

Objectives of the EuroMARC Programme

Scientific marine drilling and coring from the sub-seafloor is crucial to progress in the Earth and environmental sciences because the oceans regulate climate, cover the sites of fundamental geodynamic, geochemical and biological processes and preserve high-resolution records of the Earth's history.

EuroMARC is an ESF EUROCORES, running for three years and aiming to support all coring activities in marine areas. EuroMARC aims at enhancing the benefit from already established funding groups and research communities such as the International Marine Past Global Change Study (IMAGES) and the European Consortium for Ocean Research Drilling (ECORD), which is a contributing member of the Integrated Ocean Drilling Program (IODP).

EuroMARC is an essential enabling tool to boost European leadership in the planning of international marine coring expeditions and the preparation of European proposals, hence ensuring the effective exploitation of research opportunities. Support of a properly resourced pre- and post-cruise science-enabling programme will ensure that the nine participating countries (Belgium, France, Germany, Ireland, Netherlands, Norway, Portugal, Switzerland and the United Kingdom) will obtain the maximum benefit from marine coring investment, meet their mission requirements to maintain world-class environmental science communities, conduct excellent, innovative and societal-relevant science and maintain international science leadership.

List of funded Collaborative Research Projects (CRPs)

Ultra-slow spreading and hydrogen-based deep biosphere (H2DEEP)

(SNF, CNRS, NFR, FCT)

The purpose of H2DEEP is to study geodynamic and hydrothermal processes along one of the most slow-spreading segments of the global ridge system. This will lay the ground for a European lead proposal to be submitted to IODP. The Knipovich Ridge, which is one of the Arctic spreading ridges in the Norwegian-Greenland Sea, is the target area for the project. Water column analyses show that hydrothermal venting currently takes place along this ridge segment. A thick sedimentary sequence covering large parts of the rift valley floor provides a record of the extent and nature of this hydrothermal activity. This sedimentary cover further provides a unique opportunity for zero-age drilling and a potentially groundbreaking new insight into the existence of a hydrogen-based deep biosphere sustained by the formation and alteration of oceanic crust and mantle by ultra-slow spreading.

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The last deglacial sea-level and climatic changes (CHECREEF)

(SNF, DFG, CNRS, NERC)

The timing and course of the last deglaciation are essential components of the understanding of the dynamics of large ice sheets and their effects on Earth's isostasy and the complex relationship between freshwater fluxes to the ocean, thermohaline circulation and, hence, global climate during the Late Pleistocene and the Holocene. The general scientific objectives of CHECREEF (in relation to IODP proposal No. 519) are to establish the course of post-glacial sea-level rise during the last deglaciation, to define sea-surface temperature variations during this period and to analyse the impact of sea-level and environmental changes on reef development with a special emphasis on the comprehensive reconstruction of environmental changes. To achieve these objectives, we will study reef cores retrieved around Tahiti during IODP expedition No. 310, investigate further the Tahiti reef slopes, and perform a site survey cruise on the Great Barrier Reef to generate high resolution bathymetric and seismic data.

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Atlantic meridional overturning circulation during interglacials (AMOCINT)

(DFG, CNRS, NFR, FCT)

AMOCINT aims to decipher the spatial and temporal structure of the interglacial peaks and demises in the Northern Atlantic and their timing with forcing variations. The project will provide multiproxy data sets to correlate land and ocean climate records and forcings, focusing in particular on two prominent interglacials events. Lags and leads of the different forcing mechanisms and the respective thresholds will be quantified with a century-scale resolution. Through these studies the groundwork will be laid to justify coring the complete suite of interglacials over the past one million years through a future IODP proposal to be submitted. The main objectives of AMOCINT will be to survey and core sites for sampling of high sedimentation rate interglacial sections, to conduct detailed site surveys to recover thick marine sediment sections over past

interglacials, and to provide a feasibility study based on already available cores from IMAGES cruises and new cores taken within this project.

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Response of tropical Atlantic surface and intermediate waters to changes in the Atlantic meridional overturning circulation (RETRO)
(DFG, CNRS, NWO, NFR)

Palaeo-oceanographic data have demonstrated that the ocean current mode of ventilation is not unique but can switch rapidly between different states with severe climate repercussions. Recent studies indicate that changes in the meridional overturning circulation (MOC) are associated with ocean-wide reorganisation in heat transport and temperature distribution. However, the hypotheses concerning oceanic processes are still poorly constrained by the observations. It is possible to interpret past changes of the Atlantic MOC only if palaeo-property gradients can be estimated over depth transects perpendicular to the main ocean currents feeding the MOC. In RETRO, IMAGES cores from two specified depth transects will be retrieved. The vertical temperature and density gradients in the ocean interior will be reconstructed and the links between high- and low-latitude climate change will be investigated through innovative modelling experiments making use of high quality data.

