Report of the 6th recognition trip of the argentine Norwest: Arizaro Salt Flat sector

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Introduction

Since the year 2000, the IATE Group of the Observatorio Astronómico de Córdoba (IATE-OAC), in collaboration with the European Southern Observatory (ESO), the Department of Astronomy of the University of Cornell and the Instituto Argentino de Radioastronomía (IAR), are developing a site testing project that aims to characterize the region of North-West of Argentina in order to search adequate places to install great astronomical facilities.

The team searched sites in the region limited by 23 º and 28º of latitude south, and 66º 30' and 69º of longitude West, large more than 200 km by 500 km.

To complement satellite image analysis and seismic information, the team has made six recognition trips to evaluate environmental, logistical and human conditions of the potentially candidate areas (Figure 2).

First trip: San Antonio de los Cobres to the North East of arizaro Salt Flat, Salta province, in October 2000.
(www.eso.org/gen-fac/pubs/astclim/espas/argentina/diego).

Second trip: San Antonio de los Cobres, Olacapato, Pocitos salt flat, Santa Rosa de los Pastos Grandes, Sico and Jama Passes, Olaraz Salt Flat, Susques, in Salta and Jujuy provinces, in January 2002
(www.iate.oac.uncor.edu/sitetesting & www.eso.org/gen-fac/pubs/astclim/espas/argentina/diego)

Third trip: San Francisco pass, in Catamarca province, in October 2002. (www.iate.oac.uncor.edu/sitetesting)

Fourth trip: Antofagasta de la Sierra, Hombre Muerto Salt Flat, Antofalla Salt Flat (north), in Catamarca province, March 2003. (www.eso.org/gen-fac/pubs/astclim/espas/argentina/diego)

Fifth trip: Antofagasta de la Sierra, Antofalla Salt Flat, West of the Antofalla Salt Flat to the Chilean border, Archibarca Range, Quebrada Honda Range, in Catamarca province, May 2003. (www.eso.org/gen-fac/pubs/astclim/espas/argentina/diego)

Sixth trip: The sector of the West and South West Arizaro salt flat, in the Province of Salta, was the last non visited site, then, since September the 3rd to the 10th of 2003, the team (Figure 1) made up of Dr. Marc Sarazin (ESO), Federico Bareilles (IAR) and Eng. Pablo Recabarren (IATE-OAC) visited this sector, as the last stage of the exploration of the whole interesting area.

Figure 1. F.Bareilles, P.Recabarren & M.Sarazin crossing Arizaro salt flat.

