

## Holocene climate variability and ecosystem change in coastal East and Maritime Antarctica (HOLANT)

Duration of the project:       Phase 1: 15/12/2005 – 14/12/2007  
  Phase 2: 15/12/2007 – 14/12/2009

Budget phase 1: 334.202

Keywords: Antarctica, Paleolimnology, Diatoms, Fossil DNA, Fossil pigments, TEX86

### Context

The Earth's climate undergoes significant changes, which are not yet fully understood. Although the Holocene has not experienced climate changes of the same magnitude as during the major Quaternary glaciations, it has been marked by many, often rapid, global temperature and precipitation anomalies. Recently, parts of the Antarctic Peninsula (AP) region have experienced some of the most rapid warming on Earth, whereas a decline in the temperature record was observed in other Antarctic areas. This temperature rise near the AP has already led to ice shelf disintegration and rapid glacier retreat and influenced marine and terrestrial ecosystems. In order to understand how Antarctic temperature variation in inland and coastal areas are interrelated and can impact other regions on Earth, it is necessary to learn from the record of past natural climate variability.

### Project description

#### Objectives

The IGBP project PAGES ([www.pages.unibe.ch](http://www.pages.unibe.ch)) has set up the PEP (Pole-Equator-Pole) traverses 1, 2 and 3 in order to determine past climate changes along continental transects. HOLANT will explicitly extend the PEP 1 transect towards Sub-Antarctica and coastal Maritime Antarctica and contribute to the PEP2 and 3 transects by establishing and comparing a series of high resolution records of Holocene climate variability in coastal Antarctica based upon biological and sedimentological proxies in (coastal) lake sediments.

The specific research questions are:

1. What are the timing, duration and magnitude of Holocene climate anomalies in coastal areas in maritime and east Antarctic regions and how are these anomalies related to climatic events recorded in inland locations (ice cores)?
2. How did Holocene climate changes affect regional ice sheet/glacier dynamics?
3. How did Holocene climate changes affect the diversity of primary producers in Antarctic lakes?

#### Methodology

HOLANT will use biological and sedimentological proxies and seismic surveys to reconstruct past climate changes and the evolution of climatically influenced lake basins in coastal Antarctic and Sub-Antarctic regions. In parallel, we will exploit our newly-developed techniques to study fossil DNA in lake sediments as a tool to reveal the response of the basal food web to past climate anomalies. We will relate the emerging spatio-temporal pattern in climate changes in Antarctica to

changes in regional ice sheet volume and to global-scale climate anomalies during the past 10,000 years.

Interactions between the different partners

The scientific activities are organised into seven work packages (WP). The responsible partner is indicated after each task/work package.

WP1: Field work

- Task 1.1. Coring and sampling of lakes in Maritime Antarctica (BAS, PAE)
- Task 1.2. Coring, sampling and seismic survey of lakes near Syowa Oasis (PAE, BAS, RCMG)
- Task 1.3. Coring, sampling and seismic survey of lakes on Kerguelen Archipelago (RCMG)

WP 2: Establishment of sediment chronology from cores (BAS, PAE)

WP 3: reconstruction of past climate changes using sedimentological and biological proxies in lake-sediment cores

- Task 3.1. Sedimentological parameters as indicators of past changes in the main sediment input processes of the lake (RCMG)
- Task 3.2. Diatoms as indicators of past changes in productivity and in the precipitation-evaporation balance (PAE)
- Task 3.3. Reconstruction of changes in lake productivity using fossil pigments, the microfossil record and loss on ignition (BAS, PAE)

WP 4: development of relative sea-level (RSL) curves and reconstruction of the deglaciation history (BAS, PAE)

WP 5: fossil DNA to reveal the response of the basal food web to past climate anomalies (CIP, PAE)

WP 6: reconstruction of regional climate change and integration with other regions (all partners)

WP 7: valorisation of the expected results (all partners)

Link with international programmes

HOLANT is closely integrated with three international research programs, namely the BAS CACHE program ([www.antarctica.ac.uk/BAS\\_Science/programmes2005-2010/CACHE/projects/PEP/index.html](http://www.antarctica.ac.uk/BAS_Science/programmes2005-2010/CACHE/projects/PEP/index.html)), the Japanese Antarctic Research Expedition REGAL project and the French PEISACG program. HOLANT will also contribute to IPY research proposal MERGE ([www.ipy.org/development/eoi/proposal-details.php?id=55](http://www.ipy.org/development/eoi/proposal-details.php?id=55)) and to the new SCAR EBA program ([www.scar.org/researchgroups/lifescience/eba](http://www.scar.org/researchgroups/lifescience/eba)). On a wider international level HOLANT will contribute to the IGBP PAGES PEP 1, 2 and 3 programs.

Expected results and/or products

1. Primary research papers which will appear in front-line journals. The project will present data to the scientific, political and public communities at the occasion of international and national meetings.
2. The data on the distribution of organisms will include:
  - 16S/18S rRNA sequences of fossil cyanobacteria and protists from selected layers of cores that show evidence of transitions
  - Biological and limnological data of c. 50 lakes in Antarctic Peninsula and Syowa Oasis
3. High resolution paleoclimate and relative sea-level reconstructions from different regions in Antarctica
4. A HOLANT website with contact information and providing an overview of our scientific results.
5. Vulgarisation and valorisation actions within the framework of the International Polar Year 2007-2008 and existing networks, such as BE-POLES. These actions will include the contribution to the project websites, attending meetings and workshops organized for students.

## Partners

### Activities

#### 1. PAE (UGent) - coordinator

The research group of Prof. Wim Vyverman studies the biology, biodiversity, and functioning of protists in freshwater and marine ecosystems and uses biological proxies in paleolimnological studies.

#### 2. CIP (ULg):

Dr. Annick Wilmotte studies the molecular evolution and taxonomy of cyanobacteria. She has research experience in the isolation, cultivation, and characterisation of cyanobacteria by phenotypic and genotypic methods.

#### 3. RCMG (UGent):

The research group of Prof. Marc De Batist has gained a worldwide reputation as one of the leading research groups in the field of reflection seismic investigations at sea and on lakes.

#### 4. BAS (UK):

Dr. Dominic Hodgson is head of the Ecology and Evolution Section, Biological Sciences Division at BAS and project leader of the CACHE-PEP science programme to study past climate change in Antarctica.

## Contact Information

Project website : <http://www.HOLANT.UGent.be>

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