Rescue Experiences in the Chilean Andes - Technical and Mountain Rescue
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1. Chile

Chile is located along the western coast of the southern cone of South America, between the highest section of the Andes mountain chain and the Pacific Ocean. Its shape is unique: it is one of the longest countries in the world, with 4,300 km (2,672 miles) long while also one of the narrowest, with an average width of only 180 km (112 miles). It has every type of climate found on the planet with the sole exception of tropical weather.

The official language of Chile is Spanish, and its currency the Chilean peso. The population is mestizo, a mix of European and indigenous ancestry, whose traditions are still perceived in some parts of the country. According to the 2002 Census, Chile has a population of approximately 16,000,000 inhabitants. The literacy rate is 94%, standing out as one of the highest in Latin America.

Surface
Chile is described as having three geographical areas. The first one, continental Chile, is a long strip of land that runs down the western side of the Southern Cone, extending between parallels 17°29'57" S and 56°32'12" S, mainly from the south-eastern banks of the Pacific Ocean to the highest peaks of the Cordillera de los Andes. It spans 4,270 km (2,653 miles) long, a maximum width of 445 km (276 miles) at 52°21' S and a minimum width of 90 km (56 miles) at 31°37' S. It borders Peru to the north, Bolivia to the northeast and Argentina to the east, totaling 7,801 km (4,847 miles) of land borders, and the Drake Passage to the south.

The second area, insular Chile, is a set of islands of volcanic origin in the South Pacific Ocean: the Juan Fernández Archipelago and the Desventuradas Islands, belonging to South America, and Salas y Gómez Island and Easter Island, located in Oceania.

The third area, Chilean Antarctic Territory, is an area of Antarctica covering 1,250,257,6 km² (7,768,738 sq mi) between the meridians of 53° O and 90° O, over which Chile claims sovereignty, extending its southern border up to the South Pole. This claim was suspended according to the provisions of the Antarctic Treaty to which Chile is a signatory party. As a result, Chile defines itself as a tri-continental country.

Chile’s coastline is 6,435 km (4,000 miles) long and exercises exclusive rights, claims in varying degrees, and sovereignty over a maritime area known as the Chilean Sea. This includes four areas: the territorial sea (120,827 km2), the adjacent area (131,669 km2), the exclusive economic area (3,681,989 km2), and the corresponding continental platform (161,338 km2).

Weather
The unusual north-south extension of Chile, equivalent to crossing Europe from the far north of Norway to beyond the most southern tip of Spain, gives rise to a great variety of climates with the only absence of humid tropical climates. In the North, regions I, II and III have areas where rainfall has never been recorded, such as the Atacama Desert, and others where sporadic rainfall in winter has given rise to an explosion of flowers in spring, a phenomenon known as “Flowering Desert”. In this vast section of the country, the coast has a
moderate climate, with foggy mornings and sunny afternoons. As the altitude increases, temperatures during daytime rise and drop at night. In the highlands (altiplano), temperatures plunge below freezing at night, even during the summer. This season is also known for the “Bolivian Winter”, a phenomenon that brings occasional rain and hail storms.

Further south, between regions IV and VIII, the landscape turns Mediterranean, with valleys and coastlines boasting a temperate climate, well-defined seasons, dry summers and relatively rainy winters. Between regions VIII and X, a mild rainy climate sustains vast native rainforests and a flourishing agricultural industry. In regions XI and XII, the climate is rainy, moderately cold, and especially windy along the coast and the Patagonian pampa. At the far end of the continent, temperatures are lower and there is less rainfall. Easter Island and the Juan Fernández Archipelago enjoy a subtropical climate with pleasant temperatures and moderate humidity that varies very little throughout the year.

1 Government of Chile: www.gb.cl/nuestro-pais/

2 2016 National policy for sustainable mountain management in Chile and action plan by 2030

2. Chilean Mountain ranges

The Andes

The territory of Chile is made up of a high percentage of mountain areas. According to the FAO The Food and Agriculture Organization a specialized agency of the United Nations, 63.8% of the national territory corresponds to mountains. The mountains constitute a fundamental sustenance for the life and economy of the country. They contain the main source of fresh water for the population, as well as a great biodiversity and associated ecosystem services. The lists of attributes that confer such a condition are wide, which is the country with the second largest number of active volcanoes on the planet; that more than 80% of the glaciers in South America are concentrated; that about 60% of the world's temperate rainforest is concentrated; that the largest copper reserves in the world are protected, until in perpetuity it provides us with the protection of climatic screens with the biological consequences that this implies; We have the best spaces worldwide for astronomical observation, and despite the fact that they were occupied by indigenous peoples, they presently have a very low human occupation.