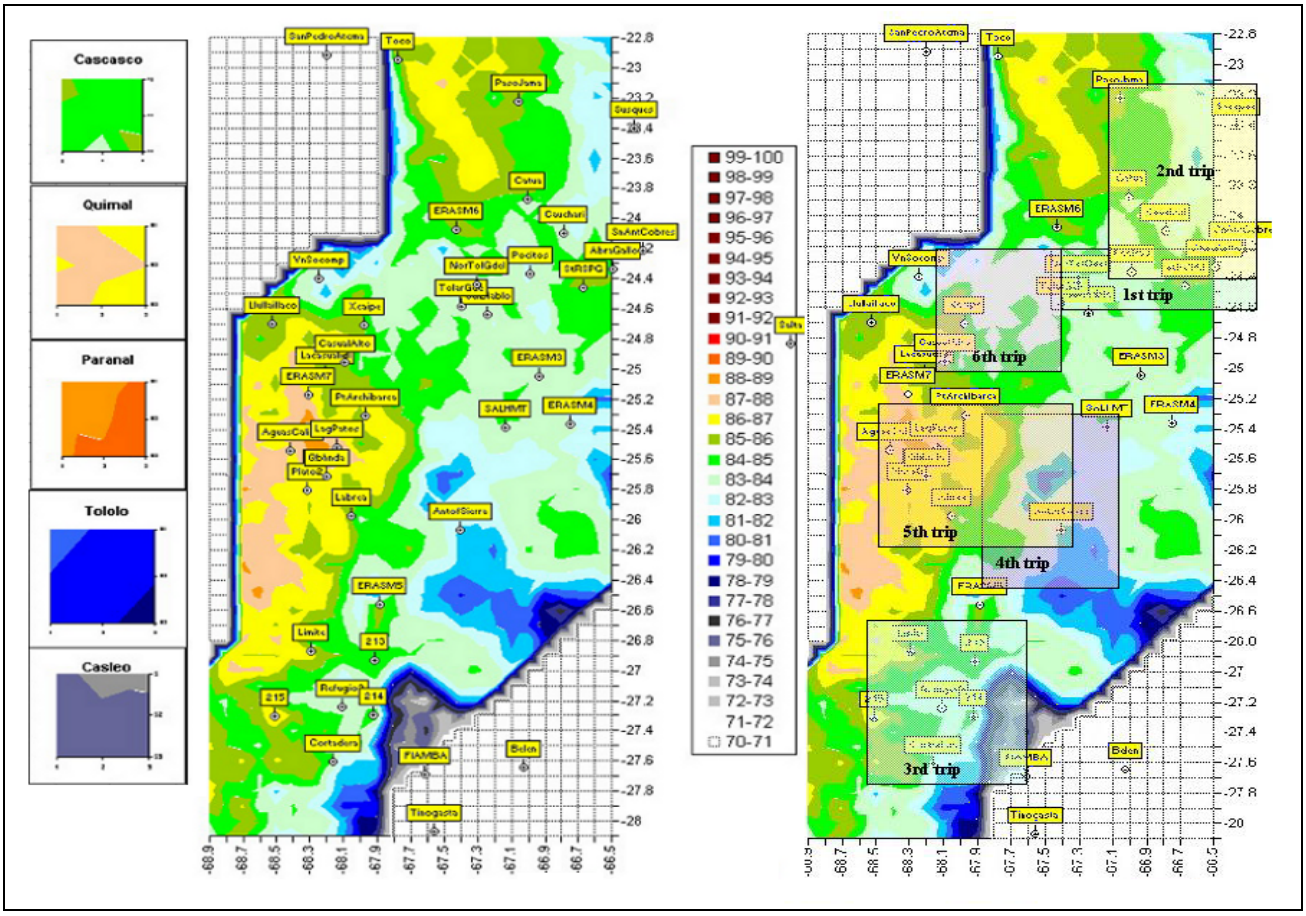

Figure 2. Clear sky distribution and covered areas in each trip.

Developed activities

Chronology

9/3/2003	F.Bareilles travels La Plata – Cordoba.
9/4/2003	F.Bareilles and P.Recabarren travel Cordoba – Salta. They meet in Salta with M.Sarazin.
9/5/2003	the team meets Dr. J.Viramonte, Geologist of the Universidad Nacional de Salta. Trip Salta – San Antonio de los Cobres.
9/6/2003	Trip San Antonio de los Cobres – Salar de Pocitos – San Antonio de los Cobres, (truck troubles in Pocitos).
9/7/2003	Fix truck and trip San Antonio de los Cobres, Salar de Pocitos, Tolar Grande, recognition trip to the north of Tolar Grande, near Macon range.
9/8/2003	Recognition trip to Mina La Casualidad, in the Rio Grande Salt Flat, near the Chilean border.
9/9/2003	Going back trip to Salta.
9/10/2003	Going back trip to Cordoba.
9/11/2003	F.Bareilles goes back to La Plata.

In Salta City, the team meets Dr. José Viramonte, geologist and researcher of the Geoandes Group, of the Universidad Nacional de Salta. He was very interested in the project and provided us important information that involves geological, seismically and meteorological aspects. One of the most remarkable information he mentioned was relative to the called “mega storms”. Mega storms are very strong, but not frequently, windstorms from the WNW to the ESE direction, which probably can produce non-desirables effects in buildings and instruments due the impact of sand and other particles.

Dr. Viramonte offered us logistical support on we have to do on the terrain.

General description of the sector

There are several salt flats in the explored sector. Three of them are located in the visited sector called Arizaro, Pocitos and Rio Grande. Arizaro salt flat is the biggest one in Argentina. The altitude of this sector goes from 3500 m to more than 6000 m on some summits as Mount Queva (6130m). 4000 m is the normal altitude in most of the flat places.

Pocitos and Arizaro salt flats are limited by mountain ranges of more than 5000 m, in a north-south layout. At the East of Pocitos salt flat there is the Mount Queva and toward the West, the Macon range, with 5200 m. This range goes from the southeast of Mount Rincon, in the Chilean border to the south east of Tolar Grande, at the East of the middle of Arizaro salt fat. Following to the south of Macon range there is other mountain group, in the east of the south part of Arizaro that has very interesting places with more than 5000 m of altitude.

At the West side of Arizaro salt flat there is other high mountain range that goes to the west of Rio Grande salt flat where we found the Erasmus 7 site (Erasmus & Sarazin, 2002), near Mina La Casualidad.

From Rio Grande Salt Flat, toward the northwest, we found the Del Llullaillaco salt flat, and mount Llullaillaco, on the Chilean border, the biggest mountain in the area (6700 m). At the north of Llullaillaco there is Socompa Volcano (6030m), in the Chilean border too.

