

Holocene Environmental Change in the Maritime Antarctic. Interactions between permafrost and the lacustrine environment

HOLOANTAR



**REPORT ANTARCTIC CAMPAIGN
JANUARY-FEBRUARY'15**

Summary

HOLOANTAR is a multidisciplinary project in which researchers from the University of Lisbon (Portugal) and the Federal University of Viçosa (Brasil) lead research activities in collaboration with other scholars from the Universidad of La República (Uruguay), University of Alcalá (Spain) and also from several Spanish research organisms such as Centro de Estudios y Experimentación de Obras Públicas (CEDEX), Instituto Geológico y Minero de España (IGME), Agencia Estatal del Consejo Superior de Investigaciones Científicas (CSIC) and Parque Natural de Peñalara.

The project is led by the Institute of Geography and Spatial Planning - Centre for Geographical Studies of the University of Lisbon through the research group Antarctic Environments and Climate Change Research Group (ANTECC). Results of HOLOANTAR project will contribute to the understanding of the landscape evolution and climate changes in the South Shetlands Islands following Holocene environmental evolution in Byers Peninsula (Livingston, Antarctica).

The South Shetlands Islands are located in the northwestern tip of the Antarctic Peninsula, one of the Earth's regions that have experienced a stronger warming signal during the second half of the 20th century. The terrestrial ecosystems in the ice-free areas of this archipelago are supported by permafrost, one of the key components of the cryosphere, as recently defined by the World Climate Research Programme, though the reaction of permafrost to climate change is still poorly known. However, in the recent years a very important effort has been conducted to monitor the thermal state and characteristics of permafrost in order to study its response to the recent warming trend. Our team is involved on several of these long-term monitoring projects (PERMANTAR, PERMANTAR-2, PERMANTAR-3), but HOLOANTAR, in addition, offers a new integrated approach aiming to bridge the gap between contemporary and past changes in permafrost environments.

HOLOANTAR is based on two hypotheses:

- a) A multi-proxy analysis of lake sediments will allow to reconstruct the palaeoecological and palaeoenvironmental evolution in the Maritime Antarctic and the role played in it by permafrost and active layer dynamics,
- b) The detection of activity rates, spatial patterns and geographical controls of contemporary key-geomorphic processes and permafrost distribution, will permit to define their boundary climatic conditions that will be used to interpret the sedimentary record.

Antarctic campaign January-February 2015

Participants

António Correia (University of Évora) - AC

Jesús Ruiz Fernández (University of Oviedo) - JR

Marc Oliva (IP, University of Lisbon) - MO

Dates

Flight to Punta Arenas:

- AC: from Lisbon (Portugal) to Madrid (Spain), 17th January
- JR: from Oviedo (Spain) to Madrid (Spain), 17th January
- MO: from Barcelona to Madrid (Spain), 17th January
- All: from Madrid to Punta Arenas (Chile), 18th January

Punta Arenas: from 18th to 20th January

Departure Punta Arenas-Frei: 20th January

Aquiles ship: 21st to 26th January

Field work: Byers Peninsula: 26 to 31st January

Aquiles ship: 31st January to 2nd February

Field work: Fildes Peninsula: 2nd to 11th January

Frei-Punta Arenas: 11th February

Flight home: 13th February

Logistics

Logistics was supported by the Chilean, Chinese and Uruguayan Antarctic programs.

Chile provided:

- Flight Punta Arenas-Frei (DAP)
- Accommodation and transport by ship to Byers Peninsula.
- Helicopter support.
- Camp equipment (tents, food, WC, fuel, etc.).
- An expert climber to support field work in Byers Peninsula (Pablo Espinoza).

China provided:

- Accommodation at the Great Wall station.

Uruguay provided:

- Flight Frei-Punta Arenas.

Study area

Our research was centred on Byers Peninsula, in the westernmost tip of Livingston island (South Shetland Islands, Maritime Antarctica) and Fildes Peninsula, in King George Island. During the first part of the campaign we stayed in a Chilean camp in Byers Peninsula. The camp was close to the Spanish igloos, which facilitated field work activities and our daily stay in Byers. This area constitutes the largest ice-free area in the South Shetland Islands. It is a protected area in Livingston Island with the largest biodiversity in Antarctica (Toro et al., 2007). Byers has a relatively flat relief with more than 110 lakes/ponds (López Martínez et al., 1996) that started to originate during the Early Holocene, from ca. 8300 cal. years BP to 450-500 BP (Bjorck et al., 1996; Toro et al., 2013). All the activities carried out in Byers were framed within the Management Plan for Antarctic Specially Protected Area No. 126 (Byers Peninsula, Livingston).



