	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Original
# Samples	28	28	28	28	28	28	28	28
Average mg/l	3,213	3,270	211,310	214,864	1.1	1.1	7.4	7.4
Std Dev	2,239	2,350	104,475	104,856	0.1	0.1	0.6	0.5
Graph r^2	0.969		0.999		0.999		0.956	
RPD%	1.8%		1.7%		0.2%		0.1%	

Table 12.6 Orocobre submitted duplicate sample statistics

	B		K		Li		Mg	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
# Samples	41	41	41	41	41	41	41	41
Average mg/l	321	323	8298	8283	706	707	1778	1781
Std Dev	800	793	4860	4886	452	459	1245	1258
Graph r^2	0.996		0.998		0.999		1.000	
RPD%	0.7%		0.2%		0.0%		0.1%	
	SO ₄		TDS		Density		pH	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Original
# Samples	41	41	41	41	41	41	41	41
Average mg/l	8,130	8,116	204,882	204,864	1.1	1.1	6.2	7.2
Graph r^2	1.000		1.000		1.000		1.000	
Std Dev	16,223	16,233	114,568	114,729	0.1	0.1	2.6	0.4
RPD%	0.2%		0.0%		0.0%		14.6%	

Table 12.7 Alex Stuart internally submitted laboratory duplicates

12.2.6 Anion-cation balances

Anion-cation balances were conducted on all samples collected during the diamond and auger drilling programs. There were a total of 425 samples analysed in total by ASA (Figure 12.11), including the duplicate samples and standards (ion balances were not provided for the first two sample batches). The cation-anion balance is calculated as follows when values are converted from mg/l to milliequivalents:

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

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. Three samples mildly exceeded 5% (with balances of 5.1 to 5.2%) and as this exceedance is minor they were included in the data set used in the resource estimate. Sample 51155 had low analyte concentrations, whereas samples 51294 and 51296 had moderate to elevated analyte concentrations.

The average ion balance for the ASA drilling and pump testing data is +/-2%, for the ASA analyses. Results are considered to be of acceptable quality.

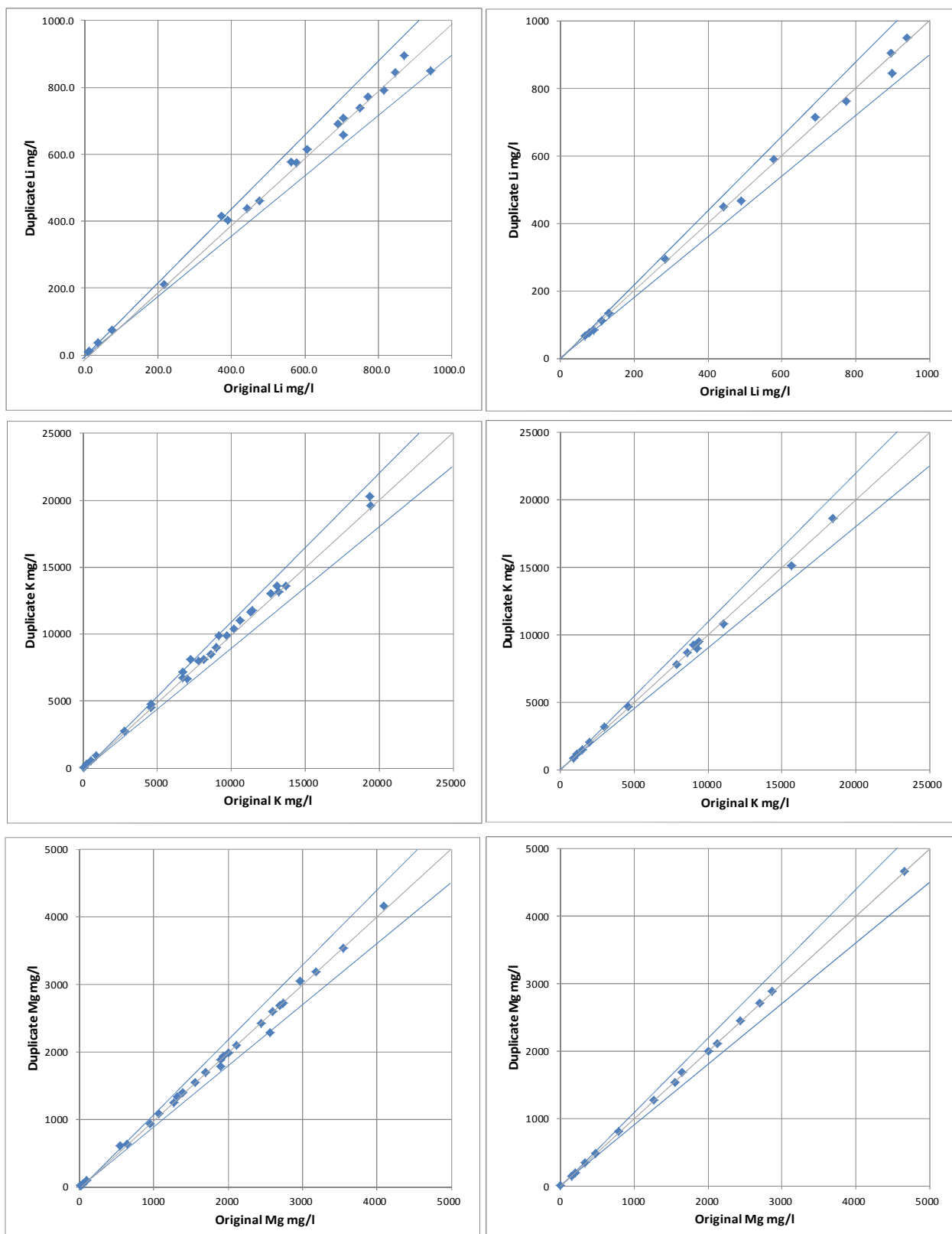


Figure 12.8 Duplicate sample data Orocobre and ASA submitted samples
Orocobre submitted samples shown left and ASA internally submitted duplicate samples on the right.

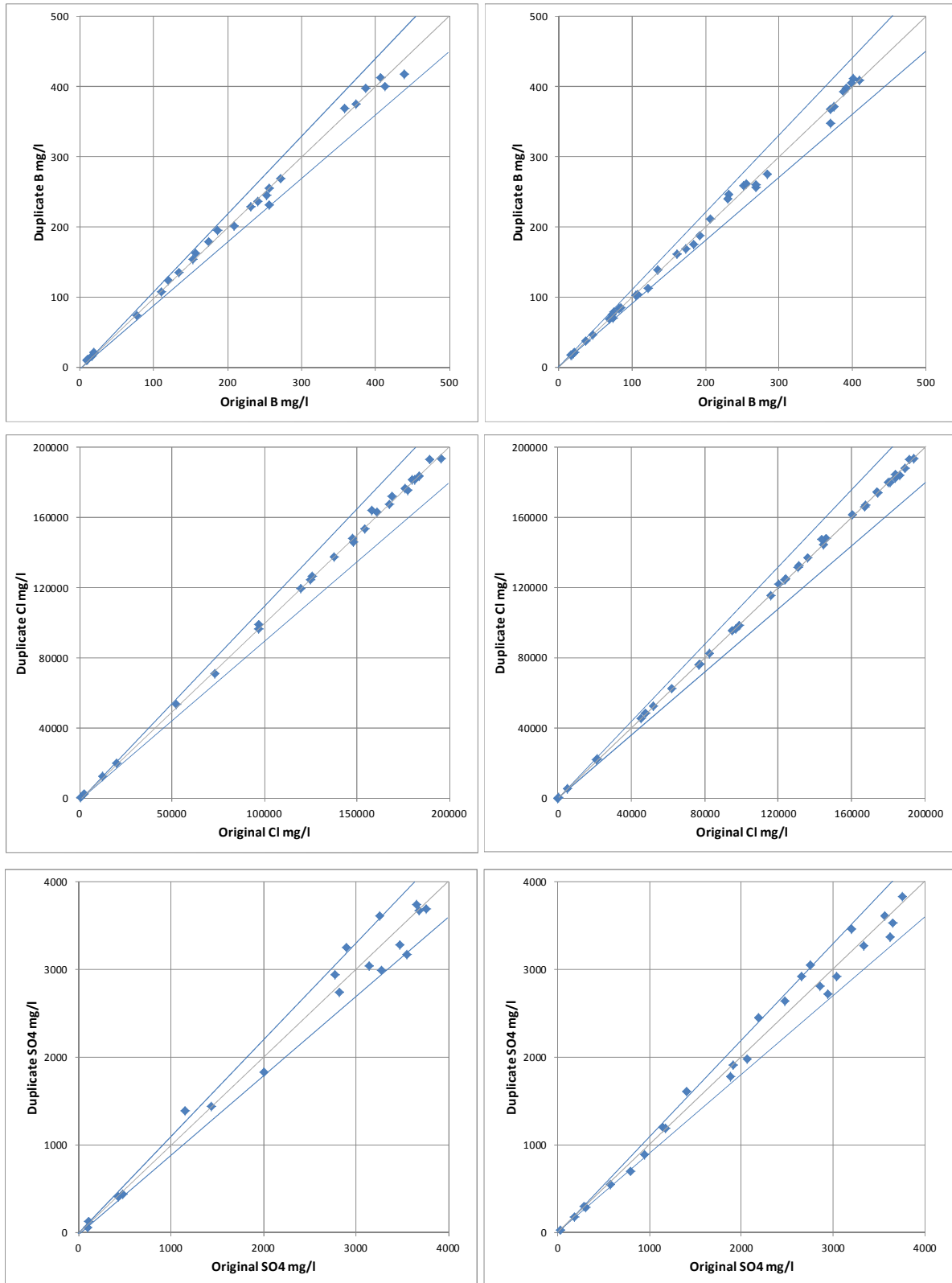


Figure 12.9 Duplicate sample data Orocobre and ASA submitted samples
 Orocobre submitted duplicates shown left and ASA internally submitted duplicate samples on the right.