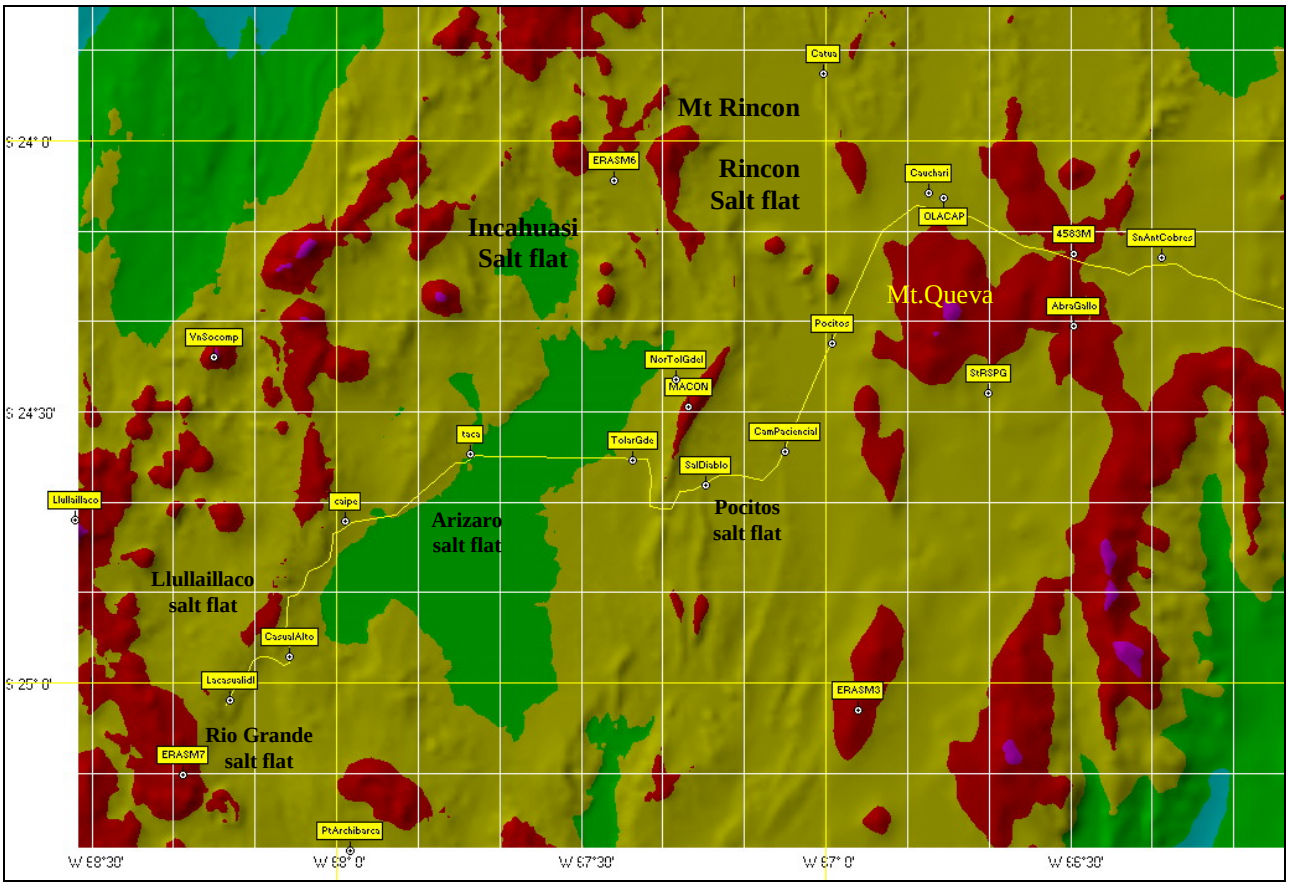

Figure 3. Digital Elevation Modell plot (>2500m, green; >3500m, yellow; >4500m, red; >5500m , violet)

