

AN AVALANCHE TRAGEDY IN CHILE

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Introduction

The Andes enter Chile in the North and extend for 3500 km along the Chile-Argentine border to the Tierra Del Fuego. This report is about an avalanche tragedy that occurred in the central section of the Chilean Andes, near Santiago (Fig. 1), where the mountains rise abruptly and where heavy snowfall produces frequent avalanches of major proportions.

Unlike Europe, where quite densely populated areas are located in avalanche-prone terrain, Chile's avalanche experience is restricted to mining sites, mountain railway and highway routes, hydroelectric plants and ski resorts, where the population density is thin. In this respect, the problems more closely resemble those of Canada and the United States.

Both the San Martin International Highway and the Transandean Railway, that connect Los Andes with Mendoza, are affected by avalanches which have caused death, considerable damage, and additional economic loss due to prolonged closures that have lasted as long as six months of the year.

Likewise, the exploitation of mineral resources has been a challenge for the men who have faced the mountains in search of valuable ore. Remarkable examples of this challenge are the copper mines of Rio Blanco, El Teniente and Disputada of Las Condes; all are operating mines in Central Chile, and all are subject to avalanche hazards of various degrees (Atwater, 1970).

Table 1 summarizes 182 recorded fatalities that occurred in central Chile from 1926-1976. These statistics are probably incomplete. The account of the Caracoles tragedy is particularly well documented¹, and is next discussed in detail.

¹Sources are: Santiago newspapers and magazines (Vea, El Mercurio, Ercilla), Los Andes newspaper (La Aurora), Rancagua newspaper (El Rancaguino), and the book Alive, by P. Read, Lippincott Co., Phil. 1974.

Caracoles, Chile, August 12, 1941

Caracoles (32°50'00" S - 70°06'20" W) is the last of the Chilean Transandean Railway Stations before one arrives at the Argentine border. It is located at the bottom of the Juncalillo River Canyon, at 3198 m. Nearby is the well-known statue of the Christ of the Andes, located among mountains whose higher peaks reach 4500 m.

The Transandean Railway runs along the southeastern slope of this range, 50 m above the bottom of the Juncalillo River Canyon, and is highly exposed to large avalanche paths. There is practically no avalanche-free area in its entire length. The railway has been forced to erect a number of snowsheds to partially solve the problem. The annual average snowfall is 1200 cm.

The Caracoles Railway Station area is affected approximately every 30 years by a huge avalanche whose fracture line runs along the top of the southeast slopes for a length of 2000 m at an altitude of 3829 m. It has a vertical fall of 631 m and a gradient of approximately 30°. The slope over which this slide runs is formed by a glacial moraine on which the final part of the San Martin Highway has been constructed. The mountainous range is cut by the Transandean International Railway Tunnel 3030 m in length.

The railway station was the main building of a small village formed by the Customs House, Railway Terminal Camp, and the Locomotive Repair Shop (800 square meters). These buildings were erected with walls of hand-cut stones set in mortar and likewise reinforced with steel beams. The thickness of the walls was 60 cm. The remains of these destroyed buildings are still standing as a witness of what happened at Caracoles.

During August, the central zone of Chile was subject to one of the worst storms in 15 years. On August 2, 1941, a heavy snow began falling on Caracoles; by the 4th the zone was totally isolated, both highway and railway had been blocked. The railway's telephone system was the only communication available. The railway snowsheds were completely buried by avalanches.

People inhabiting Caracoles at this moment were:

- Julian Veas	Chief, railway station
- Tiberio Montecinos	Railway changing operator
- Ramon Vicencio	Railway labourer
- Manuel Molina	Railway labourer
- Juan Ureta	Railway labourer

- Indalicio Tapia Railway labourer
- Ramon Cortez Radio-operator
- Mrs. Cortez
- Marcelino Tapia Policeman

On Tuesday, August 12th, 1941, the storm was still raging. In the morning at approximately 10:00 a.m., a huge avalanche ran from the Christ of the Andes zone continuing down to hit the Caracoles buildings, smashing and throwing them some 100 m from their original location, carrying the debris close to the Juncalillo River shed.

The avalanche front measured some 200 m in length and covered the area with a depth of nearly 20 m of snow. It cut down everything in its path, including telephone, telegraph and high tension lines.

Julian Veas, the Cortez family, Tiberio Montecinos and Marcelino Tapia, the policeman, were trapped under the destroyed railway station. Ramon Vicencio, Manuel Molina, Juan Ureta and Indalicio Tapia, were buried under the Camp.

The only man able to immediately free himself from the icy prison was Indalicio Tapia, who managed to get out while the building was beginning to disintegrate due to heavy snow load. He then started through the deep snow, almost frozen to death in a nightmare walk of nine hours from Caracoles, passing through the International Tunnel to Las Cuevas, Argentina's first railway station, 7 km away from the scene of the tragedy. In Las Cuevas he was given all necessary care, and he made a phone call through the West Coast Lines to inform Los Andes of what had happened at Caracoles.

