

PRIME MINISTER'S SERVICES

SCIENCE POLICY OFFICE

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**ANTARCTIC TREATY
EXCHANGE OF INFORMATION
IN ACCORDANCE WITH
ARTICLES III(1) & VII(5)
AND RECOMMENDATION VIII(6)**

***BELGIAN ANTARCTIC ACTIVITIES
PLANNED FOR 1993-94***

Brussels - November 1993

CONTENTS

INTRODUCTION	1
ACTIVITIES FOR 1993-94	2
I. DETAILS OF SHIP, AIRCRAFT AND OTHER VEHICLES	2
II. EXPEDITION ITINERARY	2
III. DETAILS OF STATIONS	2
IV. PERSONNEL	2
V. PERSONAL ARMAMENTS	3
VI. PROGRAMME OF WORK	3
VII. SCIENTIFIC EQUIPMENT	6
VIII. TRANSPORTATION FACILITIES AND COMMUNICATION EQUIPMENT	7
IX. FACILITIES FOR RENDERING ASSISTANCE	7
X. NOTICE OF EXPEDITIONS TO THE ANTARCTIC NOT ORGANIZED BY THE PARTY BUT ORGANIZED IN, OR PROCEEDING FROM, THE PARTY'S TERRITORY	7
XI. DESCRIPTION OF UNOCCUPIED REFUGES	7
XII. ANNUAL RETURN OF THE NUMBER OF EACH SPECIES KILLED OR CAPTURED ..	7
XIII. NOTICE OF INTENDED USE OF RADIO-ISOTOPES IN SCIENTIFIC INVESTIGATIONS	7
XIV. NOTICE OF INTENDED USE OF SCIENTIFIC ROCKETS	7
XV. NOTICE OF OCEANOGRAPHIC RESEARCH SHIPS	8
XVI. REPORTS OF ACTIVITIES OF TOUR ORGANIZERS	8
SCIENTIFIC LEADERS	9
PROGRAMME'S RESPONSIBLE AUTHORITY	9
ABBREVIATIONS AND ACRONYMS	10

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INTRODUCTION

The research projects of which 1993-94 field activities are presented in this report form part of the Third Phase of the Belgian Scientific Research Programme on the Antarctic (1992-95). The implementation and management of it are assigned to the Science Policy Office.

This co-ordinated multi-annual research effort aims at contributing to the development of the knowledge required for a science-based conservation and management of the Antarctic environment and to the assessment of the mechanisms through which the Antarctic and the global climate interact. With a concern of effectiveness, the Programme focuses on some of those scientific topics internationally recognized as first-order priorities in line with that goals. Emphasis is given on a multi-disciplinary approach of the dynamics of the global functioning of Antarctic main natural systems and of their evolution and interactions, making use of mathematical modelling.

The research work addresses the following topics:

- ECODYNAMICS OF THE SOUTHERN OCEAN AND INTERACTIONS WITH THE CLIMATE
 - Biogeochemical fluxes and cycles in the main trophic compartments
 - Development of tools for modelling the global dynamics of ecosystems
 - Assessment of the role of "new production" in the burial of atmospheric CO₂
- EVOLUTION AND PROTECTION OF MARINE ECOSYSTEMS
 - Application of predictive ecological models to simulate the response of the ecosystem to climatic disturbances connected to human activities
 - Mathematical modelling of the dispersion of hydrocarbons spills
- ROLE OF THE ANTARCTIC IN GLOBAL CHANGES
 - Ocean-Atmosphere-Cryosphere interactions
 - Sedimentary palaeo-environment

Since the beginning of the Programme the Belgian research teams got closely involved in an international network of co-operation up to the point that for now, joint-research projects are being commonly implemented with other Antarctic Treaty member countries.

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ACTIVITIES FOR 1993-94

I. DETAILS OF SHIP, AIRCRAFT AND OTHER VEHICLES

No national Belgian expedition will go to Antarctica in 1993-94. Belgian scientists will participate in campaigns organized by other countries.