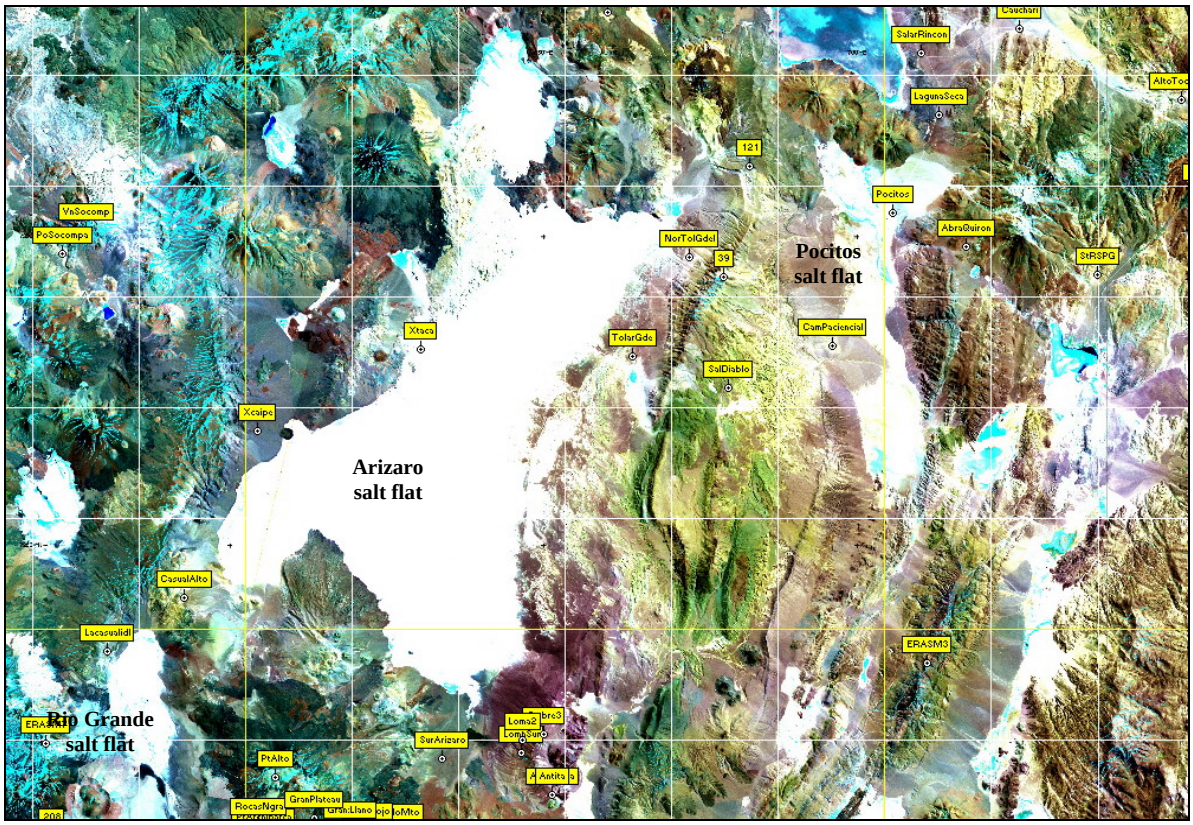

Figure 4. Satellital image of the area

Cities, Towns and Roads.

The main city of this region is Salta, which is the Capital City of Salta Province, located 900 km from Cordoba and 1600 km from Buenos Aires.

Referring to the road map (Figure 5), there is a 120 km paved road from Salta City to San Antonio de los Cobres (SAC, 3781 m, 3200 inhabitants), which is the main town in the trip to Arizaro Salt Flat.

