

# CLIMCOR



Paleo CLIMatic CORing: High Resolution and Innovations

## WP3: OCEAN

### C2FN - Marine Coring

C2FN-OCEAN is a national coordination structure for marine coring created in 2009, with a partnership between DT INSU and IPEV (CNRS). It is based in Brest (France), in the IPEV building.

C2FN-OCEAN deals with R&D on marine coring technologies, and also carry out operational support & logistics, mainly onboard R/V Marion Dufresne mainly.

### R/V Marion Dufresne (IPEV - TAAF)

Europe largest oceanographic vessel. Only one deploying giant Calypso 2. Sailing worldwide.



**Specifications:**  
Length: 120 metres,  
Crew: 50 sailors  
Displacement: 10000 tons  
8000 metres aramid cable  
Telescopic cranes and davits  
A-Frames and handling forks

### Corers



**Giant Calypso 2:**  
The main C2FN corer is the Calypso 2 Giant Piston corer. Based on a Kulenberg technology, it can take core up to more than 60 metres. It is under permanent development and improvement. Among these works, the «Cinema» project developed with Ifremer highlighted that the stiffness of the main coring cable is a critical aspect of the quality of the sediment recovery.



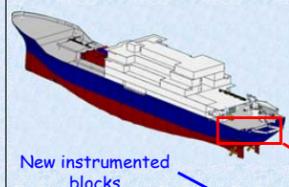
Two other gravity corers are frequently in use:  
• the CASQ corer equipped with CTD probes  
• the Multicore equipped with acoustics&camera



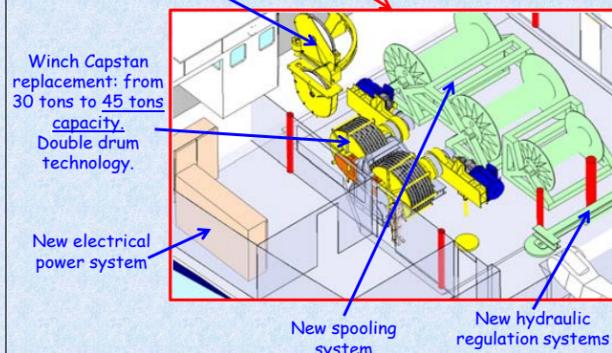
### CLIMCOR - OCEAN Project 2012-2019

The goal of this project is the improvement of both quality and size of the sediment cores. These two objectives rely on two main changes: the coring cable and the winch that drives it.

### Siamois Coring Winch Improvement



The coring winch will be upgraded in order to be more efficient and reliable for any operations. Equipped with the last technologies and a stronger capstan, it will be able to beat new records of coring length and productivity.



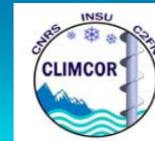
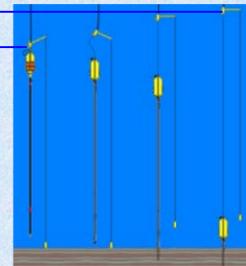
### New Calypso coring cable



A new 7000 metres oceanographic cable will be designed to fit with the new requirements of «perfect» long coring: it has to be both extremely strong - to bear 45 tons extraction strength of giant pipes - and very stiff. New fibers and braidings are under investigation and development.

Elastic stretching has to be known and/or minimized:

It lifts the piston up and creates over suction of the sediment, thus destroying the sample.  
A cable with a very high stiffness prevent this stretching, to get the best sample's quality.



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The French coring/drilling has been acknowledged among the leaders in this field for the last 20 years or so, especially in ice and marine domains. However technological developments are pursued at different levels and the present CLIMCOR project, funded by the French Government new program for excellence in Infrastructures, intends to provide the French scientific community with top-notch technological support and a new generation of drilling/coring tools. CLIMCOR project concerns ice, continental and marine coring activities. **ANR-11-EQPX-0009-CLIMCOR**

General contacts for CLIMCOR: PI D.D. Rousseau (denis.rousseau@lmd.ens.fr) & co-PI M. Calzas (michel.calzas@dt.insu.cnrs.fr)

Global climate changes have been evidenced in various ways since the start of paleoclimatology in the 70s but mainly through ice, marine and continental coring. However such fundamental data cannot be recovered without high technological equipment to retrieve quality records.

The recent focus on the last millennium climate variations made possible the link with the measurements and observations of present day parameters but such link is still to come for much deeper times when much more contrasted conditions prevailed. Such data in hand would allow better calibrating the Earth System model.

The technical limitation of the present equipments does not allow such important jump in the quality of the data, and therefore in the knowledge of i, past climate variations at extremely high resolution and ii, of the behavior of the different domains as studied in IPCC experiments while societal requirements are more and more expressed by policy makers. This project is going to improve coring tools and facilities.