There are two main mountain ranges that run from north to south, the Cordillera de la Costa with maximum altitudes of 3,000 meters and the Cordillera de los Andes, with heights above 6,000 meters and 4,300 kilometers long. In the southern extremes the Andes are complemented by the mountains of the North Ice Field, the highest mountain being Monte San Valentin of 3,910 (12,828 ft) and the South Ice Field, with its highest mountain, the Lautaro Volcano of 3,623 mts. (11,834 ft), in addition to the emblematic Monte Fitz Roy and Cerro Torre, and further south with the Cordillera del Paine mountain range, the Torres del Paine being the best known. Crossing the Strait of Magellan, in Tierra del Fuego is the Darwin mountain range, where Mount Sarmiento is the most emblematic

The Andes are divided into four main areas from north to south. The Northern Andes, with high-rise mountains, mainly volcanic and with many mountains above 6,000 meters (19,685 ft). Its general characteristics are moderate to strong slopes, large scree slopes, very loose rock, presence of some isolated snowfields, and some with snow and ice like the Payachatas. The highest mountain in the area and also the highest in the country is the Ojos del Salado volcano of 6,891 meters (22,615 ft), being also the highest volcano in the world. To the south of this area, there are the Central Andes, a place with more vertical mountains and with the presence of snow and glaciers and with more Alpine characteristics. The rock is mainly Andesite, with few places with granite and sandstone. It is the area where technical mountaineering has developed more, since it is in the area with greater population density in the country. Here the classic south faces (similar to the north faces in the alps) of rock and ice technical climbing stand out, in addition to remote mountains, many over 5,000 and some 6,000 meters, the highest being the Tupungato volcano of 6,570 more. (21,555 ft).
In this area the Chilean mountaineering was forged mainly and where the most difficult alpine climbs were made, with ascents to the south face of the Cerro Morado mountain, south face of the Cerro Arenas mountain, north face of the Zanzi Needle, and south face of the Meson Alto between others. It is in these mountains where the most emblematic alpine climbing and technical accidents have happened.

The southern Andes, is composed of lower mountains, which do not exceed 4,000 meters, being mainly volcanoes, such as the Descabezado Grande volcano of 3,953 meters. (12,969 ft). It is a very good area for randonee skiing and more forest begins to exist at the base of the mountains

Further south are the Andes Patagónicos, with different characteristics, such as the mountains of the South Ice field, remote and mainly of ice, and on the other hand the vertical granite walls of the Torres del Paine. They are not very high mountains, with heights of up to 3,600 meters. (11,834 ft), with virtually no access roads and a permanent common factor, bad weather and high winds.

3. Mountain Rescue System in Chile

In Chile, there are currently several types of search and rescue interventions in the mountains. Wilderness search, mountain rescues, technical rescue, ice and snow and high altitude rescue. The institutions that are in charge of Chilean emergencies are state agencies; SAR of the Chilean Air Force and GOPE of Chilean police, and by civil voluntary agencies the Cuerpo de Socorro Andino (Andean rescue team). In this last time more response agencies are being added.

FACH (Chilean Air Force)
On May 10th, 1950, the Air Search and Rescue Service (SAR) was born in Chile, as a unit dependent on FACH. They search and rescue mainly aircraft and also intervene in mountain rescue, although less and less. It has a national presence.

Carabineros de Chile (Chilean Police)
The Special Police Operations Group (GOPE) is a unit of police that develop and execute high-risk police operations throughout the country. It was created on June 7th, 1979, as a complement and support of the police tasks of the time.
Its functions include: location, tracking and deactivation of bombs and explosives, rescue of people in difficult access places, raids and anti-crime clashes. It has a national presence and began participating in mountain rescues since 1984

Cuerpo de Socorro Andino CSA (Andean Rescue Team)
Created on May 31th, 1949, was born from the Federation of Andinism of Chile for the need to respond to emergencies in the mountains in Chile and is composed entirely of volunteers

ONEMI
The National Emergency Office of the Ministry of Interior and Public Security was created in 1974. ONEMI is the state technical agency, in charge of planning and coordinating public and private resources for the prevention and care of emergencies and disasters.

The people when they are injured in the mountains, call the number 133 that is from the police of Chile or 136, from the Socorro Andino and 103 from firefighters. There is no single emergency number. If you don’t have phone contact, they usually come down for help.
At the call for help, the institutions attend the emergency response and sometimes go up to 3 rescue teams, not knowing each other they were going, because those affected called the 3 emergency numbers, which makes it more of a group responding to the emergency, which generates lack of coordination and problems to operate the rescue

The different rescue interventions vary greatly depending on the area of the Andes where the accident occurs.
A mountain rescue in the Northern Andes, they have the main difficulty of the High Altitude, remoteness, lack of water and roads. This usually involves going in a 4x4 vehicle and then on foot to go to the help of an injured person. Rescuers normally for an emergency of this type are not acclimatized, which increases the risk and at the same time slows the response. If you also have to perform a technical rescue, the weight of the equipment is a great disadvantage, so in general they tend to carry very little equipment and improvise systems according to the circumstances and without having been previously tested or reviewed. The types of emergencies are generally problems with altitude, HACE and HAPE, hypothermia, freezing and falls in isolated snowfields.