One day later, August 13th, a train carrying the necessary rescue patrols and supplies was dispatched from Los Andes, but could only get to Rio Blanco, a small village 30 km from the site of the tragedy. From this village, after the storm finally abated, the rescue party made its way on foot, first to Juncal, then Portillo, and finally arrived at Caracoles.

This army rescue patrol, a well-equipped and trained group, started the evacuation of the neighbouring railway station's personnel of Juncal and Portillo. This was accomplished by shouldering children and oldtimers. The rescue became a nightmare. With no appropriate snowshoes the men sank deeply into the snow. Also they were constantly exposed to avalanche pathways. In this manner, they finally reached Rio Blanco, 24 km below the above places.

Three railway crews of 20 men each walked daily the 6 km from Portillo to Caracoles to work in the rescue operations. They did not wear proper shoes, but used footwear called "tamangos", (Fig. 2) which consisted of a piece of sheepskin covering woollen stockings. Over the sheepskin a canvas was fastened by leather ties to form a boot of sorts. These men had to make an excavation approximately 20 m deep to reach the demolished buildings. This was extremely tedious. (Figs. 3 and 4.)

Work continued through August 14th and 15th. Meanwhile, the rescuers were supplied by both Chile's and Argentina's Air Force planes. On the afternoon of August 16th, at 15:30 hours, the policeman, M. Tapia, was rescued still alive! He was buried for 101 hours under the building's debris and snow! On Monday, August 19th, 1941, the bodies of R. Cortez and his wife were recovered, J. Ureta was rescued still alive, but in such bad physical state that he died a day later while being transported from Caracoles to Juncal. Ureta had survived more than seven days of burial under the avalanche. On Tuesday, August 20th, at 0800 hours, the body of M. Molina was recovered. The following day, the cadaver of R. Vicencio was found. He had been crushed to death against the walls of the Camp Building.

On August 21st, one of the airplanes of the Chilean Air Force assigned to supply food to the rescue groups, was caught by air turbulence and crashed killing the two crew members.

The body of T. Montecinos was finally rescued on August 23rd, at 1830 hours. As later determined, he died because of hunger and asphyxia. He was lying amongst the debris of the coalhouse. It appeared that he tried to escape from the building as the avalanche hit, but was not successful.

The corpse of the Railway Station Superintendent, Julian Veas, was found on October 23rd, 1941, at 1430 hours, as the work gangs opening the railway, preceded by a bulldozer, were approaching the zone of the disaster. The body was located near the railway, outside of the Railway Station, crushed by some of the beams of the building. He had been buried in the snow for 73 days.

Conclusion

It can be inferred that the study of the avalanche paths in the Caracoles area took into account only the more frequent paths. Snowsheds were erected both of brick and wood. All of these have rendered excellent service. It is quite evident that in locating the railway buildings in the

Caracoles area, the people involved in this responsibility overlooked the less frequent, but still hazardous paths. It is evident that climax-type avalanches do exist. They occur periodically with long intervals of time between avalanches. If accurate historical records are not kept, one may forget their magnitude and periodic occurrence.

The same climax-type avalanche again ran in 1972, but it diverted from its normal path. I presume that barriers of rocks and sediments built up by frequent earthquakes in the area, earth moving works when repairing the road, and also rainfall, etc., contributed to this change of path.

Fortunately, the new buildings were not damaged by the avalanche. They were, however, almost wholly covered by the snow. In fact, their new location consisted only of changing their position to the other side of the railway, looking north of the former location.

As a final suggestion, I am of the opinion that, at an international level, the World Meteorological Organization (W.M.O.) should promote the distribution, publication and translation into the major languages of the world all literature concerning avalanches, their prevention, control and forecast. Snow rescue procedures and related subjects, likewise, should be made available to all interested persons.

I also suggest the possibility of a monthly publication by the W.M.O. of all current articles relating to the subject of snow and avalanches. In this way, I think it will be possible to inform thoroughly the majority of people with snow problems of all new developments in the control, prediction, and seriousness of avalanches.

Reference

Atwater, M.M. 1970. Avalanche Problems at Mine Sites. (in Ice Engineering and Avalanche Forecasting and Control.) Proceedings of a conference held at the University of Calgary, 23-24 October, 1969, compiled by L.W. Gold and G.P. Williams, National Research Council of Canada Technical Memorandum No. 98, Ottawa, pp. 99-105.