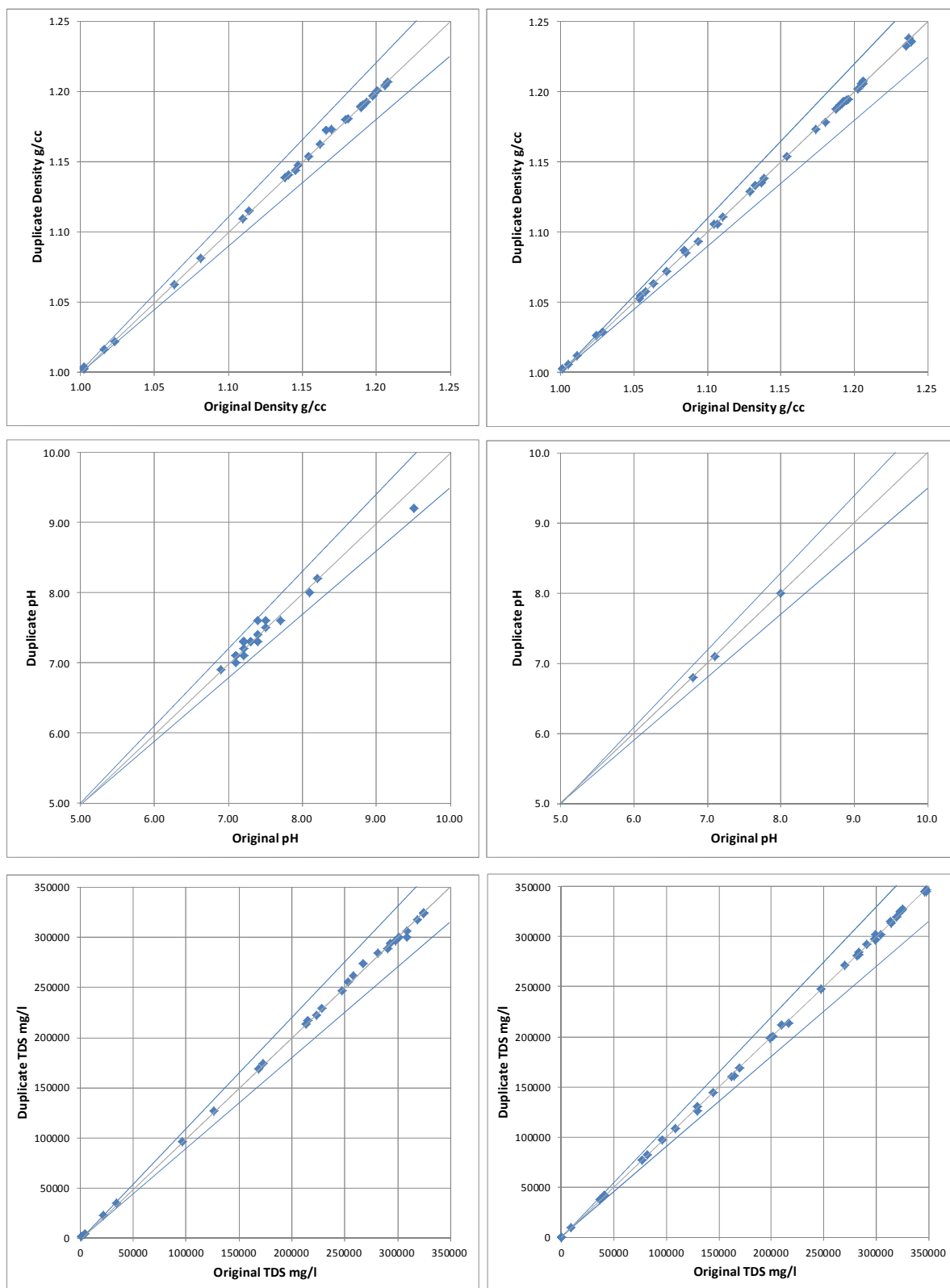


Figure 12.10 Duplicate sample data Orocobre and ASA submitted samples
Orocobre submitted duplicates shown left and ASA internally submitted duplicate samples on the right.

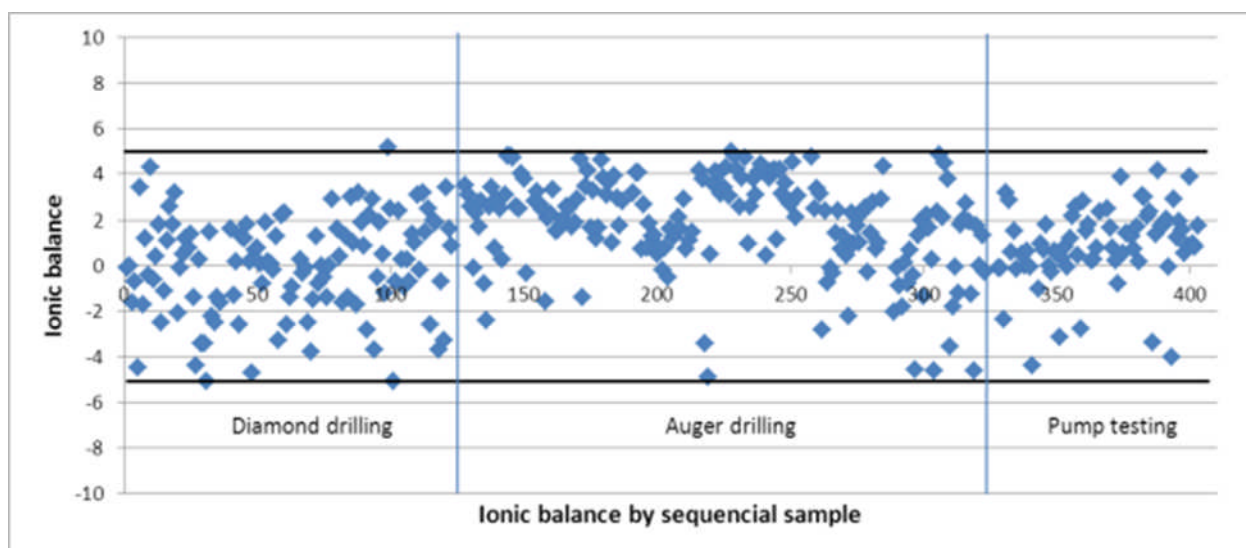


Figure 12.11 Ionic balances for ASA laboratory samples

12.2.7 Inter-laboratory samples summary

One ASA prepared 2SG standard and 5 duplicate samples were submitted to the University of Antofagasta laboratory in Chile, as an independent check on results obtained from the ASA laboratory in Mendoza. The University of Antofagasta was selected as the check laboratory as the university has extensive experience analyzing samples from brine projects.

The results show a high level of correlation between the laboratories, with low RPD values. Values for the 2SG standard (Table 12.8) were within 5% of the standard values, with the exception of B and Ca, which were present in relatively low concentrations.

For the duplicate results (Table 12.9 and Figure 12.2) analyses were within 10%, with the exception of:

- One sample for Li, with an RPD of 13%;
- Two samples for Mg, with RPD's of 12 and 16%
- One sample for Ca with an RPD of 12%.
- RPD's for B, which is generally present in concentrations <400 mg/l, exceeded 10% for all samples
- RPD's for sulphates exceeded 10% for all but 1 sample, and total alkalinity exceeded 10% for all but 2 samples.

Sample #	B mg/L	Ca mg/L	K mg/L	Li mg/L	Mg mg/L	Na mg/L	SO4 mg/L	Cl mg/L
2SG	80	200	6,000	600	1,301	117,698	60,845	149,869
60201	115	354	5,810	610	1,335	117,313	63,139	142,312
RPD%	36%	56%	3%	2%	3%	0%	4%	5%

Table 12.8 Inter-laboratory check of standard sample 2SG

Samples	B mg/l	Ca mg/l	K mg/l	Li mg/l	Mg mg/l	Na mg/l	Sulfates mg/l	Chlorides mg/l	Total Alkalinity_Mg CaCo3
51250	42	1,056	1,432	129	360	13,926	881	24,906	107
60202	48	1,010	1,331	130	393	13,513	696	25,647	87
RPD%	14%	4%	7%	1%	9%	3%	23%	3%	21%
51221	395	2,096	16,169	1,200	3,250	95,514	3,659	184,375	460
60203	451	2,075	14,850	1,294	3,444	103,188	3,367	185,317	531
RPD%	13%	1%	9%	8%	6%	8%	8%	1%	14%
51226	370	2,234	15,643	1,121	2,866	91,533	4,709	173,788	649
60204	418	2,144	14,650	1,275	3,219	99,438	3,993	179,445	609
RPD%	12%	4%	7%	13%	12%	8%	16%	3%	6%
51233	144	1,486	7,000	508	1,090	41,860	2,564	75,867	565
60205	147	1,356	6,555	520	1,280	41,275	2,256	77,028	435
RPD%	2%	9%	7%	2%	16%	1%	13%	2%	26%
51280	119	1,369	4,574	390	1,067	52,353	2,000	96,658	265
60212	137	1,213	4,750	430	1,138	56,500	1,692	99,135	242
RPD%	14%	12%	4%	10%	6%	8%	17%	3%	9%

Table 12.9 Sample results for original ASA and inter-laboratory duplicate analyses at the University of Antofagasta

12.3 Fluid chemistry sample analyses – brine extraction samples

12.3.1 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 Salinas Grandes project, with the samples extracted from diamond cores used as a comparison with those bailed over 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. 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 °C prior to any treatment or dilution for analysis. All samples were tested at dilution, the dilutions being carried out volumetrically.