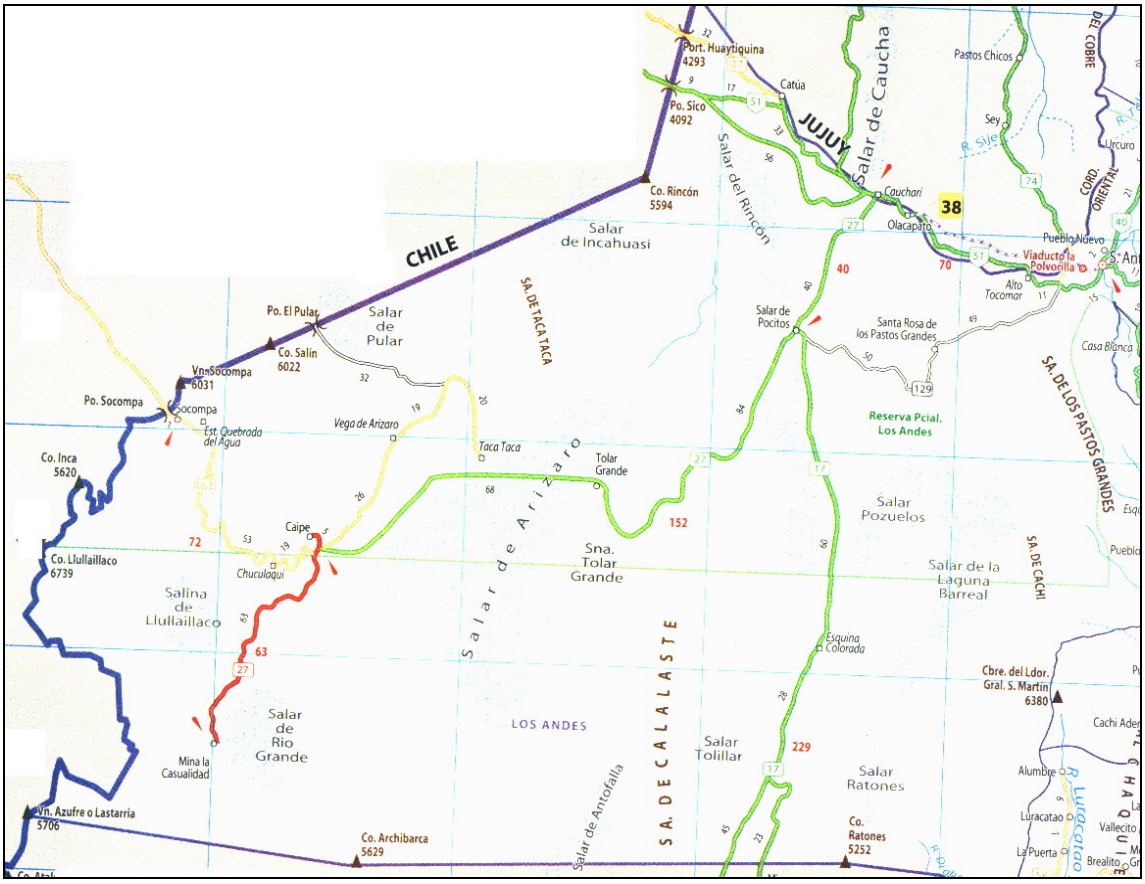

Figure 5. West Salta Road map.

The next towns in the way to Tolar Grande (TG, 3550 m, 152 km) by a non paved road, are Olacapato, (4050m, 65 km from SAC), and Salar de Pocitos (4045m, 110 km from SAC) in the Pocitos Salt Flat, at the east of the Macon range (5050 m), and at the west of the Queva mount (6130 m).

The road in this part goes in a high valley between two ranges, the south part of the Del Cobre range toward the north, and the Queva mount range toward the south.

An interesting place between SAC and Olacapato is Alto Chorrillo(4583 m, 30 km far SAC), near Alto Tocomar, in the map. The road, the railway and a high voltage electric line cross the place.

From Salta to San Antonio de los Cobres, at the side of the road, runs the railway to Olacapato, Salar de Pocitos, Caipe Station and Socompa Station (in the Chilean border), where it links with the Chilean railway net to Antofagasta (Chile).

In Cauchari the road turns to the south, Salar de Pocitos, with 50 inhabitants. In this town there is a road that leaves to Hombre Muerto Salt Flat (see 4th trip) and Antofagasta de la Sierra, toward to the south.

It is possible to reach Salar de Pocitos by the East of the mount Queva, crossing a small town called Santa Rosa de los Pastos Grandes, and crossing for the Abra del Gallo pass, with an altitude of 4800 m.

From Salar de Pocitos there is other road to Tolar Grande, crossing the Pocitos Salt Flat (4000 m), Del Diablo Salt Flat (4200 m) and the Macon range (5100 m).

Macon range is a very interesting candidate site. It runs in north to south direction and has no altitudes at the west near 15 km (Figure 7).

Tolar Grande is a very small village of 70 inhabitants, located between the Macon range and the Arizaro Salt Flat, which offers some facilities to the travelers, as a comfortable refuge (Figure 6) recently made as collaboration between the French embassy and Salta government, and the possibility to buy fuel and food. Tolar Grande is the last chance to supply fuel.

Figure 6. Town Hall refuge, in Tolar Grande

The town hall of the village appreciates the visit of travelers and people who are interested to developed different activities in the area, which can produce any kind of favorable impact in the sector as tourism or job.

Leaving Tolar Grande, and going to the west, we crossed the salt flat to Caipe station (63 km from TG), which is abandoned, and from there, a 63 km well paved road goes to Mina La Casualidad (4100 m), at the south west of Arizaro Salt Flat, at the west side of the Rio Grande Salt Flat.