II. EXPEDITION ITINERARY

Nil.

III. DETAILS OF STATIONS

Nil.

IV. PERSONNEL

A. SUMMER PERSONNEL

<u>Name</u>	<u>Period</u>	<u>Discipline</u>	<u>Affil.</u>	<u>Expedition, Organizer</u>
J.-L. Tison	Oct 93 - Jan 94	Glaciology (Project A3/11/002)	ULB	Terra Nova base Italy
Ph. Bart M. De Batist E. Van Heuverswyn	Nov 93 - Dec 93	Marine Geophysics (Project A3/02/002)	UG	GEBRA 93 R/V Hesperides Spain
F. Dehairs L. Goeyens M. Semeneh	Jan 94 - Mar 94	Marine Biogeochemistry (Project A3/03/001)	VUB	ANTARES 2 M/V Marion Dufresne TAAF, France
Ch. Lancelot P. Menon	Jan 94 - Mar 94	Marine Ecology (Project A3/11/001)	ULB	ANTARES 2 M/V Marion Dufresne TAAF, France
E. Maes W. Versteeg	Jan 94 - Mar 94	Marine Geophysics (Project A3/02/002)	UG	ANT XI/3 R/V Polarstern AWI, Germany
M. Beghyn S. Vanhove	Jan 94 - Apr 94	Marine Ecology (Project A3/02/001)	UG	Signy base BAS, UK
J.-H. Hecq	Feb 94 - Apr 94	Marine Ecology (Project A3/12/001)	ULg	Magellan 94 Chile, Italy

B. WINTER PERSONNEL

Nil.

V. PERSONAL ARMAMENTS

Nil.

VI. PROGRAMME OF WORK**A. RESEARCH PROJECTS OF THE SUMMER PARTY**

1. Project A3/03/001 (VUB) - Scientific Leader: Dr F. Dehairs
Seasonal variability in biogenic elemental fluxes in the Southern Ocean with special emphasis on export flux:

Measurement of nitrate and ammonium profiles in the upper 200 m of the water column (11 stations). Assessment of the spatial variability in nitrogen uptake behaviour of the different algal communities by incubation experiments of size fractionated samples taken at different depths in the euphotic layer (10 stations). Analysis of the $\delta^{15}\text{N}$ variability in suspended organic matter and comparison with nutrient regime and population structure. Characterization of micro-zooplankton feeding on labelled phytoplankton to evaluate the nitrogen translocation into higher trophic levels. Sampling of phytoplankton (for home-laboratory determination of assemblages). Elemental analysis of Ba, Ca, Sr, Al, Si, POC, $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ in total suspended matter (10 stations) and sediment trap material collected between 0 and 600 m depth including the oxygen minimum depth (3 stations). Three areas of the Indian sector of the Southern Ocean will be compared in all the above respects: the Polar Front, the open ocean and the marginal sea ice zone.

2. Project A3/11/001 (ULB) - Scientific Leader: Dr Ch. Lancelot
Dynamics of the planktonic microbial food-web of the Southern Ocean in response to environmental changes:

Physiological parameters characterizing the photosynthesis and growth of large diatoms and nano-sized algae will be determined through a method combining radiocarbon techniques and biochemistry. The selective uptake of nitrate and ammonium associated with the growth of different populations of phytoplankton will be investigated in collaboration with project A3/03/001. Protozoa grazing on micro-algae and bacteria will be measured by means of direct microscopic examination and flow cytometry based on fluorescent-labelled preys method. The relative part of protozoa and bacteria in total ammonium microbial regeneration will be determined based on joint ^{15}N dilution and protozoan and bacterial activity field experiments conducted in parallel on the same samples (in collaboration with project A3/03/001).