12.3.2 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:

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 12.10 Analytical methods used by the British Geological Survey

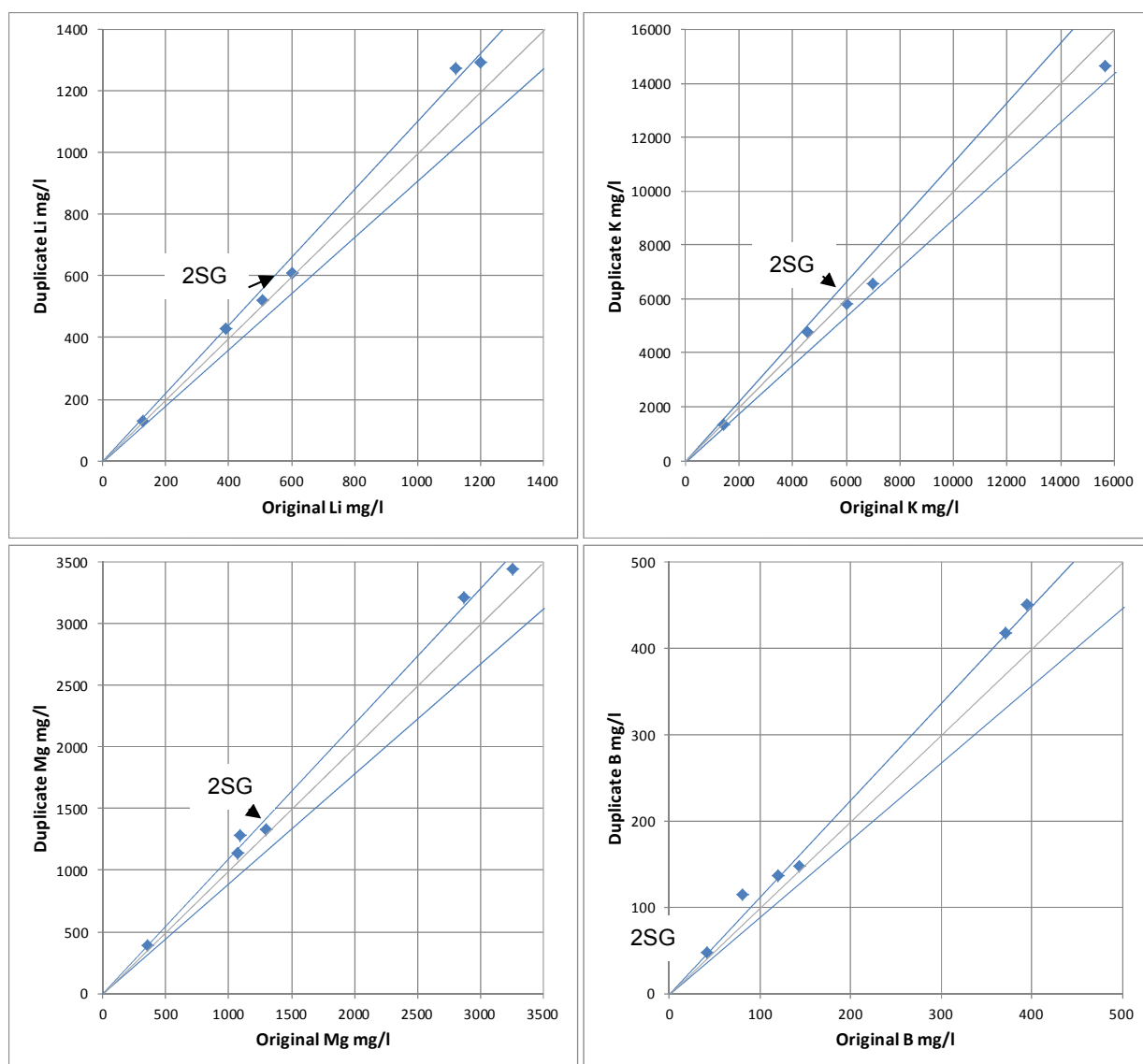


Figure 12.12 Inter-laboratory comparison of results from ASA and the University of Antofagasta

12.3.3 BGS standard analyses

A total of 140 samples were analysed by the BGS, with this number including two duplicate and two standard samples (one of G4 and G5). A total of 37 of these samples were subsequently re-analysed, together with 8 standard samples (four of G4 and G5). The analysis of standards is presented in Table 12.11. With the exception of one standard Lithium result for the Olaroz G4 standard results are within $\pm 10\%$ of the standard value. Similarly, with the exception of one of the Olaroz G4 and G5 standards the values for potassium are within $\pm 10\%$ of the standard value (Figure 12.13). RPD values with the exception of Ca, which is present in low concentrations in the standards, are less than or equal to 10% (Table 12.11). Analytes such as sulphate and chloride were not analysed for the original standard samples and sulphate analyses are significantly lower than the standard value. There is a notable difference between the original two standards and the standard values in the repeat sampling. However lithium values are within 10% of the standard value in both sets of standards.

	Sample	Ca	K	Li	Mg	Na	SO ₄	Cl
	Standard values mg/l	200	6,000	600	2,600	80,000	9,000	132,281
Original	12567-0013c STD G4	151	5,006	639	2,389	78,220		
Repeats	12567-0013c STD G4	219	6,442	610	2,364	85,312	6,779	128,968
Repeats	12567-0013c STD G4	213	6,432	608	2,273	84,199	6,576	125,590
Repeats	12567-0013c STD G4	206	6,386	966	2,259	83,290	7,296	129,532
Repeats	12567-0013c STD G4	211	6,471	594	2,292	84,465	6,949	126,637
	Average	200	6,147	683	2,315	83,097	6,900	127,682
	Std Dev	38	675	17	138	3,370	1,345	3,346
	RPD%	34%	24%	55%	6%	9%	10%	3%
	Sample	Ca	K	Li	Mg	Na	SO ₄	Cl
	Standard values	100	6000	800	3000	80000	11000	133126
Original	12567-0014c STD G5	57	5,114	804	2,678	77,160		
Repeats	12567-0014c STD G5	115	6,509	803	2,813	85,357	8,357	129,221
Repeats	12567-0014c STD G5	116	6,274	802	2,772	83,862	8,389	127,719
Repeats	12567-0014c STD G5	115	6,086	803	2,750	82,783	7,908	123,133
Repeats	12567-0014c STD G5	117	6,047	804	2,739	81,582	8,135	126,739
	Average	104	6,006	803	2,750	82,149	8,197	126,703
	Std Dev	26	531	1	49	3,116	223	2,590
	RPD%	58%	23%	0%	5%	10%	6%	5%

Table 12.11 Standard sample results from the BGS analyses, with original samples and repeat samples.

Highlighted values show analyses contributing to high RPD values

12.3.4 BGS repeat analyses

As there were a limited number of standards and duplicate samples with the initial BGS analyses, and as the correlation with the lithium values from ASA (from bailer sampling) is poor it was decided to reanalyze the 37 samples discussed above. A comparison of the two data sets is shown in Figure 12.14. It is noted that there is some bias between the data sets, with the original or the repeat samples consistently higher or lower for some analytes. In the case of lithium values below 200 mg/l Li shows a high level of dispersion, and values between 400 and 600 mg/l Li show considerably higher values in the reanalysis, falling well outside the bounds of +/-10%. Potassium shows consistently higher repeat samples values, with many values falling outside the bounds of +/-10%.

To evaluate the correlation of the original and repeat samples data from both data sets was plotted against the RPD for the paired samples. This showed poor sample repeatability below 200 mg/l Li, with the most consistent repeatability in samples in the >1000 mg/l range.

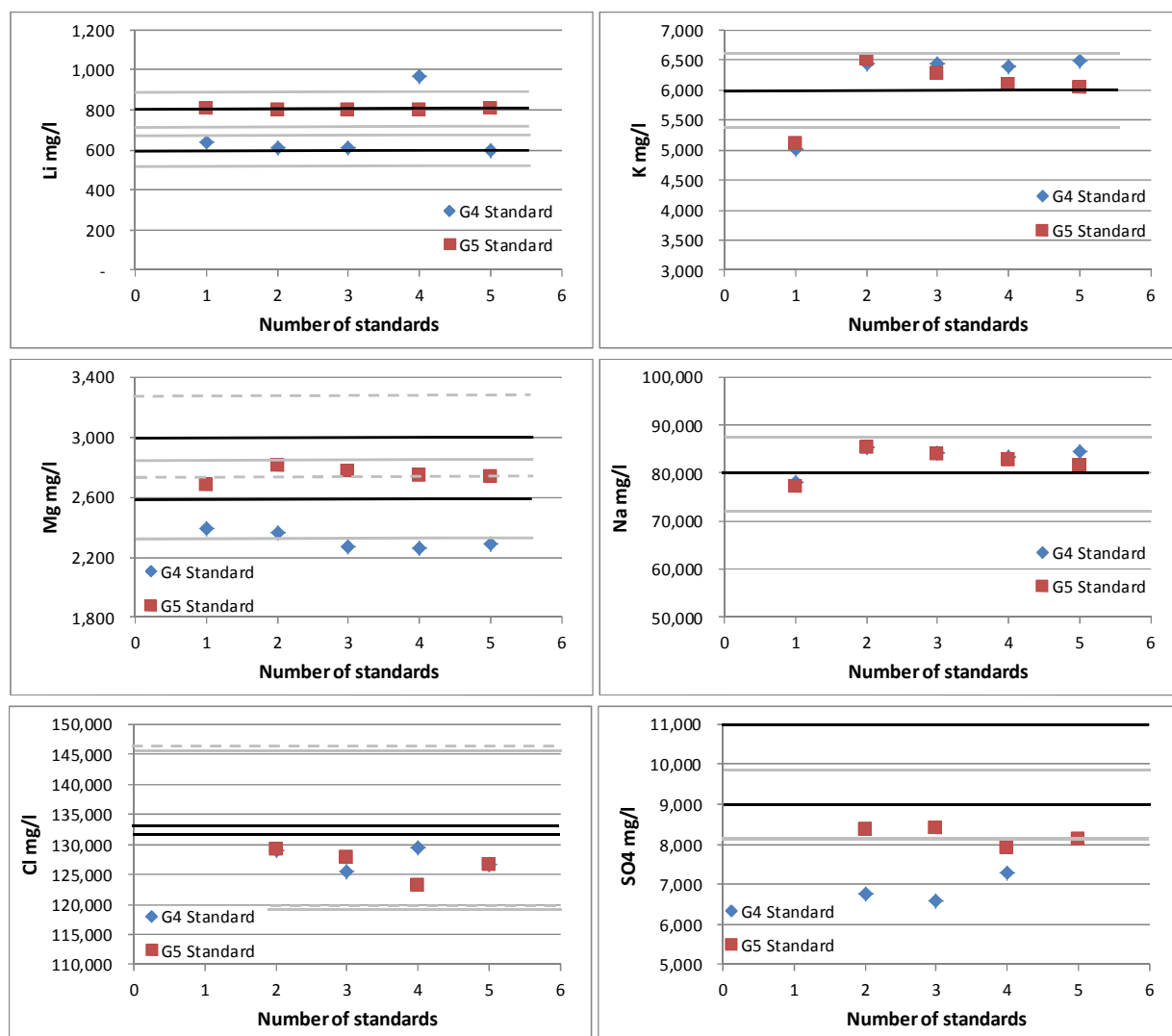


Figure 12.13 BGS standard analyses and standard values

12.3.5 BGS ionic balances

Anion-cation balances were conducted on the BGS samples, with the original samples having an average balance of 3.1%. Of the 140 original analyses analysed 5 samples (4%) had balances exceeding 10%, while 11 samples (8%) had balances exceeding 5%. The poor balances generally correspond to more dilute samples with lower analyte concentrations. However, the small volume of sample available for analysis from the brine extraction may have also contributed to the variation in analysis.