TABLE 1

Avalanche Fatalities in Central Chile 1926-1976

Place	Fatalities	Province	Year	Type of Centre
Los Maitenes	9	Santiago	1926	Hydroelectrical Pwr. Plant
Juncal (km 57)	3	Aconcagua	1936	Transandean Railway
Caracoles	7	Aconcagua	1941	Transandean Railway
Sewell (El Teniente)	120	O'Higgins	1944	Copper Mine
Lo Voldes	23	Santiago	1953	Mountain Expedition
Rio Blanco	1	Aconcagua	1959	Copper Mine
Portillo	5	Aconcagua	1965	Ski Resort
Disputada Las Condes	5	Santiago	1965	Copper Mine
Rio Blanco	1	Aconcagua	1969	Copper Mine
Tinguirrica Volcano	8	Colchagua	1972	Crashed Plane



FIGURE 1 CENTRAL ANDES OF CHILE AND ARGENTINA



FIGURE 2 RESCUERS WERE HANDICAPPED
BY IMPROPER FOOTWEAR

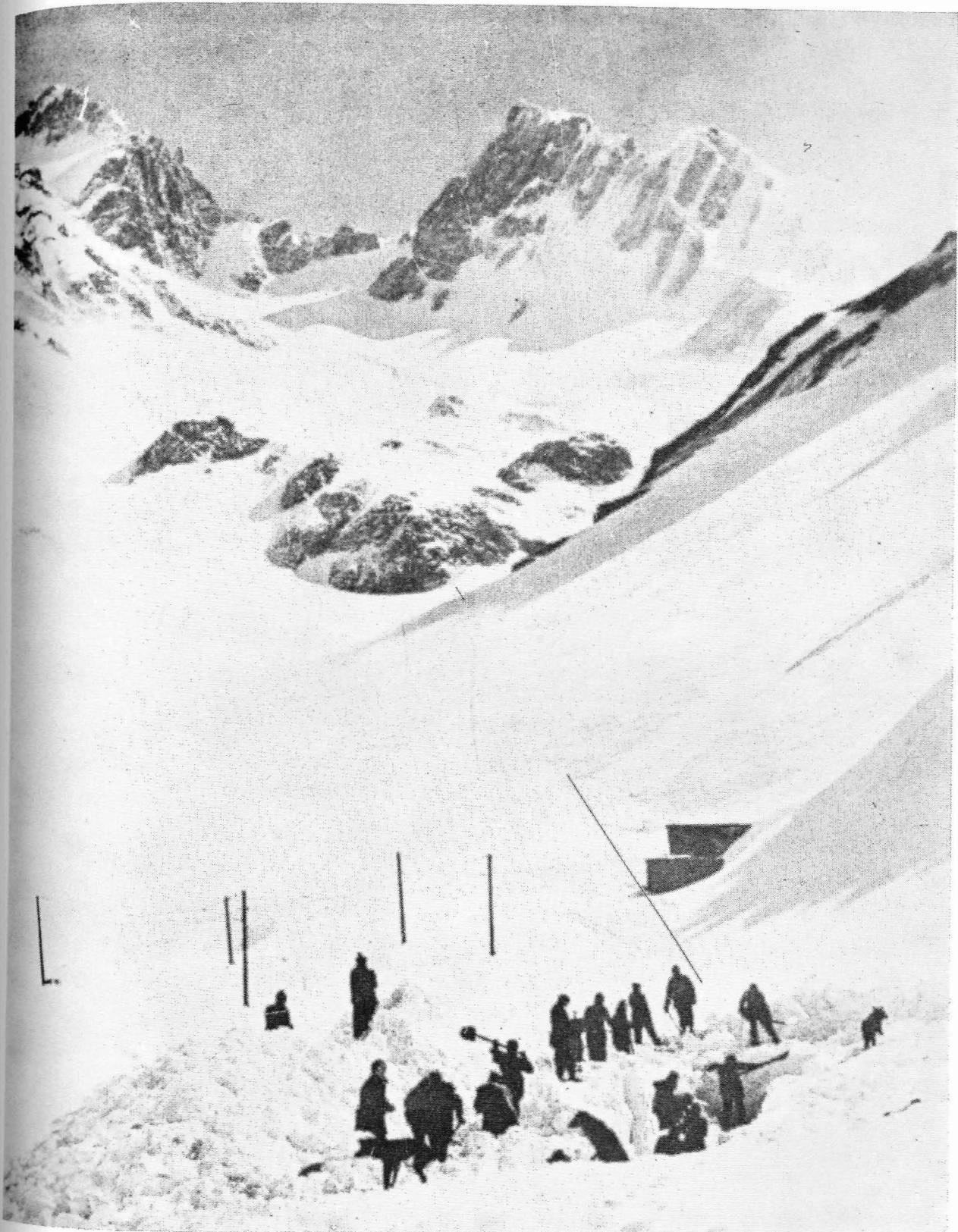


FIGURE 3 BEGINNING OF RESCUE OPERATIONS



FIGURE 4 RESCUERS EXCAVATE 20 m DEEP PITS TO REACH VICTIMS