3. Project A3/12/001 (ULg) - Scientific Leader: Dr J.-H. Hecq
Control of the Antarctic pelagic ecosystem by higher trophic levels in relation to variations in environmental conditions

Suspended particulate organic matter will be sampled along subsurface horizontal profiles and along the seawater column down to 600 m. Subsamples of micro-, meso- and macro-zooplankton and of fecal pellets will be obtained by selective filtration of particulate matter samples. Vertical distribution and migrations of main zooplankton groups will be determined in function of the main physico-chemical parameters characteristic of the dynamics and nutrient regime of the waters of the Magellan Strait. Phytopigments and their degradation products (mainly phaeophorbids) will be analyzed by HPLC technique in total suspended matter, in fecal pellets and in zooplankton stomachal content. Rates of ingestion and assimilation of phytoplankton by zooplankton will be calculated from phytopigments data in stomachal content and in fecal pellets. Rates of ammonium excretion by the various classes of zooplankton will additionally be determined by colorimetry. These data will be used to develop an ecological 1D mathematical model aimed at describing the role of grazing in the exportation of the primary production in the pelagic food web of the Southern Ocean.

4. Project A3/02/001 (UG) - Scientific Leader: Dr M. Vincx
Role of the meiobenthos in Antarctic ecosystems:

Determination of the seasonal nature of secondary production of meiobenthos by determining the densities and the biomass of the total meiofauna and the composition of the species of nematodes from samples taken every fifteen days during the summer period. Flux of organic matter through the benthic systems (e.g. grazing experiments). Determination of the in situ respiration of the meiobenthos by means of the "bell jar" method. Quantitative and qualitative determination of the amount of organic matter (POC + DOC) and nutrients in the sediments, in relation to the distribution of the meiobenthos in these sediments, and determination of the contribution of the meiobenthos to the remineralization processes (correlations to be determined in vertical profiles between biotic and abiotic variables).

5. Project A3/11/002 (ULB) - Scientific Leader: Prof. R. Souchez
Isotopic and chemical composition of Antarctic shelf ice: implications for global changes:

The project aims at studying three properties of marine ice accreted at the bottom of ice shelves, which provide information on the conditions prevailing at the ice shelf/ocean interface and on the dynamic response of ice shelves to changes in boundary conditions related to man-made climatic changes. Ice cores will be drilled into Hell's Gate ice shelf in order to sample sea ice accreted at the bottom of the shelf. Ice slices from the cores will be analyzed at home-laboratory for:

- stable isotopes ($\delta^{18}\text{O}$, δD) by mass spectrometry
- major cations (Na, K, Ca, Mg) by AAS
- major anions (chlorides, sulphates) by ionic chromatography
- crystallographic texture and c-axis by light microscopy.

The isotopical and chemical data will be used to reconstructing the origin of waters (i.e., melting from sea ice or from continental glaciers or ice sheet) that have frozen at the interface between the ice shelf and the sea. The type of the sea ice (e.g. frazil ice or congelation ice) will be determined on the grounds of the crystallographic data, allowing to provide further information on the mechanisms of shelf accretion.

6. Project A3/02/002 (UG) - Scientific Leader: Dr M. De Batist BELANTOSTRAT:

a. GEBRA 93 - Bransfield Strait and South Shetland Islands:

Acquisition of seismic profiles, complementary to the existing international data base (ANTOSTRAT) using various systems (medium-resolution airgun profiles, high-resolution sparker profiles and sub-bottom profiles) in order to establish the structural context and a detailed sequence stratigraphic picture of the sedimentary infill of a young extensional basin in a glacial environment.

b. ANT XI/3 - Bellingshausen Sea and Amundsen Sea:

General geophysical reconnaissance. Acquisition of combined refraction/deep reflection seismic profiles in order to determine the overall crustal structure of the continental margin. Acquisition of medium- to high-resolution reflection seismic profiles (airgun array and watergun) on the continental shelf and adjacent slope, in order to assess the structural and stratigraphical evolution of the margin and its palaeoclimatic signature.

B. RESEARCH PROJECTS OF THE WINTER PARTY

Nil.