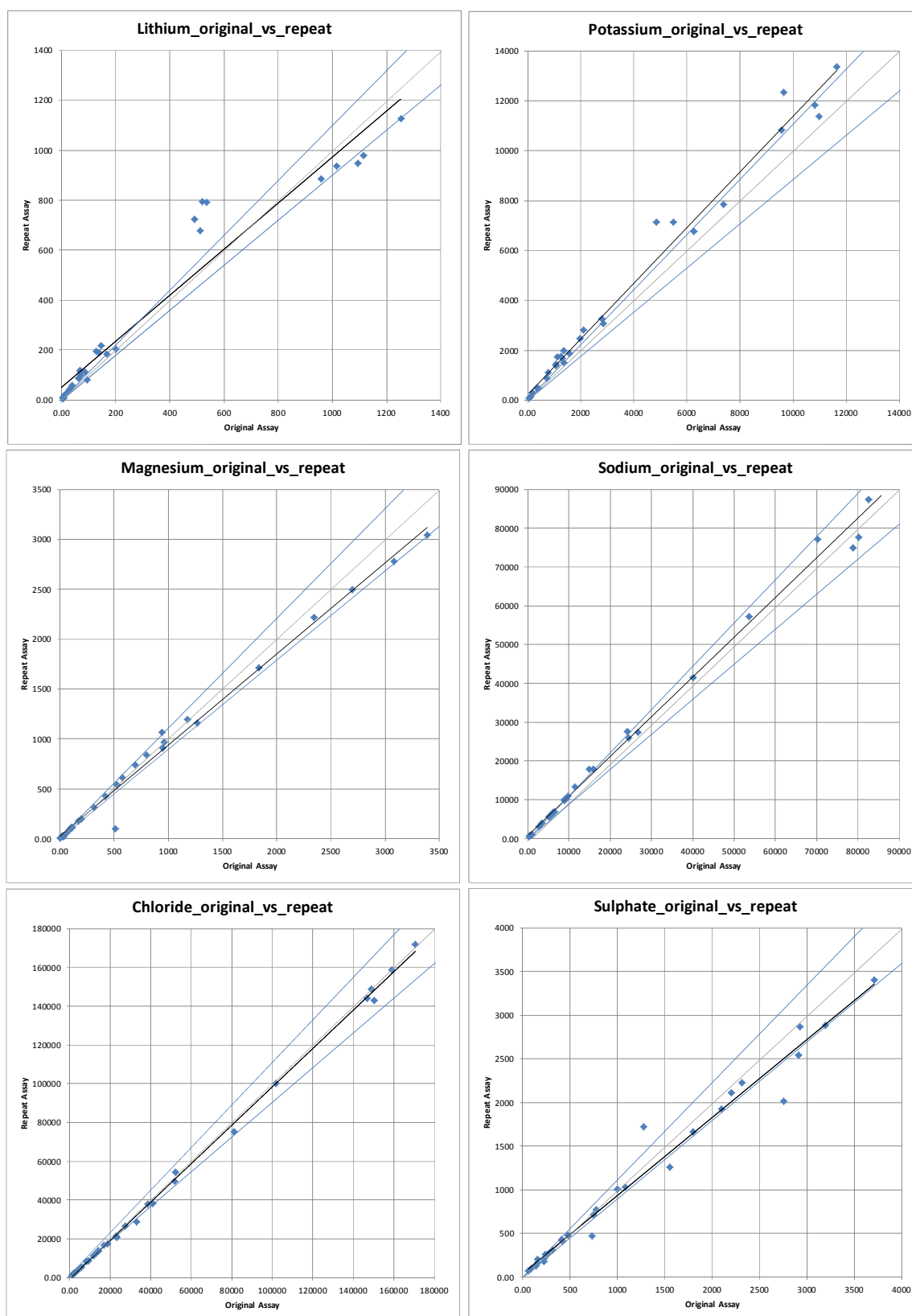


Figure 12.14 Comparison of original and duplicated data for BGS chemical analyses

12.3.6 Comparison of ASA and BGS diamond hole data

The overall correlation of ASA analyses, (from bailer sampling during diamond coring), with the BGS results show a very poor general correlation. However, the ASA and BGS sample data sets clearly show that elevated Li (>500 mg/l) and K is generally limited to the upper 10-15 m of the salar, where the subsequent auger drilling was undertaken. Beneath this depth samples are generally brackish, with low Li and K contents, with the suggestion of minor intervals (<10 m thick) with <500 mg/l Li.

Sampling method

In comparing the diamond 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 or 6 m composite samples of inflows within the corresponding interval, to provide a sample broadly representative of the interval (and the relative contributions from different units within it) and what could be extracted during pumping.
 - Sampling was conducted with the drill casing 3 m (or in initial holes 6m) above the base of the hole, 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 occur if the drill casing is not well seated in the drill hole, and contamination from drilling brine can occur if fluorescein is not identified.
- Brine extraction sampling was used on the Olaroz project and designed as a check on bailed sample results. 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.

Observations

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

- Bailer samples in diamond holes decrease with depth in all holes except HCJ002D and HCJ006D, where values continue throughout the holes
- There are occasional peaks in the bailer samples below the upper zone, some coinciding with similar BGS sample results, but these are all below 500 mg/l Li (excepting BGS samples in HCJ3 48-54.7, which is suspect, as it coincides with a zone of low densities),
- Both data sets suggest that Li (and other analytes) can vary substantially over several metres vertically,
- There is some evidence of possible contamination by drilling fluid/brine. However, this is thought to be limited or minor overall, as holes HCJ008D, 9D and 10D, on the margins of the salar (contained very low Li, K and B concentrations) were drilled using brine (with elevated Li, K and B concentrations) to ream in the casing.

It is noted for the BGS samples that:

- There is a high level of variation between BGS samples, relative to the smoother nature of the ASA data, due to the point versus composite nature of the sample

types. There appears to be considerable scatter in the precision of the BGS results, as indicated by the repeat analyses. Higher values (>1000 mg/l Li) are generally considered more reliable than low values (<200 mg/l Li).

- The results from 48.7, 51.7 and 54.7 in HCJ003D correspond to bailed samples that were not submitted to the laboratory, due to their densities of near 1.00 g/cc. The results of these three BGS samples exceed 1000 mg/l Li and suggest the BGS samples have been contaminated (or mislabeled/mixed up) or these values are correct and ASA samples have been contaminated by brackish water (which was encountered 10-15 m higher in the hole and should have been cased-off),
- Four BGS samples in HCJ006D, which has elevated ASA brine values of > 845 mg/l Li show values of < 200 mg/l Li. The brine has high densities identified in the field. This important disparity suggests either contamination of the bailer samples by drilling brine, until fresher units dilute this later in the hole, or that the BGS lab equipment is poorly calibrated.
- There were limited standards and duplicates included in the samples analysed by the BGS and despite the good results for the standards in the repeat sampling there are concerns regarding how well calibrated the BGS equipment was during the initial analyses.

Conclusions

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

- Immature salar development. The Salinas Grandes salar is located at 3400 m, and is topographically lower and further east than other salars in the Puna region of Salta/Jujuy.
 - The Salinas Grandes salar is interpreted to be a young salar, compared to other salars in the Puna. There is no halite in the salar sequence, except the surface crust of up to 0.5 m in the southern central part of the salar. This compares to thicknesses of > 50 m in the Olaroz and Cauchari salars, amongst others.
 - The immature nature of the salar has limited the downward density-driven movement of brine in the salar, with the consequence that elevated Li values are largely restricted to the upper part of the salar.
- Lithological data show the salar is heterogeneous and the three geochemical data sets all suggest there are considerable lateral and vertical variations in analytes (subject to considerations of sample integrity). However, there are some doubts regarding the geochemical data sets and which data set is more representative.
 - Auger drilling shows there is a high level of geological heterogeneity in the upper part of the salar.
 - Drilling suggests that channels within the salar sequence may be responsible for lateral and vertical differences and the distribution of fresher/more brackish fluids.
- 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 discrete intervals.
- There exists the possibility of sample contamination for the bailed diamond samples and analytical deficiencies with the brine extraction samples.

- In the case of the brine extraction samples, the brine is extracted from the central parts of the cores, so it is considered unlikely drilling fluid would have infiltrated the central part of the cores.
- Brine from surface pits in the salar was used for drilling. This brine has much higher Li concentrations and densities than many of the sample results.

Based on the identification of traces of fluorescein in some samples in both HCJ002D and HCJ006D there is possible contamination of some bailed diamond hole samples, although the extent of contamination is uncertain. There is also some doubt as to the influence of brackish artesian zones diluting brine concentrations. On this basis the brine sampling data is inconclusive as to the extent of a deeper aquifer zone ("mushroom stalk") in the central part of the salar. Consequently a resource has not been defined in this deeper zone.

Auger sampling was conducted in holes drilled without drilling fluid (as the formation is saturated) and values are composites reflecting inflows throughout the depth of each hole drilled.

12.3.7 Summary

Analyses of the geochemical standards by ASA show a drift in the results relative to the standard values over the period November 2010 to January 2012. However, results are within 10% of stated standard values, with a small number of exceptions for each element.

Duplicate samples show there is a high level of analytical repeatability and precision in the bailer analyses (diamond and auger holes) 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.

Ionic balances show the ASA analyses are of good quality, with only three ASA samples exceeding 5% for the ionic balance. The BGS analyses for 8% of samples exceeded a 5% difference in the ionic balances, with 4% of samples exceeding a 10% balance. 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 two laboratories, suggesting ASA analyses have an acceptable level of accuracy as well as precision.

Overall the results are considered of acceptable accuracy and precision to be used for the purpose of the inferred resource estimate.

Composite samples from the auger drilling in the shallow zone are considered representative of shallow salar conditions and have been used to produce a resource estimate for this zone. However, there are some concerns regarding sampling and analyte continuity from diamond drilling (brine and brine extraction sampling) in the deeper zone between 20 and 60 m and consequently a resource has not been defined in this deeper zone, although one may exist there.

13 DATA VERIFICATION

13.1 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 analytical certificates from Alex Stewart Assayers were received by the 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 12.3 was the methodology used. Analytical and sampling quality control measures employed by the company are discussed in Section 12 above.