In the Central Central Andes it is where more rescue is carried out, since it is close to the capital, place with the highest density of habitants of the country. In this area there are mountains of up to 6000 meters and technical walls, so the types of emergency range from problems with altitude, technical rescue and snow. The difficulties in responding to emergencies are generally due to the difficulty of accessing to the mountains and routes, although in general it can be accessed by helicopter, which are not always the most effective, because the pilots are not well trained to fly in mountain. This year 2019, the Aeropolicicial (police helicopters section) , began an exchange with the PGHM of Chamonix. In recent years the number of emergencies has increased, due to the increase of outdoor sports practitioners. What has increased interventions in low mountain and wilderness environments. This has caused other institutions to be involved in rescue, as is the case of firefighters, with good organizational capacity, but little experience in the mountains.

When a rescue of a climber in a technical wall happens, it is usually a question of intervening in a helicopter (of carabineros de chile), but if it is not possible, again the rescuers must climb on foot with technical equipment, which adds the difficulty of the weight. Those who ultimately carry less technical equipment and therefore systems with less redundancy and safety margin. On the other hand, in general the rock is not very solid, which makes anchoring difficult.

In the Patagonian Andes and especially in the North and South Ice Fields, mountain rescue has the complexity of a remote environment and bad weather, which makes helicopter flights very difficult and therefore the speed of response. In general, climbers who make climbs in this area are experienced, so the accident rate is low, but when there is an emergency the response is usually slow and it is difficult to get there. So it tends to wait for the good weather to access by helicopter, because on feet it could take many days, like any normal expedition.

4. Some statistical data on Mountain Rescues
source: Dario Arancibia - Cuerpo de Socorro Andino 2002
5. Some experiences of Mountain Rescue

• Placa Roja (Red plate)

Route: The Three Stooges, west face of Placa Roja, 300 meters 5.10b
Accident date: December 11th, 2010
Recovery date: December 12th 2010

The accident
The leader of the party was climbing the 3rd pitch of the variant of the route, and reaching the section without bolts, when climbing a dihedral a large block the size of a refrigerator comes off and falls, at the same time the block falls towards a terrace where it breaks and bounces in the direction of the belayer, which was hit by the block in the head dying instantly.
The partner managed to get off the wall after the fall and called warning of the accident to ask for help.

The rescue
Emergency organizations and people who participated: mountain guides, Gope and Socorro Andino.
The initial strategy was for a party climb the route to access from below and from the same belay where the climber’s body was located, lower him and the rescuer with a counterweight system belayed from the base of the route.
The weather was drizzling, so we decided to make the recovery the next day. The strategy was also changed, deciding to climb the normal route, to access from above towards the body and perform an extraction maneuver descending from above (wall pick off).
The next day, we climbed the normal route (mountain guide party), placing fixed ropes for the rest of the team, formed in total of 8 people, who, supported radially from the base, arrived at the appropriate terrace to define the edge transition place to directly access the body from above.
We rigging a main line and belay line, was appointed an edge attendant and a rescuer who will go down connected to one of the ropes and also with a purcell prusik to the interlocking long tail bowlines. It would also carry another purcell to connect it to the body and be able to lower it. The main line was in charge of the Gope (Chilean Police), the belay line in charge of the Socorro Andino, the rescuer also of the Socorro Andino, edge attendant a mountain guide and Control would be in charge of my person. The wall pick-off operation consisted of lowering the rescuer to the place where the body was connecting to the system, then using a jigger on the main line to raise it a few meters, disconnect it from the anchor and then continue the descent to the base of the wall. When the rescuer arrived with the body at the base of the wall, all those who were operating the systems, we retreated a few meters from the edge to avoid the fall of rocks, while the team at the base with the stretcher approached to pack the body and move it. The total lower was about 100 meters. After finishing this stage, we began to de-rigging, then use the fixed ropes to descend. The last ones made the rappels removing the ropes.

**Technical system**

**Anchors:** 3 bolts were installed for the Main line and Rappel chains (bolts) were used for the Belay line

**Ropes:** 2 static ropes were used, one of 80 meters x 10.5 mm and another of 200 meters x 11 mm

**Descent Control Device:** Petzl Rack

**Belay System:** 8mm tandem prusik

- **South face San Gabriel**

Route: Colombiano, 400 meters 5.10a
Accident date: October 22th, 2011
Rescue and recovery date: October 22th and October 23th, 2011

**The accident**

A party of two was rappelling the route when halfway through the wall, one of them prepared to rappel and at the time of hanging, the anchor, which was a stone, was released, falling to the base of the wall, leaving the partner in the middle of the wall and without rope.

