



International Trans-Antarctic Scientific Expedition

Reports

Publications

Science Plans

Maps

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CHILEAN SOUTH POLE SCIENTIFIC EXPEDITION 2004

Gino Casassa

email: gc@cecs.cl

G. Casassa¹, L. Urrutia², M. Antivil³, P. Carrasco⁴, G. Collao⁵, J. Hernández⁵, C. Iturrieta⁴, J. Quinteros^{6,1}, A. Rivera^{1,7}, J.C. Simões⁸, C. Teitelboim¹, R. Traub¹, R. Zamora¹ and **Patriot Hills Expedition Group**

- 1 Centro de Estudios Científicos, Valdivia, Chile
- 2 Comando de Institutos Militares, Ejército de Chile, Santiago
- 3 V División, Ejército de Chile, Punta Arenas
- 4 Instituto Geográfico Militar, Ejército de Chile, Santiago
- 5 Escuela de Alta Montaña, Ejército de Chile, Río Blanco
- 6 Dirección General de Aguas, Ministerio de Obras Públicas, Santiago, Chile
- 7 Departamento de Geografía, Universidad de Chile, Santiago
- 8 Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Onset of the idea

The expedition started as an early dream shared between Chilean and Brazilian glaciologists. The first possibilities of converting this dream in reality developed during the reopening of the Chilean Base O'Higgins in March of 2003, following an invitation from the Chief Commander of the Chilean Army General Juan Emilio Cheyre. Less than two years later the dream became true, having completed the first Chilean scientific expedition to the South Pole during November and December of 2004.

South Pole Traverse

The 2004 Chilean-Brazilian South Pole Expedition was a highly successful scientific traverse. The tractor convoy covered a total distance of 2410 km, leaving Patriot Hills (80°18' S, 81°22' W) on November 13 and reaching the South Pole on November 30. After an 8-day stay at the South Pole the convoy returned to Patriot Hills on December 31.

A Swedish tractor Berco TL-6 composed of two bodies (front and rear) was used, with a Cummins Euro III B 5.9 Echo engine of 250 HP made in the UK. The tractor pulled two Berco sledges of 6 m and one Berco sledge of 3 m which carried two living modules and the scientific and logistic equipment, with a total convoy length of 30 m. The maximum total load was 20 tons, including the weight of the sledges, modules and fuel, plus a weight of 6.6 ton for the tractor. The convoy cruising speed varied between 7 km/h and 14 km/h with a fuel consumption between 0.2 km/lt and 0.4 km/lt depending on load, slope, snow conditions and elevation. The convoy was self-sufficient on fuel during each stage of the traverse (on the way south and upon the return), with partial refueling at the South Pole.

The traverse group was composed of 13 people on the way south (see Appendix), and 11 people on the way north, 2 people having returned via South Pole-McMurdo-Christchurch. The tractor and sledges were transported from Punta Arenas to Patriot Hills onboard an Ilyushin IL-76 aircraft from Antarctic Logistics and Expeditions (ALE). Part of the personnel, fuel and equipment was transported by means of Chilean Air Force (FACH) Hercules C-130 aircraft. Both aircraft landed on wheels in the blue-ice runway of Patriot Hills.

Ice depth and high resolution shallow soundings were performed along the route by means of a 150 MHz ice depth radar on the way south (on loan from the University of Kansas) and a GSSI SIR 3000 400 MHz snow accumulation radar (on the way north) respectively, with precise position control provided by dual-frequency GPS receivers (on loan from The Ohio State University – OSU, USA). 54 stakes were deployed along the route, being measured by dual-frequency GPS on the way south and again on the way back for deriving glacier velocities. A dual-frequency GPS base station at South Pole was operated by the National Science Foundation (NSF) of USA throughout the period of the tractor traverse, which will be used for processing of kinematic GPS data. Analysis of the radar data, kinematic GPS data, stake positions and heights will provide information on the characteristics of the ice sheet and its stability across the transition from the West Antarctic Ice Sheet (WAIS) to the East Antarctic Ice Sheet (EAIS).