13.2 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 pasted onto sample bottles. Samples sent to laboratories were labeled with printed sample tickets and data regarding the sample recorded on the sample tickets and in excel sheets used as sample registers.

13.3 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 with the Gauss Krueger UTM projection, Zone 3, and the Posgar 94 datum. Drill holes were subsequently surveyed with differential GPS equipment to cm-level accuracy.

Overall the project geological, hydrogeological and analytical results are considered of acceptable accuracy and precision to be used for the purpose of the estimated inferred resource.

14 ADJACENT PROPERTIES

14.1 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. Both salars are mature, in so much as the host aquifer in both cases is a large halite body.

Although the Orocobre Salinas Grandes project is not located in the immediate vicinity of a current lithium producing salar, it is clear from the table below that lithium values are highly elevated throughout the region, and the Salinas Grandes salar exhibits particularly high lithium values near surface.

The following summary of adjacent properties (tenements) and projects is based on publicly released information. The QP (author) and Hydrominex have been unable to verify the information regarding any of these projects. The information regarding the mineralization on any of the adjacent projects listed in this section is not necessarily indicative of the potential of mineralization on the properties that are the subject of this report.

	Salar de Atacama Chile mean	Hombre Muerto Argentina FMC	Salar de Rincon, Argentina Sentient	Salar de Olaroz, Argentina	Salinas Grandes* Argentina Orocobre	Guayatayoc* Argentina	Cauchari* Argentina	Salar de Cauchari Argentina (LAC)	Salar de Uyuni Bolivia	Silver Peak Nevada 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, Rincon, 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 Cauchari (LAC), from NI 43-101, Lithium Americas Corporations, February 15th 2010.

Table 14.1 Comparison of Salinas Grandes (2010 pit sample) results with other salar brine chemical compositions (from Houston, 2010b)

14.2 Adjacent properties to Salinas Grandes

14.2.1 Minera Santa Rita

The private Argentine boric acid producer, Minera Santa Rita, holds a number of tenements in the west of the Salinas Grandes salar. No information is available regarding activities conducted on the tenements.

14.2.2 Daijin Resource Corp

Daijin holds tenements in the Guayatayoc salar, NNE of the company's Salinas Grandes tenements. Daijin reported drilling two rotary mud holes to depths of > 300 metres in a press release dated June 2, 2011. However, no potentially economic concentrations of lithium, potassium or boron were reported and the company appears to have abandoned the project.

14.2.3 Other lithium exploration projects

Roskill Information Services (2009) reports that the brine exploited by Minera Altiplano (FMC) at the Hombre Muerto salar contains 600-650 ppm Li, with Mg:Li ratios a favorable 1.5:1. Reserves are reported at 4.5 million tonnes lithium carbonate, sufficient for more than

70 years production at current production levels of 10,000 tonnes lithium carbonate and 7,600 tonnes lithium chloride per year (Houston, 2010a).

A number of other companies are evaluating the potential of other salars in northwestern Argentina. This includes evaluations at the Hombre Muerto salar by the company Lithium 1. In a press release, dated 7 March 2011, quoting their NI43-101 resource statement, Lithium 1 report an inferred in-situ resource of 1.02 million tonnes of Li metal and 11.2 million tonnes of potassium. The Qualified Person and Orocobre have not verified the data publicly released by Lithium1, and no reliance should be placed on that data with regard to evaluating the Orocobre tenements that are the subject of this technical report.

The company Lithium Americas Corporation (LAC) has properties adjacent to the Orocobre Olaroz/Cauchari tenements, west of Salinas Grandes, with 36,974 ha over the Cauchari and Olaroz Salars held through its Argentinean subsidiary Minera Exar S.A.

Lithium Americas has conducted an exploration program which includes pitting and brine sampling, seismic traverses, 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. Drill hole depths range from 28 m to 450 m. Lithium results quoted by the company are significantly elevated over broad intervals.

The company produced an NI43-101 report and an inferred, indicated and measured resource for the project effective December 6th, 2010. This consists of a total measured and indicated resource in their Cauchari properties of 1 million tonnes of lithium metal (measured grade at 656 mg/l Li and indicated at 637 mg/l Li), together with 9 million tonnes of potassium (measured at 5.9 g/l and indicated at 5.7 g/l). The Qualified Person and Orocobre have not verified the data publicly released by LAC, and no reliance should be placed on that data with regard to evaluating the Orocobre tenements that are the subject of this technical report.

Orocobre holds tenements covering extensive areas of the Olaroz and Cauchari salars. At Olaroz the company announced a resource of 1.2 million tonnes of Lithium and 10.1 million tonnes of potassium in an NI43-101 report dated effective May 13 2011. Orocobre has completed initial drilling on the company's Cauchari properties and activities are underway for calculation of a maiden resource for this project. The Orocobre Olaroz/Cauchari properties are not immediately adjacent to the tenements (properties) that are the subject of this report.

The mineralization on the properties discussed in this section is not necessarily indicative of the potential of mineralization on the properties that are the subject of this report, except insofar as the Salinas Grandes properties lie within the Argentine Puna province which is rich in Li and K bearing brine resources.

14.3 Borate mineralization

Quaternary ulexite mineralization occurs throughout several areas within the salar tenements held by Orocobre. Some of these occurrences were previously mined by small borate producers.

Ulexite mineralization occurs as a precipitate just below the current surface of the salar. The ulexite forms extensive layers, with a 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. 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.

14.4 Salt mineralization

Salinas Grandes hosts a number of salt harvesting operations. During the wet season the salar floods, bringing dissolved salts with the flood waters and dissolving salt in the upper layer of the salar. The salt is re-precipitated during solar evaporation, forming an upper salt crust several centimeters thick. This salt crust is harvested using graders and front end loaders and sold as halite.

15 MINERAL PROCESSING AND METALLURGICAL TESTING

15.1 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 contiguous aquifers and surface water may allow flow into the host aquifer.

The Salinas Grandes project is at too early a stage to have such data available, but 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 Orocobre tenements by conducting long duration pump testing and monitoring.

15.2 Mineral processing and metallurgical testing

The shallow brine body has attractive grades and, as previously reported, excellent chemistry, with a low magnesium to lithium ratio of 2.5, a high potassium to lithium ratio of 12.5 and a low sulphate to lithium ratio of 5.8 in the central area of drilling, rising to 10.6 for the area covered by all the company properties over the salar. Evaluation of brine characteristics, evaporation rates and the potential process regime has been underway since late 2010. An evaporation pond farm has been constructed and evaluation of brine evaporation rates and chemistry is ongoing. Brine is supplied to the evaporation ponds from a number of pits dug in the salar.

Analyses of pond samples are undertaken by Alex Stewart Assayers (ASA) in Mendoza, Argentina. The ASA Mendoza laboratory has extensive experience in analysis of lithium brine samples.

The chemical processing of the brine is being investigated by Orocobre chemists and consulting processing engineer Peter Ehren, of Ehren Gonzalez Ltda, a Chilean consultancy designing the process route for the company's Olaroz project.

As the Salinas Grandes brine is a low Mg/Li and low SO₄/Li brine, a similar process to that used at the Salar de Atacama can be applied. The process (Figure 15.1) is expected to involve pumping low sulfate brine, together with brine with some higher calcium levels, from the salar to halite solar evaporation ponds - in order to saturate the brine in silvite (KCl). The calcium in the brine mix will reduce the sulfate levels in the brine, through precipitation of gypsum, avoiding lithium losses later on in the process. When the brine is saturated in KCl, it would be transferred to the silvinite (KCl.NaCl) solar evaporation ponds.

The silvinite salts can be harvested and fed to a potash plant. In a potash plant the salts are milled and silvite is floated, washed, filtered and finally dried. When the brine is almost saturated in carnalite (KCl·MgCl₂·6H₂O), it is transferred to the carnalite ponds. The carnalite salts are then leached in order to recover the potassium.

When the brine is almost saturated in bischofite (MgCl₂·6H₂O), it is transferred to the bischofite ponds. The bischofite salts are harvested and drained in order to recover the impregnated lithium brine. Finally the bischofite salts are stored in piles and a fraction will be sold as an anti-dust application for rural and mining roads. As the Salinas brine has a low

Mg/Li ratio, smaller amounts of bischofite will be produced resulting in higher overall lithium recovery.

When the brine is almost saturated in lithium carnalite ($\text{LiCl} \cdot \text{MgCl}_2 \cdot 7\text{H}_2\text{O}$), it is transferred to the lithium carnalite ponds. The lithium carnalite salts are leached in order to recover the lithium and finally disposed of as bischofite salts.

In the lithium carnalite ponds the brine is concentrated up to 6% lithium and about 1.8 % magnesium, which is the final concentration (eutectic point). This brine would be sent to a future lithium carbonate plant, possibly at the Olaroz Salar, which has the potential to be expanded in order to receive brine from Salinas Grandes.