Figure 7. Tolar Grande square

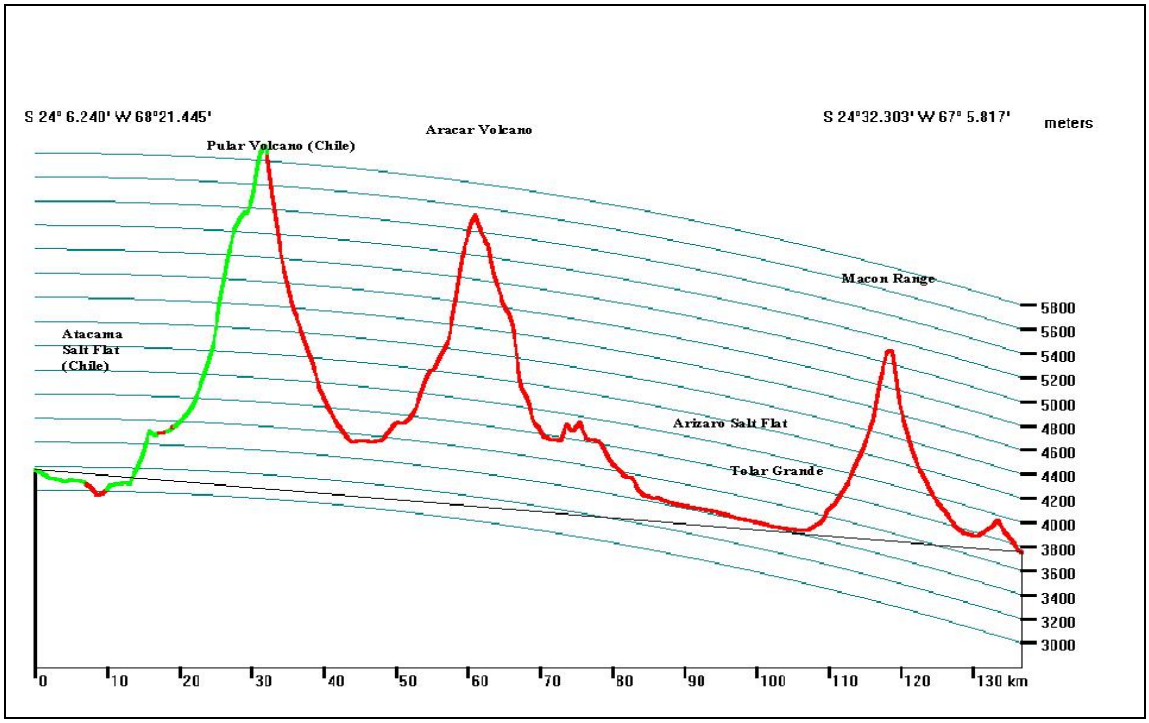

Figure 8. Altitude profile over Tolar Grande, in the direction of the most frequently winds.

Tolar grande is located at the North-East side of the Arizaro Salt Flat. Crossing the flat, we reached two abandoned railway stations, Taca Taca and Caipe. To the west of these places we found mountains with altitudes between 5000 and 6000 m.

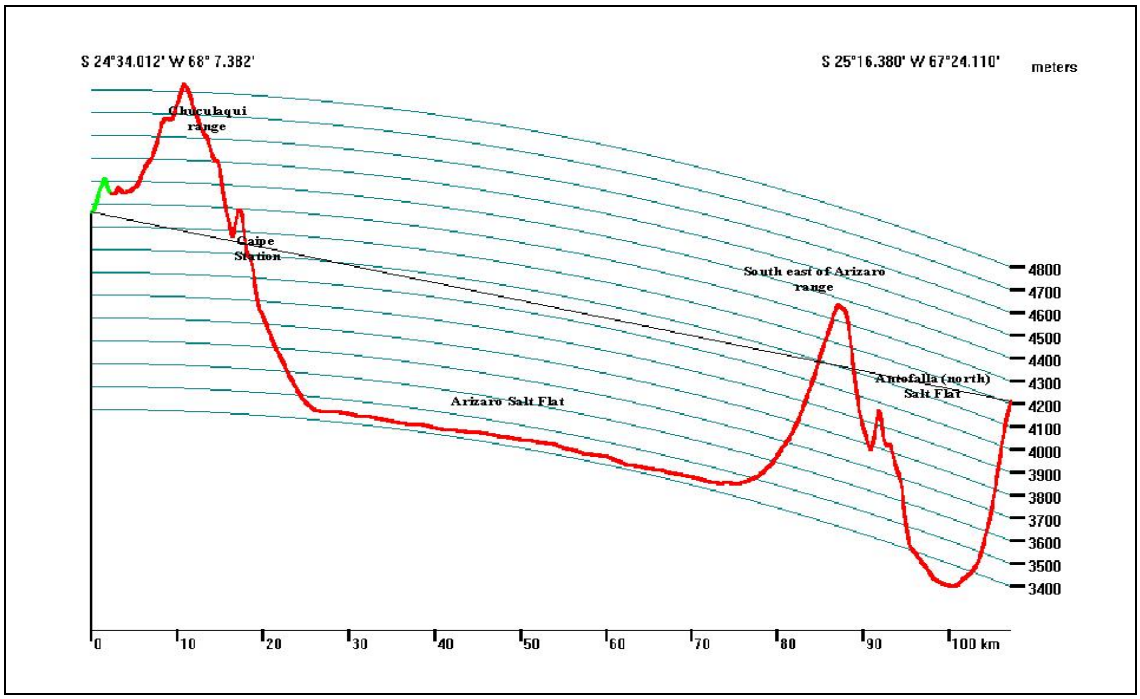

Figure 9. Altitude profile over Caipe, in the direction of the most frequently winds.