**The rescue**

Emergency organizations that participated: climbers, Gope, and Socorro Andino.

A party of climbers ascended until to the person in the middle of the wall, and descended with him in tandem rappel to the base. The Gope arrived at the base of the wall where the body of the deceased climber was found on a terrace near the beginning of the route. The recovery would be carried out by helicopter.

The Sked stretcher was used. Socorro Andino was in charge of the technical systems, for the descent of the
stretcher to the extrac:son site. The descent slope was about 40 degrees. The system operated so that one anchor had the DCD and the other the Belay (Prusik), somehow replicating an "extended rappel." The stretcher had a guide rope ahead to handle it. The stretcher was guided from below, with no person connected to it.

Technical system
Anchors: 2 anchors with removable protection, were installed
Ropes: 80 to 100 meters were used with 2 dynamic ropes joined with knots.
Descent Control Device: Petzl Reverso (picture 1)
Belay System: 1 prusik knot with 6mm cord (picture 2)

• Paine Towers

Route: North Tower of Paine, Monzino route, 650 meters 5.10a
Accident date: February 18th, 2012
Rescue date: February 18th and 19th, 2012.

The accident
A party of two was climbing the Monzino route of the North Tower of Paine. The descent of the route goes along the southern ridge of the north tower and then the Col Bich, a rock couloir with ice depending on the season. During the descent of this couloir they were made at night, so they could no longer see the travers that avoided the steep slopes that lead to the Valley of Silence and each time they were more in slabs of greater slope. To this is added the presence of verglass, for this reason they decided to continue rappelling. In one section the slabs were very icy so the climber who was descending first decided to tie the ends of the rope to the lower anchor for safety. His partner, in the upper anchor, decided to recover a protection and when loading the anchor, he released, falling 60 meters to pass next to his friend and following another 60 meters down where the rope stopped the fall and bumped with his legs suffering a femur fracture.

The rescue
Emergency organizations and people that participated: climbers, mountain guides, Aeropolicial (Carabineros Helicopter) and CONAF park rangers.
Some climbers who were beginning to approach the North Tower heard the calls for help and came to help the injured, including a climbing doctor. They stabilized the person and gave him first aid. His legs were placed inside his backpack and began to descend with the support of a climbing rope (picture 3).
Hours later we arrived with more people and equipment, and especially with a Sked stretcher from CONAF, where we put the injured and began to slide it through the snow (picture 4). When descending to the Valley of Silence, a helicopter was expected to arrive, but finally could not arrive.

We continue advancing with the injured climber through the valley to a place to spend the night and make a vicac. The next morning the helicopter arrived very early and he could take the injured climber just before the bad weather began (picture 5).

**Technical system**

- **Anchors**: Anchors were installed with removable protection in the rock part and body anchor in the snow part
- **Ropes**: dynamic climbing rope, 60 meters
- **Descent Control Device**: Munter Hitch and body belay
- **Belay System**: no present

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**5. Conclusions**

With almost 70 years of organized rescue in Chile, there have been many SAR operations in the mountains, mainly mountain climber falls in non-technical ascents. From the 70s, the most technical rescues began, although very sporadically, the latter being increasingly complex and recurring after 2000 due to the increase in mountaineers, climbers, access to equipment and information.

This has tested the mountain emergency system in Chile and increasingly needs more technification and more reliable systems, both organizational and technical. In the absence of a national standard, or an agency that regulates rescue groups from the technical side, or an association in which the best practices are worked, the technical rescue systems are currently carried out according to the circumstances and the leader in charge, and not necessarily better suited for the job.

What rescue system is best suited to the characteristics of our mountains, and the rescue in them?

A rescue can mean walking several hours, or perhaps days of approach in remote places of high altitude, where a helicopter would not arrive. What kind of equipment to carry in the backpack, what kind of stretcher and what kind of rope? How to anchor on loose ground and on steep or moderate slopes? These are the questions that must be answered in Chile, and thus to be able to have a more integrated and safe system when a technical rescue is carried out.

Looking to the future, the development of a standard will involve looking at other more developed countries in rescue and with similar rescue terrain and characteristics, and testing various systems to define best practices and methods that adapt to light weight and high safety margin.
Annexe - Pictures:

San Gabriel

Picture 1: Lowering system:

Picture 2: Belay System
Paine Towers

Picture 3: Place where the climber injured was found, and the rescue began.

Picture 4: Lowering the injured climber by snow towards the valley of silence
Picture 5: Carabineros Helicopter, rescuing the following day the injured person from the valley of silence.