VII. SCIENTIFIC EQUIPMENT

A. Marine Biogeochemistry and Marine Ecology (ANTARES 2):

- Natural fluorescence and PAR profiling system Biospherical
- Spectrophotometer Bausch & Lomb
- 30 L Niskin bottles (6)
- On-deck plankton incubation system (nitrogen metabolism)
- Controlled-light on-deck plankton incubation system (carbon metabolism)
- Epifluorescence microscope
- Controlled-temperature centrifuge
- Controlled-temperature incubator (protozooplankton grazing)
- Vacuum pressure pumps
- Sampling manifold
- Hollow fibre filter Amicon with peristaltic pump
- Cryostat Locator
- Large volume filtration systems (2)
- Large volume phytoplankton size-separating system
- Vacuum membrane filtration unit
- Quantum Licor light sensor with automated data acquisition system
- Laptop and desktop micro-computers (4)

B. Marine Ecology (Magellan 94):

- HPLC
- Vacuum pressure pumps (2)
- Laptop micro-computers (2)
- Filtration systems (2)

C. Glaciology (Terra Nova base):

- RAND ice corer with 50 m extensions
- SIPRE ice corer with 50 m extensions

D. Marine Geophysics (GEBRA 93):

- High-resolution seismic profiling system with CENTIPEDE and 12-electrode sparker, with 100 m 8-channel streamer and with PC-based high-resolution digital recording unit.

E. Marine Geophysics (ANT XI/3):

- Reflection seismic profiling system with SODERA S15 watergun and multi-channel digital recording unit.

VIII. TRANSPORTATION FACILITIES AND COMMUNICATION EQUIPMENT

Nil.

IX. FACILITIES FOR RENDERING ASSISTANCE

Nil.

X. NOTICE OF EXPEDITIONS TO THE ANTARCTIC NOT ORGANIZED BY THE PARTY BUT ORGANIZED IN, OR PROCEEDING FROM, THE PARTY'S TERRITORY

No expeditions will be organized, or proceed from, Belgium in 1993-94.

XI. DESCRIPTION OF UNOCCUPIED REFUGES

Nil.

XII. ANNUAL RETURN OF THE NUMBER OF EACH SPECIES KILLED OR CAPTURED

Nil.

XIII. NOTICE OF INTENDED USE OF RADIO-ISOTOPES IN SCIENTIFIC INVESTIGATIONS

¹⁴C-Sodium bicarbonate will be used for measuring primary production (projects A3/02/001 and A3/11/001) and ³H-Thymidine, for measuring bacterial growth (project A3/02/001).

XIV. NOTICE OF INTENDED USE OF SCIENTIFIC ROCKETS

No rockets will be used in the Belgian projects in 1993-94.

XV. NOTICE OF OCEANOGRAPHIC RESEARCH SHIPS

No Belgian research vessels will travel the Antarctic Treaty area in 1993-94.

XVI. REPORTS OF ACTIVITIES OF TOUR ORGANIZERS

No activities of Belgian tour operators will take place in 1993-94.

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PROGRAMME'S RESPONSIBLE AUTHORITY

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ABBREVIATIONS AND ACRONYMS

AAS	Atomic Absorption Spectrometry
ANTOSTRAT	Antarctic Offshore Acoustic Stratigraphy Project
AWI	Alfred Wegener Institut für Polar- und Meeresforschung
BAS	British Antarctic Survey
BELANTOSTRAT	Belgian contribution to ANTOSTRAT
DOC	Dissolved Organic Carbon
GEBRA	Evolución Geológica de la Cuenca de Bransfield y de la Dorsal sur del Mar de Scotia
HPLC	High Performance Liquid Chromatography
PAR	Photosynthetically Active Radiation
POC	Particulate Organic Carbon
TAAF	Territoire des Terres Australes et Antarctiques Françaises
UG	Universiteit Gent
ULB	Université Libre de Bruxelles
ULg	Université de Liège
VUB	Vrije Universiteit Brussel

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