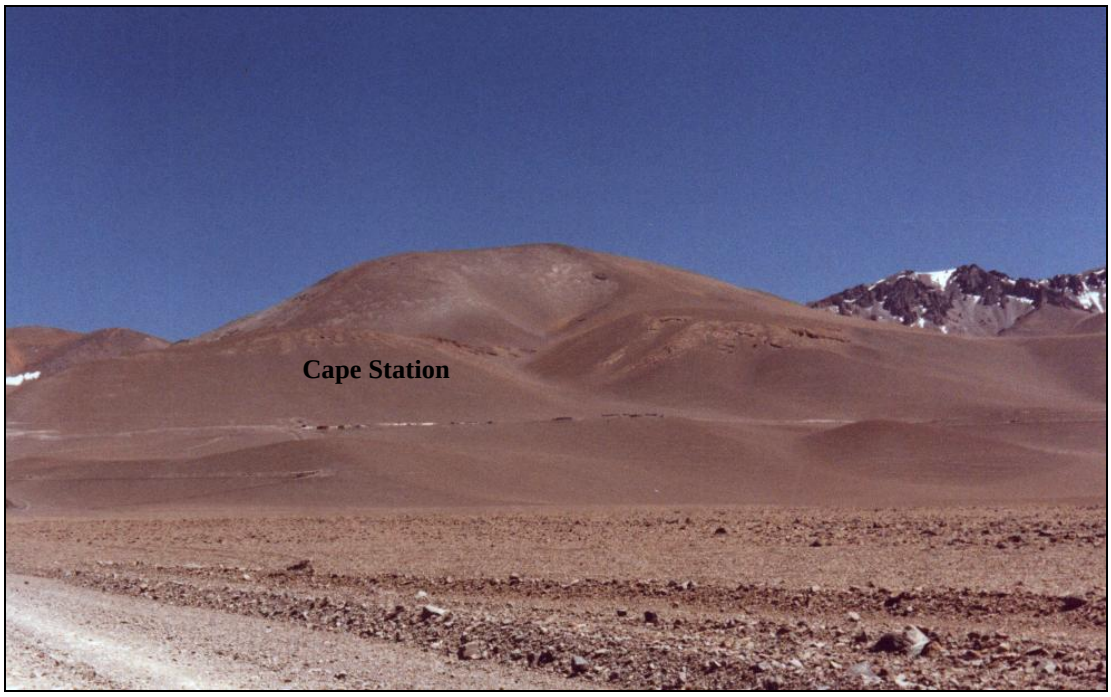

Figure 10. Caipe Station

From Caipe Station (Figure 10), there is a non-paved track to the west, to Socompa pass, in the Chilean border, at the side of the Socompa Volcano (6050 m).

Figure 11. Paved route from Caipe to Mina La Casualidad. In the back, Arizaro Salt Flat and an interesting range to the South East direction of the salt flat and at the north of Archibarca range.

From Caipe to Mina La Casualidad there is a well paved road (Figure 11) that goes at the side of the salt flat to the south, crosses a small range between Arizaro and Rio Grande salt flats, and goes low to the Camp Mina La Casualidad, at the north of the site called Erasmus 7 (A.Erasmus, December 2002).

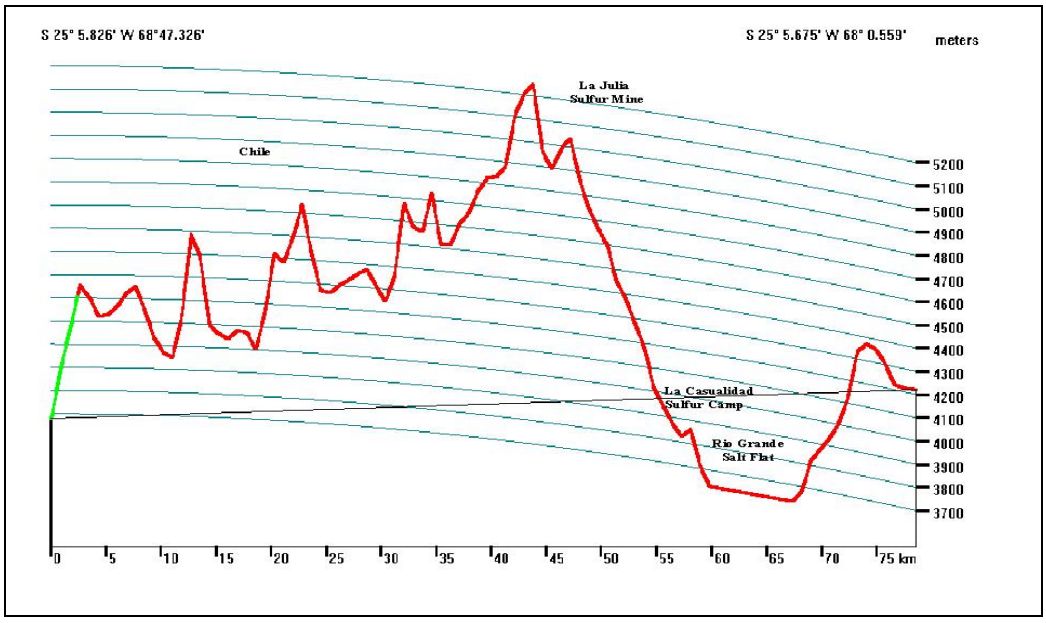

Figure 12. Altitude profile over Mina La Casualidad Camp, and La Julia sulfur mine.