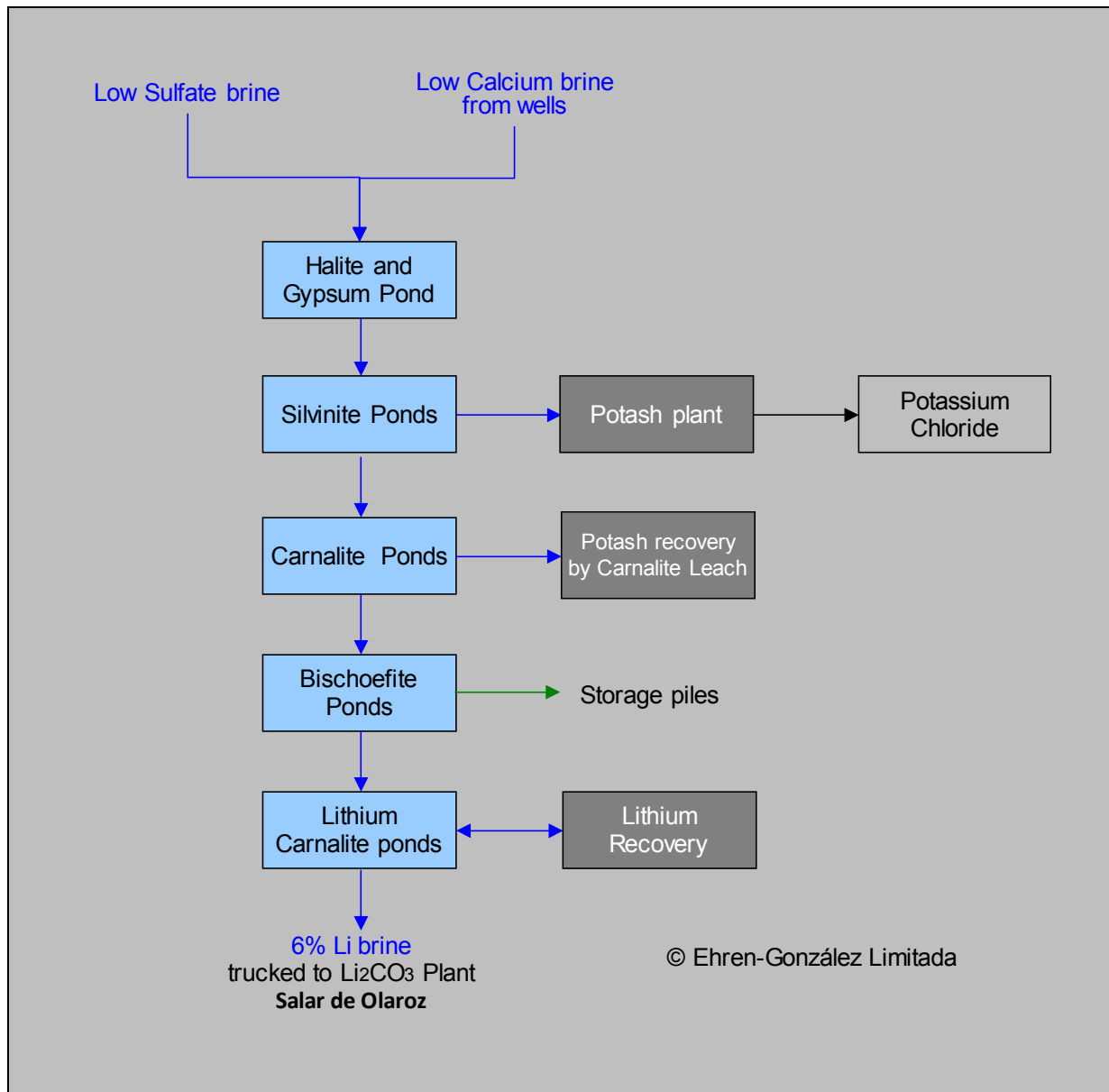


Figure 15.1 Lithium brine flow sheet process

Additionally, Orocobre is developing alternative processes with a significant higher lithium recovery than the conventional Salar de Atacama process.

The low sulphate levels of the Salinas Grandes brine indicate that potash recovery would be high and as a co-product of lithium carbonate production with potentially eight tonnes of potash produced for each tonne of lithium carbonate produced.

15.3 Solar evaporation testing

At the end of 2010 3 lines, each containing 5 pilot scale (25 m²) evaporation ponds, were installed at the Cangrejillos camp site, located a kilometre south of the Salinas Grandes salar. In September 2011 addition pilot ponds were installed to bring the final concentration up to 3.5-4% Li.

The test ponds (Figure 15.2) have confirmed the expected evaporation route. In the ponds halite initially precipitated, followed by silvinite. The silvinite salts, with potassium contents between 10 and 17%, were ground and floated at the laboratory scale at the University of Jujuy. This work produced a concentrate with 43-47% potassium (82-89 %KCl). These concentrates are normally washed in order to obtain a +95% KCl product.



Figure 15.2 Evaporation test ponds at Cangrejillos

15.4 Brine temperatures

For brine phase chemistry analysis the lowest daily brine temperature is a very important parameter as it will indicate which salt will precipitate. Temperatures in the ponds are manually registered at 09:00 and 16:00 every day.

15.5 Phase chemistry

The pilot ponds are operating continuously and are therefore representative of an industrial operation. During the winter months the evaporation rates are low and the ponds operated with a brine height of only 15 cm. The brine level was increased to about 35 cm when evaporation rates were higher. It can be observed that K levels drop strongly, which is very positive for the production of high K grade silvinite, feed stock for the KCl plant. Sulfate levels drop to very low levels (Figure 15.3), as the brine in this line of ponds has a slight excess of calcium, avoiding loss of lithium sulfate in the more concentrated ponds. The lower Mg/Li reduces the loss of brine impregnations in the ponds where bischofite crystallizes, generating a better overall recovery than at the Salar de Atacama.

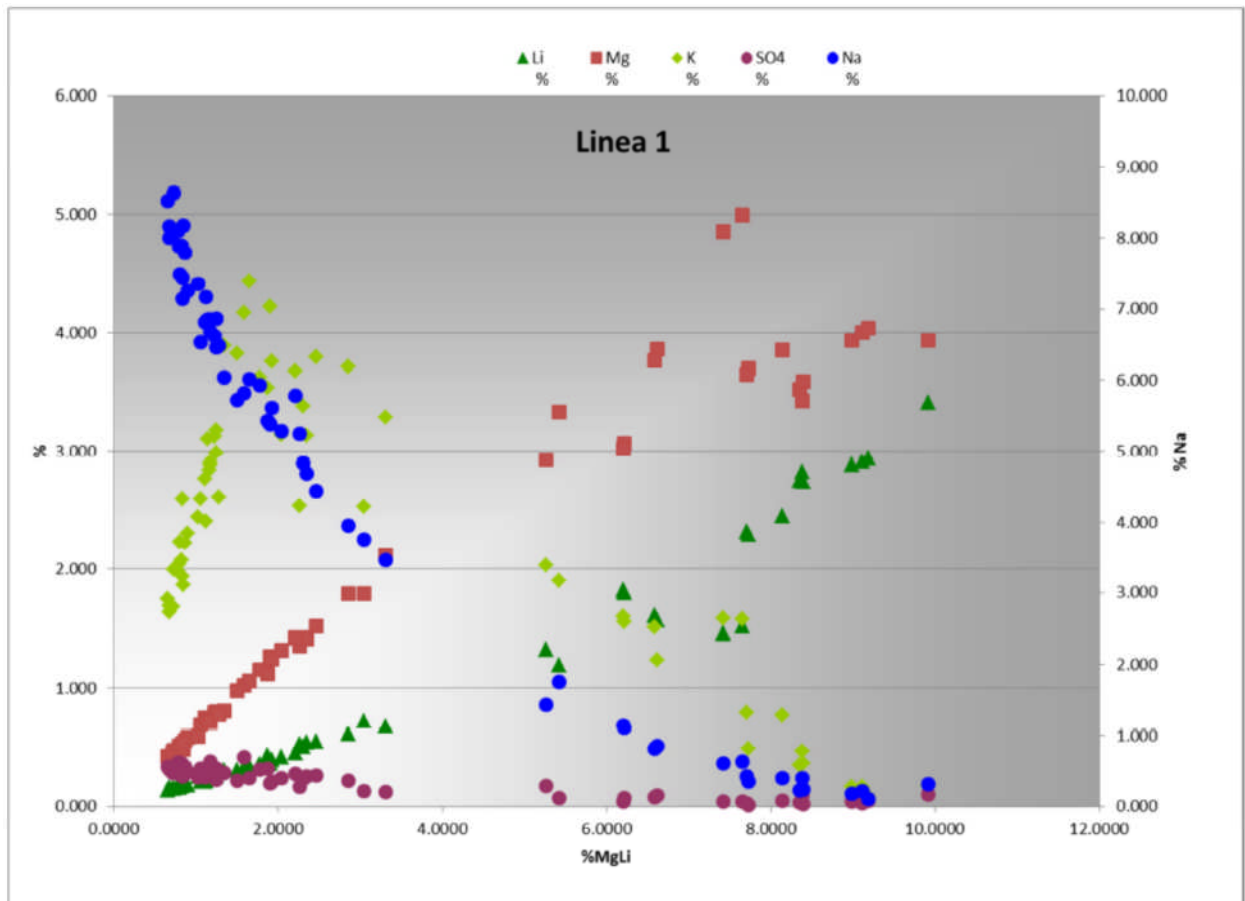


Figure 15.3 The relationship of chemical concentrations (in %) Line 1 evaporation ponds

16 MINERAL RESOURCES AND MINERAL RESERVE ESTIMATES

Diamond and auger drilling data on the Salinas Grandes 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.

16.1 Background to the resource estimate

Diamond and auger drilling established that Li, K and B concentrations in brine are elevated (generally exceeding 600 mg/l Li) in the upper 10-15 m of the Salinas Grandes salar. Diamond drilling showed that concentrations decrease with depth, with isolated Li-bearing intervals (concentrations generally < 500 mg/l Li) to depths of ~ 80 m.

Diamond holes HCJ002D and HCJ006D contain lithium values exceeding 500 and 1000 mg/l respectively. However, as values of this magnitude below the shallow zone are limited to these two holes and as there is poor continuity between these and adjacent holes, and the possibility of sample contamination, no resource has been estimated beneath the shallow zone.

16.2 Area covered by the resource

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

- The area where surficial pit samples are >1000 mg/l Li, within the salar salt crust area (162.4 km², within the provinces of Salta and Jujuy), and
- Excising areas outside the Orocobre property boundaries, which reduces the area to 116.2 km² (of which 86.2 km² are in Salta).

The resource has been extended, based on results from pitting, into the province of Jujuy, where drilling has yet to be undertaken, projecting the results of drilling on the provincial boundary into Jujuy.

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 it is developed. A value of 1000 mg/l Li in pits has been used as the external cut off (limit) for the resource. Composite auger holes results within the salar salt pan area, which were used to generate the resource, averaged 848 mg/l Li.

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 complexity. 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.

16.3 Hole spacing and data density

The hole spacing of the shallow auger holes is 1.65 km, (a hole per 2.4 km² in the resource area, noting no auger holes were drilled in the east and west of this area), whereas that of the diamond holes is 3.26 km (a hole per 11.6 km², excluding holes 8D and 10D outside the external cut off of the resource), although the diamond holes have not been used in the resource estimation, other than for comparison purposes with the auger hole data).

In the shallow auger holes sampling is typically on 4 m intervals. However, all samples are composite samples, reflecting inflows from surface to the base of sampling (i.e. 0-4, 0-8, 0-

12 m). The base of the shallow resource has been defined based on the continuity of brine geochemistry and the distribution of lithologies within the shallow part of the salar, with data assigned at auger hole locations to a maximum depth of 20m, supported by information from diamond holes.