Map of Byers Peninsula.

Fildes Peninsula constitutes the second largest ice-free environment in this archipelago. Several bases and facilities are distributed across this area. Between the 2-11 February we stayed at the Chinese base Great Wall. From this comfortable station, we went across all the peninsula looking for cosmogenic and soil samples.

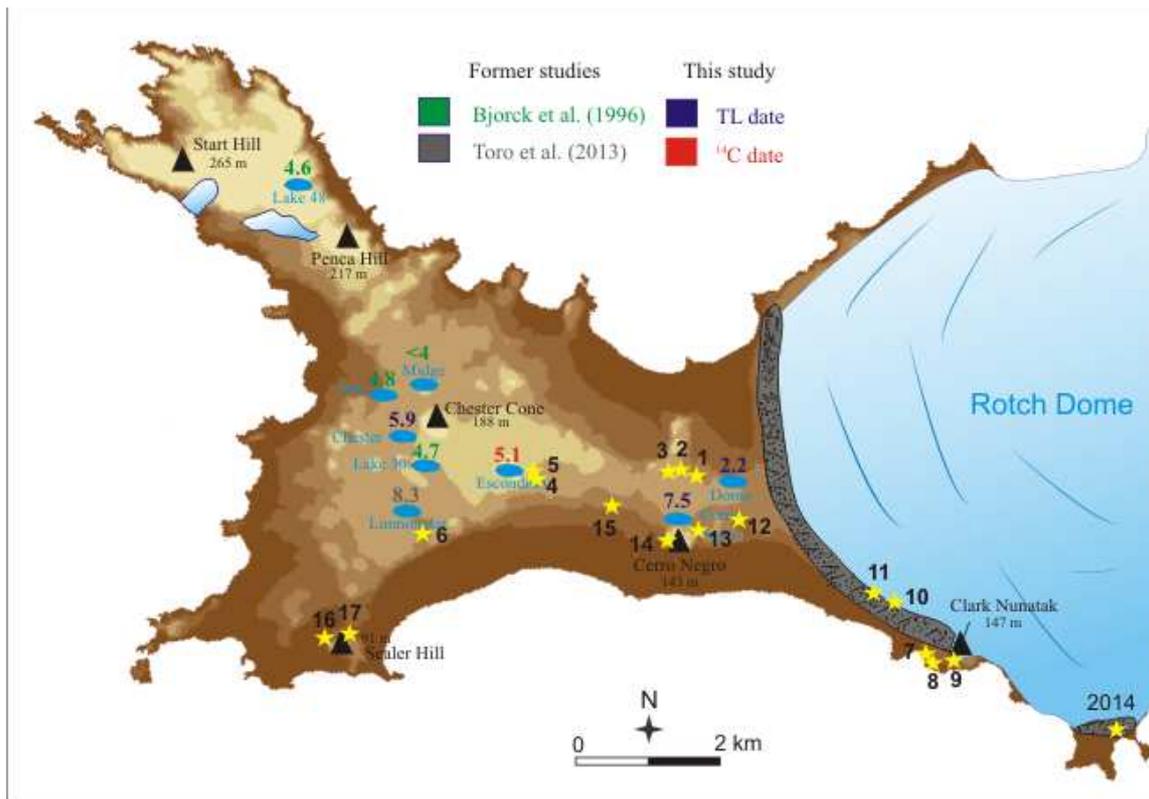


Satellite image of Fildes Peninsula

Tasks conducted

Byers Peninsula

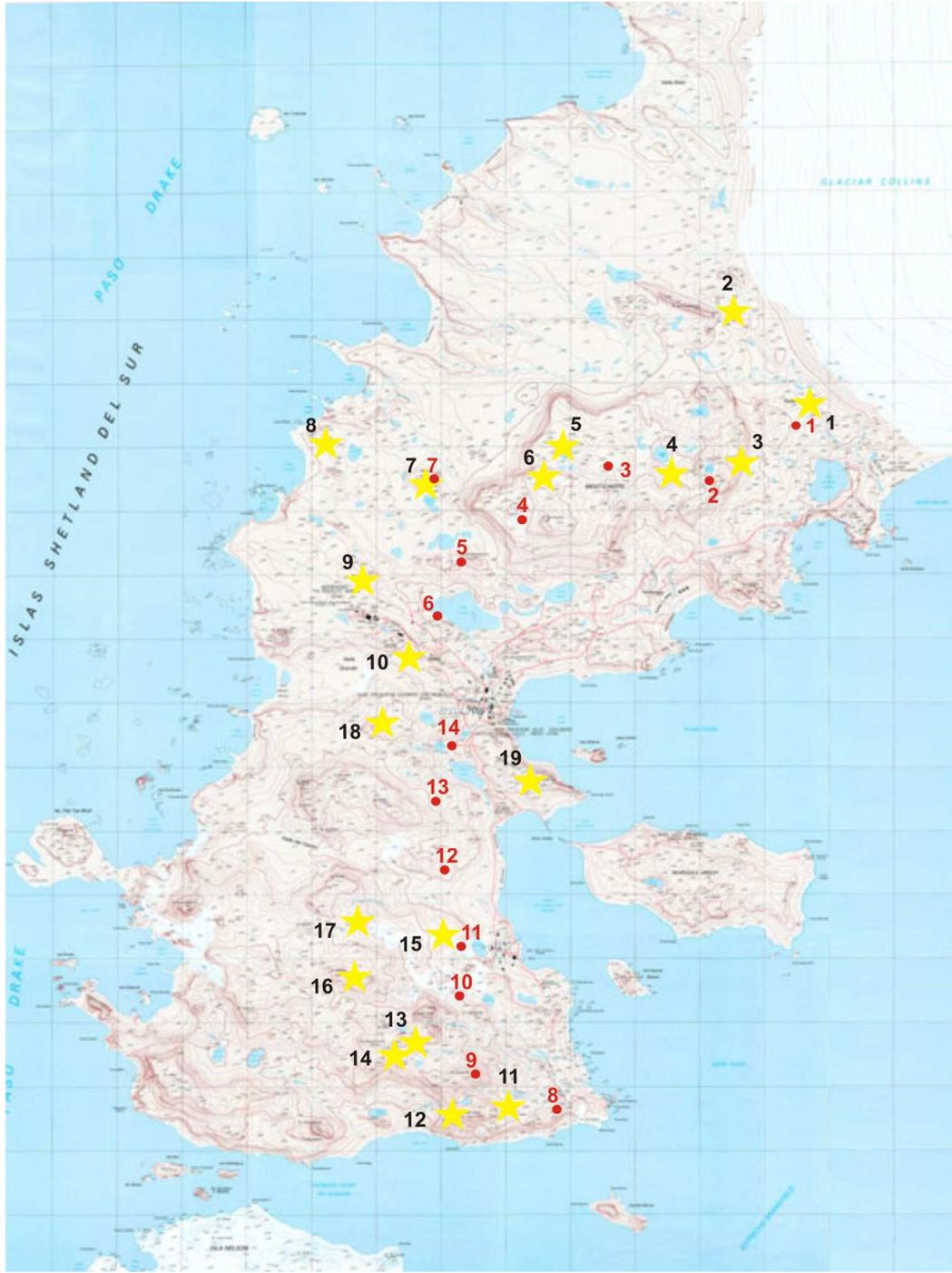
- Download and maintenance of air, soil, interface air-soil and snow depth loggers in Escondido.
- Download and maintenance of air, soil, interface air-soil and snow depth loggers in Cerro Negro.
- Download and maintenance of air, soil, interface air-soil and snow depth loggers in Domo.
- Collection of 17 samples across the peninsula for cosmogenic dating.
- Collection of soil samples for physical (Ana Navas), geochemical (Adrián González) and cryogenic (Augusto Pérez-Alberti) characterization in 16 sites along a transect from the Roch glacier to the western coast.
- Geophysical surveying along the marine terraces in the Southern Beaches area.
- Monitoring of temperatures inside the tent and igloos (Manuel Correia)



Distribution of cosmogenic samples (yellow stars) collected in Byers Peninsula

Fildes Peninsula

- Collection of 23 samples across the peninsula for cosmogenic dating.
- Collection of soil samples for physical (Ana Navas), geochemical (Adrián González) and cryogenic (Augusto Pérez-Alberti) characterization in 14 sites along a transect from the Collins glacier to the southern coast.



Distribution of cosmogenic (yellow stars) and soil samples (red dots) collected in Fildes Peninsula

Activities

We arrived in Frei on 20th January with a DAP flight. We stayed one night in Escudero and went by zodiac to the Aquiles ship. From the 21-26st January we stayed on this ship heading to Byers Peninsula.