Mina La Casualidad is an abandoned sulfur treatment camp of La Julia sulfur mine, 25 km far of there, in a range of 5496 m with good sky conditions, as Erasmus 7 site, near there (Figure 7).

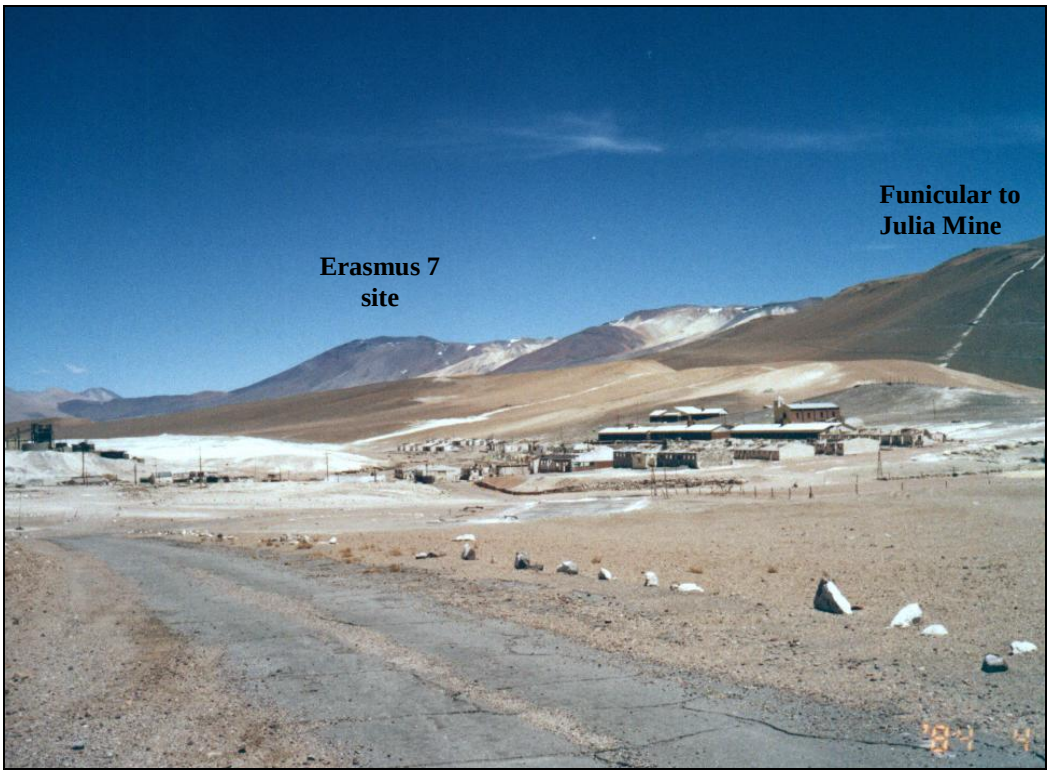

Figure 13. La Casualidad Camp. In the back, Erasmus 7 site.
The white line over the hill, at the back (right) is the funicular to La Julia Mine.

Highlights

We founded three places that should be considered possible candidates in the surveyed area: a) Macon range, at the North of Tolar Grande, b) Mountains at the West of Caipe Station and c) Mountains near Mina La Casualidad, included Erasmus 7 site.

The last two sites have very good sky conditions (cloud covering) and altitude more than 4500 m, but they have problem with the accessibility. The isolated condition in this area has the advantage of minimal light pollution for long time.

Macon range seems to be a good place, but the clear sky plot indicates that it has more clouds than in the West side of the salt flat. The main advantage of Macon range is the proximity with Tolar Grande village, which can provide good possibilities of logistical support.

Seismic activity decreases even we go toward the South, and increases in the sector near Olacapato, Alto Chorrillo and San Antonio de los Cobres, then, mountains at the South-East of Arizaro salt flat seems to be good sites.

Conclusions

The visited sector offers the mentioned potentially candidate places suitable for astronomical facilities. All the sites are located in altitudes of more than 4000 m , and most of them more than 5000m.

Accesibility is not easy, but 4WD vehicules are not needed to reach most of the sites.

There are no good weather registers, so that weather stations are required.

It is important to develop a very good program of seeing measurements to detect areas not afected by turbulence.

References

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