16.4 Resource estimation methodology

The resource has been estimated using a simple methodology, which involved:

- Using the salar outline, and the area within it hosting pit samples >1000 mg/l, as the external boundary of the area for calculations (162.4 km^2), before clipping areas with the Orocobre (SAS) property holding to 116.2 km^2 .
- Defining the base of the Li-bearing brine body, (including geological units A, B and the upper part of unit C) from geochemistry, as the unit boundaries do not appear to strongly influence the Li concentrations. Diamond and auger drilling information was used to define the base of the resource zone, coincident with values of ~ 400 mg/l Li in diamond drilling.
- Calculating a weighted Sy value for each auger drill hole, based on the proportion of sand, silt and clay in each hole, using the logged geology and the Sy values determined for each lithology type by the BGS. The depth of the resource was extended below individual drill holes where adjacent drill holes supported this interpretation, with representative lithological proportions assigned based on the surrounding drill holes.
- Using the depth weighted Sy values to calculate an equivalent brine thickness value for the length of each drill hole over a m^2 unit area.
- Converting the composite Li, K and B values to a kg/l value for each hole.
- Calculating the grade thickness of each element at each hole using grade thickness = equivalent brine thickness x composite concentration. 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.
- Clipping the grade thickness grid with the tenement holding, to exclude information 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.

The resource calculation was undertaken using cells with 100 m x and y dimensions, to minimize the number of new data points created during kriging, allowing the production of high quality output graphics. Comparison with 400 m and 25 m cell sizes showed differences of $<2\%$ in the total contained tonnage.

16.5 Resource estimation outputs

The output of the resource estimation is shown in Figure 16.1, with distribution maps as kg/m^2 for Li, K and B. The importance of the western area of the resource with higher sand contents is apparent in the kg/m^2 plots. The grid values were summed and multiplied by the block dimensions to obtain the contained tonnage of each analyte.

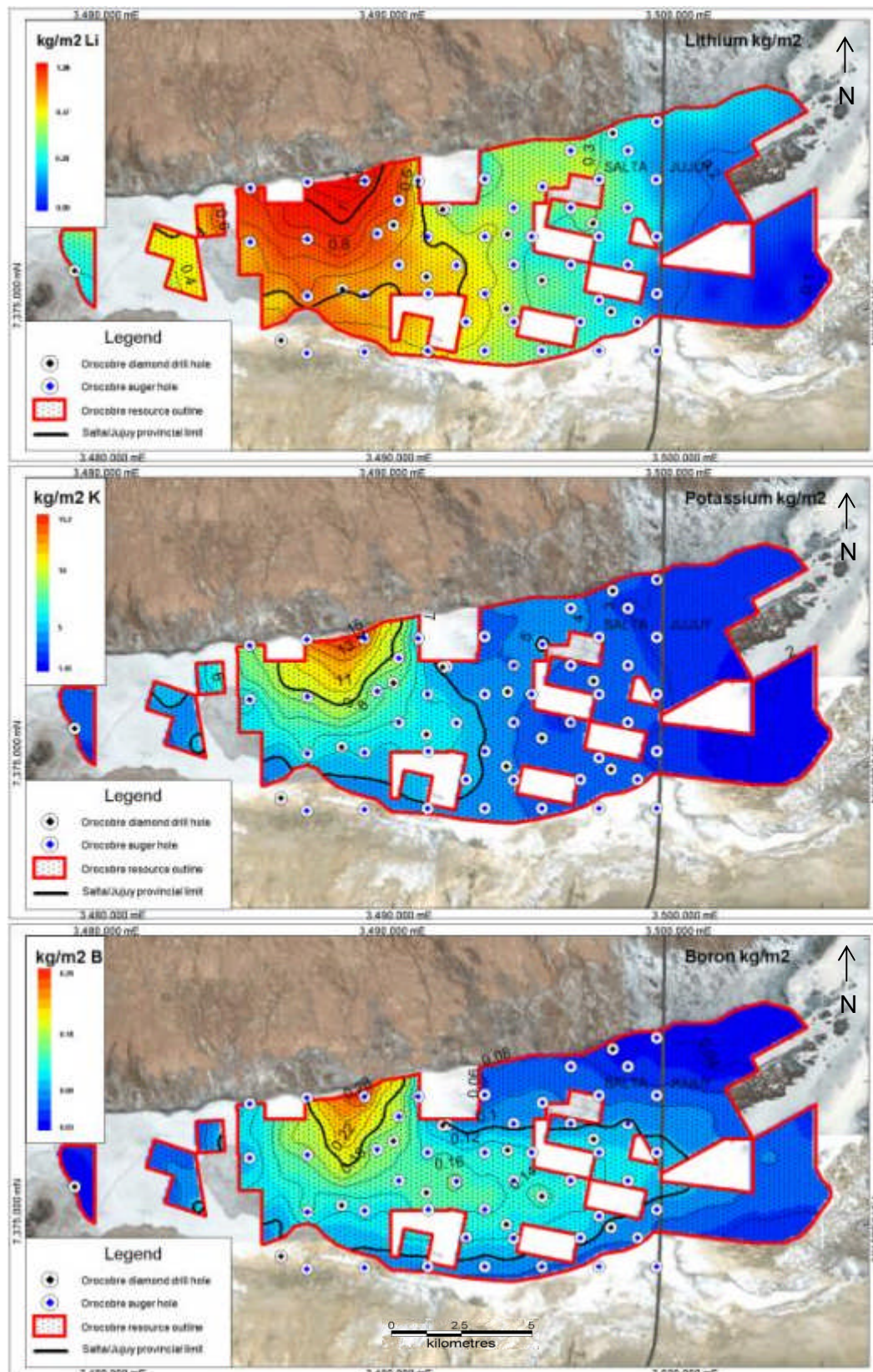


Figure 16.1 Resource area with kg/m² values for Li, K and B

The inferred resource of 56.5 million cubic metres of brine at 795 mg/L lithium and 9,550 mg/L potassium is equivalent to 239,200 tonnes of lithium carbonate and 1.03 million tonnes of potash (potassium chloride) based on 5.32 tonnes of lithium carbonate being equivalent to

1 tonne of lithium and 1.91 tonnes of potash being equivalent to one tonne of potassium. The results are presented in Table 16.1.

	Brine body parameters				Average resource concentrations			Tonnes contained metal		
Resource Category	Area km ²	Average thickness m	Mean specific yield %	Brine volume Million m ³	Lithium mg/l	Potassium mg/l	Boron mg/l	Lithium	Potassium	Boron
Inferred resource	116.2	13.3	4.1%	56.5	795	9,547	283	44,960	539,850	12,100

Table 16.1 Resource estimate results for the shallow brine unit

The estimate extends to an average depth of 13.3 meters, and applies the company's property boundaries and a 1,000 mg/l Li cut-off from the extensive surface pit sampling data to establish peripheral resource boundaries. No internal cut-off boundaries have been used because it is inappropriate to apply them in a fluid resource where extraction will cause mixing. The weighted average specific yield used is 4.1 %.

16.6 Resource extraction comments

Drilling data shows the highest brine Li, K and B concentrations are in the upper ~10-15 m of the salar, with an important influence on overall porosity of sandy zones in the north of the salar. Evaluation of the salar geology shows there are significant lithological variations within individual units, including the likelihood of local higher permeability channels. Longer duration pump testing is required to help assess potential long term pumping rates and the impact of brackish zones on resource extraction.

The resource estimate is sensitive to the proportion of sand in the salar, particularly in the north and west of the salar where auger drilling has been generally shallow (4 m) to date. It is assumed that a generally higher proportion of sand extends to depths of 10-15 m in this area, based on data from deeper drill holes and the geological model (sand being sourced from the alluvial fan north of the current salar salt pan).

The mineral resource estimate could potentially be materially affected by changes to legislation affecting mineral titles, taxation, permitting, environmental, socio economic considerations or other factors.

17 OTHER RELEVANT DATA AND INFORMATION

The project is at too earlier stage to have information regarding recovery methods. As the analytes of interest (Li, K, B) are contained in brine the potential mining method would involve pumping brine from aquifers beneath the salar to purpose-built evaporation ponds, prior to chemical processing.

The project is at too earlier stage to provide information regarding project infrastructure, market studies and contracts, capital and operating costs or economic analysis. However, any future economic development would require installation of wells, pumps and construction of evaporation ponds to receive pumped brine.

18 INTERPRETATION AND CONCLUSIONS

The Salinas Grandes salar is located in the east of the Puna region in the provinces of Salta and Jujuy, NW Argentina. Salinas Grandes is one of the larger Puna salars, with the Salinas Grandes-Guayatayoc drainage basin covering ~16,000 km². Within this the Salinas Grandes salar salt pan covers an area of ~ 250 km². The salar has an EW to NE orientation, which is unusual in the Puna. This orientation is probably related to complex faulting underlying and bordering the salar. The southern boundary of the salar is interpreted to be a fault, controlling subsidence on this southern margin of the basin. Modelling of a gravity and AMT geophysical survey line across the salar suggests the salar is at least 400 m deep, with Segemar structural interpretation suggesting there are reverse faults on the mountain ranges east and west of the salar, with multiple faults within the salar.

A total of 12 diamond drill holes were drilled in the salar to depths up to 180 m deep, but on average 71.4 m deep. Interpretation of drill cores, and down hole geophysical logging undertaken on the drill holes, suggests there are six lithological units in the salar (Units A through F), including a thin halite layer, which is generally ~0.1 m thick, reaching 0.5 m thick in the central south part of the salar. Several tuff units of unknown age have been identified in drill holes. Drilling did not intersect the basement of the salar.

Unit B is a sand, silt and clay unit, which has greater intervals of sand on the northern margin of the salar, with correspondingly higher overall porosities. The thickest geological unit is Unit C, a black to green organic rich clay and silt. The depocentre of this unit is in the south of the salar, close to the interpreted southern fault, suggesting the importance of this fault during deposition of this unit. Unit F at the base of drilling includes medium to coarse sand and conglomerate units. It appears these deeper units of the salar may be part of clastic sedimentation from the alluvial fan to the north of the salar.

Previous pit sampling on the salar (Houston, 2010b) reported highly elevated lithium, potassium and boron values, with lithium values exceeding 2,000 mg/l, potassium exceeding 20,000 mg/l and boron exceeding 500 mg/l in parts of the Orocobre tenements. Following the program of pitting across the salar fluid sampling during diamond drilling established that the lithium values decline with depth and, while extremely high at surface, do not continue with such grades beyond 10-15 m, with apparently minor exceptions. Diamond drilling and geophysics also contributed to understanding of the salar stratigraphy, and established that deeper units intersected during drilling host brackish water, which underlies brine across the salar.