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Tropical temperature history during Palaeogene global warming events (GLOW)

(DFG, IRCSET, NWO, NERC)

The Cenozoic represents a period during which the Earth's climate system switched from a warm, greenhouse to a cold, icehouse world. Several rapid global warming events occurred during the already warm Palaeogene. The main objective of GLOW is to better understand the processes that underlie such switches of the climate system at long and short timescales. Specifically, the project aims at documenting the response of the West Indian Ocean system to these kinds of global climate changes, the variability of the sea surface temperature and the evolution of the biota. These Palaeogene intervals of extreme warmth will provide insights into possible future climate patterns and biogeochemical state of the ocean. Within GLOW, the onshore Tanzanian drilling transect will be extended offshore. A site survey offshore Tanzania will be performed to obtain a grid of seismic lines which can subsequently be used in an IODP or IMAGES proposal to be submitted.

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Mid-latitude carbonate systems: complete sequences from cold-water coral carbonate mounds in the northeast Atlantic (CARBONATE)

(FWO, DFG, IRCSET, NWO)

Along the European Atlantic continental margin, fossil carbonate mounds occur from northern Norway to the Gulf of Cadiz. Up to now the carbonate stored in these mounds has not been considered in the global carbon budget. A major challenge exists to quantify the amount and flux of carbon stored by these newly discovered areas. Europe is in a unique position to champion carbonate mound research providing that appropriate sedimentary sequences are made accessible. Previous investigations of short sediment cores revealed that all mounds possess different growth histories depending on the environmental setting and the involved faunal associations. These previous cores penetrated only the upper few metres of the mounds thus limiting the research to the very late stage of mound development. One exception to this is IODP 307 which retrieved a complete sequence from one mound. By understanding how biogeochemical processes control the development of these carbonate mounds and their response to climate change, CARBONATE aims at quantifying their role as mid-latitude carbonate sinks.

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Multidisciplinary study of continental/ocean climate dynamics using high-resolution records from the eastern mediterranean (MOCCHA)

(SNF, DFG, NWO)

Located between low and mid-latitude borderlands and between monsoonal and NAO-influenced climate systems, the Mediterranean is an important site for a continuous palaeoclimate record. The two sites explored by MOCCHA seem perfect high-resolution climate recorders for future IODP proposals, in particular the near-coastal site having a high-frequency 11-year climate cycle. Similar cycles occur at the deep anoxic basin sites where we aim to complete an uninterrupted 11-year sediment trap time series. This will permit us to unravel the actual mechanisms underlying the observed 11-year cycles in the sediments. Furthermore, the comparison between the two sites will allow us to unravel near-coastal land-ocean interaction-dominated signals from typical deep-ocean signals. In addition, we will calibrate potential new proxies so as to make them applicable to older units. Assessing the origin and mechanisms of the observed variations is needed to evaluate their potential functioning in more remote time periods.

The aim of the European Collaborative Research (EUROCORES) Scheme is to enable researchers in different European countries to develop collaboration and scientific synergy in areas where European scale and scope are required to reach the critical mass necessary for top class science in a global context.

The scheme provides a flexible framework which allows national basic research funding and performing organisations to join forces to support excellent European research in and across all scientific areas.

The European Science Foundation (ESF) provides scientific coordination and support for networking activities of funded scientists currently through the EC FP6 Programme, under contract No. ERAS-CT-2003-980409. Research funding is provided by participating national organisations.

www.esf.org/eurocores

THE FOLLOWING NATIONAL FUNDING ORGANISATIONS SUPPORT THE EuroMARC PROGRAMME:

**Fonds voor Wetenschappelijk Onderzoek
– Vlaanderen (FWO)**

Fund for Scientific Research, Belgium

**Centre National de la Recherche
Scientifique (CNRS)**

National Centre for Scientific Research, France

Deutsche Forschungsgemeinschaft (DFG)

German Research Foundation, Germany

**Irish Research Council for Science,
Engineering & Technology (IRCSET)**

Ireland

**Nederlandse Organisatie voor
Wetenschappelijk Onderzoek (NWO)**

*Netherlands Organisation for Scientific
Research, Netherlands*

Norges Forskningsråd (NFR)

Research Council of Norway, Norway

**Fundação para a Ciência e a Tecnológica
(FCT)**

*Foundation for Science and Technology,
Portugal*

Schweizerischer Nationalfonds (SNF)

*Swiss National Science Foundation,
Switzerland*

**Natural Environment Research Council
(NERC)**

United Kingdom



The barrier-reef edge of Tahiti
Courtesy K. Sugihara and T. Yamada

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