At Lewis Nunatak, Thiel Mountains (85° 41' S, 88°06' W) a geodetic point was installed on rock and measured with dual-frequency GPS for a period of 12 hours, which will provide a baseline measurement for tectonic studies and constitutes as well the southernmost point of the geodetic network of Chile's Instituto Geográfico Militar (IGM). Every 10 km along the route gravity measurements were performed with a Lacoste/Romberg model G gravity meter which in combination with the ice depth data will allow to characterise the crustal structure along the transect, as well as provide data for geoid determination.

One firn core of a depth ranging from 4 m to 46 m was drilled with a Swiss electro-mechanical drill every 2 degrees of latitude, with a total of 225 m of firn samples which will be analysed for their chemical composition. In addition 105 surface snow samples were collected every 10 km along the route under clean conditions. The firn core measurements, to be complemented with the snow accumulation radar data, are a contribution to the International Trans-Antarctic Scientific Expedition (ITASE) programme, sponsored by the Scientific Committee on Antarctic Research (SCAR). These data will allow to characterise in detail the climate change in the last 200 years, since the industrial revolution, and its spatial variability along the traverse route. Firn core processing and analysis will be performed both in Chile, Brazil, and in laboratories in Argentina and Europe.

Patriot Hills

A base camp was established at Patriot Hills by FACH, providing logistic support for airborne operations and for the ground traverse. Two ski-equipped Twin Otter DHC-6 were deployed by FACH at Patriot Hills throughout the entire period as emergency support. A total group of 40 people was stationed at Patriot Hills, with 8 expedition members from the Chilean Army, Centro de Estudios Científicos de Valdivia (CECS) and the Federal University of Rio Grande do Sul (UFRGS) (see [Appendix](#)). In the vicinity of Patriot Hills IGM established 10 reference points on rock for tectonic and mapping studies, each measured for a minimum period of 48 h with dual-frequency GPS equipment (partly on loan from OSU). IGM maintained a dual-frequency GPS base station on rock throughout the complete period of the tractor traverse, which will be used in combination with the South Pole data for differential processing of the GPS data. CECS remeasured with dual-frequency GPS 165 sites on snow and ice around Patriot Hills established in 1997 for computing elevation changes and the equilibrium state of the glacier. At Patriot Hills UFRGS collected 4 surface snow samples and with the collaboration of Dirección Meteorológica de Chile (DMC-FACH) meteorological records of air temperature, humidity and wind were recorded at 3-hour intervals.

Acknowledgements

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Appendix I - Expedition Logbook

Appendix II

Expedition members South Pole traverse

Lorenzo Urrutia D., Chilean Army, Operative Leader, Lieutenant Colonel
Gino Casassa R., CECS, Scientific Leader, Glaciologist
Patricio Carrasco A., Chilean Army, Lieutenant Colonel, Politechnical Engineer
Jorge Hernández C., Chilean Army, Major, Medical Doctor
Miguel Antivil B., Chilean Army, Sergeant, Mechanic
Guillermo Collao F., Chilean Army, Corporal, Driver, Mountain specialist
Carlos Iturrieta P., Chilean Army, Geodesy Engineer
Claudio Teitelboim W., CECS, Physicist
Andrés Rivera I., CECS, Glaciologist
Rodrigo Zamora M., CECS, Electronic Engineer
Jorge Quinteros M., CECS-Dirección General de Aguas, Snow Specialist
Rodrigo Traub R., CECS, cook

Jefferson C. Simões, UFRGS-Brazil, Glaciologist

Expedition members at Patriot Hills

Guillermo Neira B., Chilean Army-CECS, Group Leader, Lieutenant Colonel

Edgardo Ortiz R., Chilean Army, Sergeant, Mechanic

José Fuentes V., Chilean Army, Sergeant, Mountain Specialist

Marco Antonio Pérez H., Chilean Army, Sergeant, Mountain Specialist

Carlos Arriaza P., Chilean Army, IGM, Geodesy Engineer

Germán Aguilera R., Chilean Army, IGM, Geodesy Technician

Felipe Contreras C., CECS, Logistics and Mountain Specialist

Francisco E. Aquino, UFRGS-Brazil, Glaciologist