Diamond core samples were sent to the British Geological Survey, with a total of 117 samples analysed for total porosity (Pt) and specific yield (Sy). This testing provided values (and ranges) of Sy values for sands (16%), silt mixes (4%) and clays (2%), which were used in the resource modelling.

Following the diamond drilling a program of 47 shallow auger drill holes was undertaken in the central area of the salar, typically to depths of 12 m. Auger drilling produced composite brine samples at 4 m intervals and better defined the distribution of lithium and porous units within the shallow portion of the salar. Interpretation of the auger drilling suggests that many lithological units are lenticular. There are more consistent intervals of sand in the northern part of the salar, with minor sand in the centre.

Brine sample results and lithological information collected during the auger drilling was used to calculate a resource for the shallow brine zone. The Sy values from the British Geological Survey (BGS) analyses were used to calculate a weighted Sy value for each auger hole, based on the lithologies and thicknesses of brine recorded. The weighted Sy data was used to calculate an equivalent brine thickness at each auger hole. The composite brine sample

results as kg/l values were multiplied by the equivalent brine thickness (litres contained over a m²), to produce a kg/m² value for each auger hole. This data was kriged across the salar to produce a set of kg/m² 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. Extensive QA/QC evaluation undertaken on the geochemical data and assays from Alex Stewart Assayers indicates the analyses are acceptable for use in the inferred resource estimate.

A shallow inferred resource has been estimated with 56.5 million cubic metres of brine at 795 mg/L lithium and 9,550 mg/L potassium, which is equivalent to 239,200 tonnes lithium carbonate (44,960 tonnes lithium metal) and 1.03 million tonnes of potash (KCl – equivalent to 539,850 tonnes of potassium) to an average depth of 13.3m.

Resource Category	Brine body parameters				Average resource concentrations			Tonnes contained metal		
	Area km ²	Average thickness m	Mean specific yield %	Brine volume Million m ³	Lithium mg/l	Potassium mg/l	Boron mg/l	Lithium	Potassium	Boron
Inferred resource	116.2	13.3	4.1%	56.5	795	9,547	283	44,960	539,850	12,100

Evaporation test work has been underway on the project since late 2010. The Salinas Grandes brine has a very attractive chemistry, with low Mg/Li and low SO₄/Li ratios and is amenable to a similar process to that used at the Salar de Atacama. The brine also has high K concentrations and evaporation test work suggests high K recoveries are likely, with the production of high K grade silvinite as feed stock for the KCl plant.

The test ponds have confirmed the expected evaporation route of halite followed by silvinite. The silvinite salts, with potassium contents between 10 and 17%, were ground and floated at the laboratory scale at the University of Jujuy. This work produced a concentrate with 43-47% potassium (82-89 %KCl). These concentrates are normally washed in order to obtain a +95% KCl product.

To evaluate the potential for long term brine extraction from the salar pump testing was completed on 10 of the shallow auger holes. This confirmed that units at Salinas Grandes have generally low hydraulic conductivities, in the order of ~3 m/day. One of the 10 holes showed a considerably higher permeability of ~50 m/d, which may reflect a more permeable channel within the salar.

The pump testing was generally conducted at flow rates of 1.5 l/s or less and pumping at or exceeding these flow rates may be sustainable over longer periods. However, to better understand the behavior of pumping from the shallow brine unit it is planned to conduct 4 pump tests on purpose constructed large diameter test production bores. These will evaluate brine extraction and brine grade over a period of months, to better understand the potential for commercial production.

Significant potential risks and uncertainties associated with the project are the standard exploration risks – whether the mineralization to be drilled is present at sufficient grades to be economic. If Li, K and B grades in the brine are low or are not stable during the long term pumping tests the lithium and potassium grades for the project may not be economic. In addition to the brine grade, if the porosity and permeability in wells are low then adequate and potentially economic pumping rates may not be reached or sustained over the length of the planned test production pumping. Long term pump testing, over a period of many months, is planned to evaluate this aspect of the project.

19 RECOMMENDATIONS

19.1 Background

The Salinas Grandes evaluation to date has defined a shallow Li, K, and B brine resource with very attractive chemistry, including a high potassium content with low sulphate and low magnesium. As the brine resource is relatively small there is the potential to develop Salinas Grandes as a satellite operation, where brine is concentrated before transportation to the company's Olaroz project.

19.2 Objectives

Future exploration activities are to focus on evaluating the extractability of this brine resource and the sustainability of long term pumping of the shallow aquifer, to assess whether commercial production rates can be sustained.

19.3 Activities

19.3.1 Long term pumping tests

- Pump test 4 test production bores in the shallow resource, to evaluate the lithium values and pump rate over time. The object is to sustain pump rates of 2 l/s or better over an extended period of months. Appropriate submersible pumps and power supplies should be acquired for these tests. Construction of new large diameter (12 inch) test production bores is required to undertake this testing.
- These holes should be drilled and 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. A minimum of three monitoring wells should be drilled at each site, to the same depth as the pump test hole, with wells at different distances from the pump bore.
- Holes should be drilled in different parts of the salar, to evaluate variation in permeability and brine grade. However, the northern margin of the salar should be the site of two of these bores, to evaluate the area where a higher sand content and high lithium values have been identified.
- The bores 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 bores 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 4 flow rate step followed by measurement of the water level recovery and pumping at a constant rate for a period of several months, if possible.
- A decision on additional work on the project should be made on the basis of the test production pumping results.

19.3.2 Climate monitoring

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

19.3.3 Water balance

Subject to positive results from the test production program evaluation of the catchment hydrology is recommended, to allow a water balance to be established. This would require monitoring surface water and groundwater flows, levels and quality to establish baseline conditions against which future changes can be compared.

19.3.4 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.

19.3.5 Hydrogeologic modelling

Design of any future bore fields in the salar will require increased geological knowledge regarding permeabilities within units. Consequently a hydrogeological model to simulate potential pumping scenarios should be considered as part of the future project assessment, providing long term pump tests suggest extraction is economically feasible.

19.4 Estimated costs

The following table provides a budget estimate of the work required to undertake the test production bore installation, pumping, laboratory analysis and data interpretation and reporting.

Salinas estimated costs	US\$
Pump bore installation, pump testing and analyses	245,000
Climatic monitoring	20,000
Water balance	100,000
Data analysis and reporting	60,000
Total estimated	425,000

Table 19.1 Budget estimate for Salinas Grandes activities

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21 DATE AND SIGNATURE PAGE - CERTIFICATES of AUTHORS

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

1. I am an independent consultant of:
Unit 9 / 6 Carr St,
Waverton, NSW 2060, 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 (IAH).

3. I have practiced my profession for twenty 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 NI43-101) 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 de Cauchari for Orocobre, Argentina (2010-2012)
- Salar Salinas Grandes for Orocobre, Argentina (2010-2013)

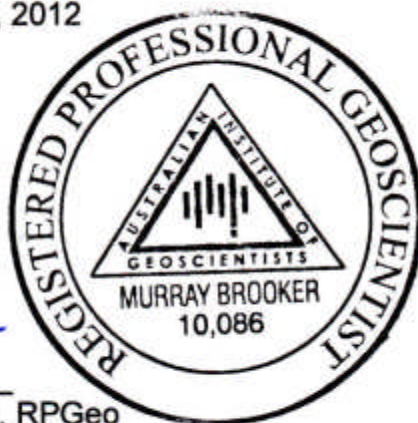
5. I am responsible for the technical report entitled “Technical Report on the Salinas Grandes Lithium Project” (the “Technical Report”) prepared for Orocobre Ltd. and dated effective April 16, 2012. I spent approximately 3 months at the Salinas Grandes project between November 2010 and December 2011, and supervised diamond drilling on the project. My last visit was for a duration of 5 days from the 7th to 11th of December, 2011.

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 1.4 of NI43-101.
9. I have read NI43-101 and Form 43-101F1 (the "form", and the Technical Report has been prepared in compliance with NI43-101 and the form.

Effective date:- 16th Day of April, 2012
Date of signing:- 16th Day of April, 2012



Signature of Murray Brooker M.Sc, RPGeo



Murray Brooker M.Sc, RPGeo.

Amended date:- 12th Day of August, 2013

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

1. I am an independent consultant and owner of Ehren-González Limitada of Pedro Pablo Rubens 2969, 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
I am an independent consultant, a Member of the Australasian Institute of Mining.
3. I have practiced my profession for 16 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 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 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 following brine resource projects:

- Salar de Olaroz for Orocobre, Argentina (2009-2013)
 - Salar de Cauchari for Orocobre, Argentina (2010)
 - Salar Salinas Grandes for Orocobre, Argentina (2010-2013)
 - Salar de Maricunga for Li3 Energy, Chile (2011-2012)
5. I am responsible for section 15 of the technical report entitled “Technical Report on the Salinas Grandes Lithium Project” (the “Technical Report”) prepared for Orocobre Ltd. and dated effective April 16, 2012. I spent approximately a variety of times at the Salinas Grandes project between 2010 and 2012, and supervised diamond drilling on the project.
 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 1.4 of National Instrument 43-101.
 9. 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.
 10. 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:- 16th Day of April, 2012
Date of signing:- 12th Day of August, 2013
Amended date:- 12th Day of August, 2013

A handwritten signature in blue ink, appearing to read 'Peter Ehren', with a long horizontal stroke extending to the right.

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

22 LIST OF ABBREVIATIONS 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 (Argentina) S.A. (“ASA”), Mendoza, Argentina laboratory
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 water (fluid) sample
Brine:	Brine is water saturated or nearly saturated with salts (i.e. sea water, water in salars), whereas fluid refers to freshwater, brackish water and brine
B:	Boron
BGS:	British Geological Survey. Porosity testing and chemical analysis was carried out there for this project
Ca:	Calcium
CaCO ₃ :	Calcium carbonate
Cateo:	Argentine mineral exploration licence
Cl:	Chloride
CO ₃ :	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 – used for chemical analysis
JORC :	Joint Ore Reserve Committee code for reporting of mineral resources
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
Li:	Lithium
Li ₂ CO 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
pH :	Measure of hydrogen ion activity and the relative acidic or basic character of a fluid
ppm:	Parts per million
Pe	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 $Pe = Sy + Sr$
Pt	
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).
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
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