Report of activities done in Byers:

Day: 26/01/2014

Weather: Moderate rain, strong wind, 1 to 2°C

Start time: 19 h

End time: 23 h

Activities: We disembark in Byers at 19 h. We set up the tents and go to sleep.

Day: 27/01/2014

Weather: Partly cloudy turning to cloudy with rain, moderate wind, 1 to 3°C

Start time: 9 h

End time: 23 h

Activities: We go to Domo, Escondido and Cerro Negro to collect all the loggers. We also collect samples for cosmogenic dating and soils. AC starts the geophysical surveying in a transect across the marine terraces.

Day: 28/01/2014

Weather: Light rain, moderate wind, 1 to 3°C

Start time: 15 h

End time: 24 h

Activities: We download the data and reprogram all the loggers in the morning. In the afternoon we go to Escondido to collect the last loggers that were hidden under snow.

Day: 29/01/2014

Weather: Moderate rain, sometimes heavy, foggy, strong wind, 1 to 2°C

Start time: 9 h

End time: 24 h

Activities: We cross the peninsula until de Clark nunataks. We collect samples for cosmogenic dating and reinstall all the loggers (except Tinytags).

Day: 30/01/2014

Weather: Moderate rain, moderate wind, 1 to 2°C

Start time: 9 h

End time: 22 h

Activities: We continue the geophysical surveying. We also finish the collection of cosmogenic and soil samples.

Day: 31/01/2014

Weather: Foggy, light rain, moderate wind, 1 to 2°C

Start time: 6 h

End time: 13 h

Activities: We wake up early to pack and prepare all the stuff. We had to carry all the equipment to the beach, where we were finally picked up by helicopter.

After the field work in Byers, we stayed in the Aquiles ship until 2th February. During these days we organized all our data, pictures, documents, etc. Then, we disembarked at Frei. AC flew to Punta Arenas to go back to Portugal. JR and MO go to the Chinese station Great Wall, where they stayed until 11th February.

Day: 03/02/2014

Weather: Sunny, -1 to 3°C

Start time: 8 h

End time: 18 h

Activities: We went to Artigas station to see Ricardo and André Medeiros. Afterwards, we go along the moraine of the Collins glacier and start sampling for cosmogenic and soils. We go across the northern plateau with that purpose.

Day: 04/02/2014

Weather: Foggy, rain, strong wind, 1 to 3°C

Start time: 15 h

End time: 18 h

Activities: Very bad weather, we stayed at the base working during the morning. In the afternoon we went to the southern fringe of the peninsula to collect some samples.

Day: 05/02/2014

Weather: Low clouds, foggy, no rain, 1 to 5°C

Start time: 10 h

End time: 18 h

Activities: We went to the area between the plateau and the airport collecting cosmogenic and soil samples.

Day: 06/02/2014

Weather: Foggy, rain, moderate wind, 1 to 3°C

Start time: 12 h

End time: 18 h

Activities: We went to the area between the plateau and the airport collecting cosmogenic and soil samples.

Day: 07/02/2014

Weather: Foggy, rain, moderate wind, 1 to 5°C

Start time: 9 h

End time: 23 h

Activities: Very bad weather, we stayed at the base working.

Day: 08/02/2014

Weather: Overcast, light wind, 1 to 4°C

Start time: 12 h

End time: 18 h

Activities: We went to the southern plateau to collect cosmogenic and soil samples.

Day: 09/02/2014

Weather: Overcast, light wind, 1 to 4°C

Start time: 12 h

End time: 18 h

Activities: We went to the southern plateau to collect cosmogenic and soil samples.

Day: 10/02/2014

Weather: Overcast, light wind, 1 to 4°C

Start time: 9 h

End time: 20 h

Activities: Last day at the Chinese station. We sealed and packed the samples and the rest of equipment.

We flew back to Punta Arenas on 11th February supported by the Uruguayan Air Force after several hours waiting in Frei due to foggy conditions. One day later we went back to our home countries.



HOLOANTAR researchers after their arrival at Frei
(from left to right: António Correia, Marc Oliva and Jesús Ruiz Fernández).

Holocene Environmental Change in the Maritime Antarctic. Interactions between permafrost and the lacustrine environment

HOLOANTAR



**REPORT ANTARCTIC CAMPAIGN
JANUARY-FEBRUARY'15**