### CLIMCOR - ICE

Ice workpackage



Shallow drilling at Dome C, Antarctica, 2009/2010

The goal of the project is to build or to provide to the ice core scientific community with new tools.

- A new logger for geophysical measurements
- A new probe
- Equipment to be set up in a terrestrial traverse

### CLIMCOR - CONTINENT

Continent workpackage



Lake sediment coring Iseo lake, ITALY 2010-10-04

Max drilling capacity:  
- Water depth ≈ 300m  
- Core length ≈ 25m

**LAKE SEDIMENT:** The goal is the improvement of the limits of the equipment in term of the length of sediment sequence and water depth.

**TERRESTRIAL MEANS:** The goal is to equip the Sédidrill 250-90 machine with the best sets of tools.

### CLIMCOR - OCEAN

Ocean workpackage



The capstan has to be changed, from a «single drum» technology that presented weaknesses along its lifetime, to a widespread double capstan technology, with a SWL of 45 tons. The whole system will also be upgraded with modern and more reliable technologies.



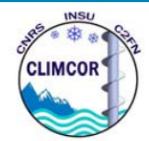
**New «high stiffness» coring cable**  
As the winch will be more powerful, a new cable will be designed to be stronger.



<http://climcor-equipex.dt.insu.cnrs.fr>



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Paleo CLIMatic CORing: High Resolution and Innovations



## WP1: ICE

During the last decades, C2FN ICE (hosted by Laboratoire de Glaciologie et Géophysique de l'Environnement - LGGE - Grenoble), has developed a large range of drilling and logging tools, successfully used in polar and non polar regions. Priorities for their use by the ice core community are decided by a dedicated French Ice Core Science Group.

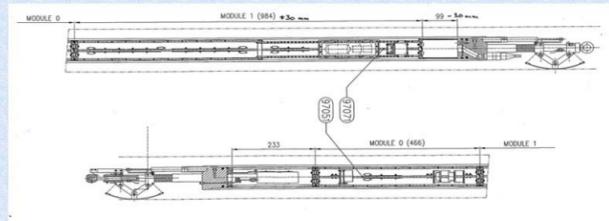
### CLIMCOR - ICE 2012-2019

Thanks to CLIMCOR C2FN-ICE will enlarge the range of tools available for this community.

### Borehole logging tools

A new borehole logger providing precise measurements of: pressure, temperature, inclination and orientation of a borehole

A new sonic borehole logger for crystal fabric studies. An existing commercial system will be adapted for use at high pressure.



Picture of the sonic logger from the University of Alaska (Fairbanks) implemented into the Dome C borehole in 2011.

### Instruments for optimal work on a traverse

This part will include:



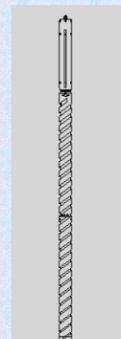
Picture of the FELICS drill in the Italian ITASE caravan (left) and of the IPEV scientific traverse (right). © M. Frezzotti, ENEA; J. Chappellaz, CNRS/LGGE/IPEV

- a dedicated caravan able to embed a small drill and its motion (thanks to traps in the roof and floor) and equipped with clean benches for core treatment
- basic scientific equipment for primary measurements on snow cores.

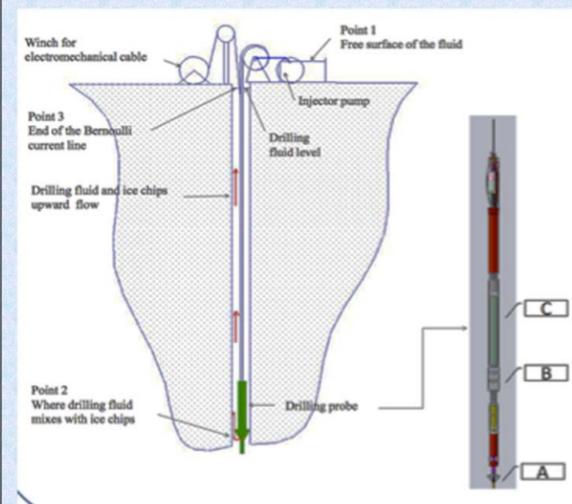
### Improvement of existing technology

Lightweight electromechanical and thermal drills:

- This equipment with both an electromechanical and a thermal drill head and core barrel will allow to collect ice cores in extreme conditions (high altitude and carried by man) and in "warm" ice (with the thermal head)
- R&D budget will be dedicated to reduce contamination of ice cores with organic compounds released by standard drilling systems, in order to obtain optimal measurements of organics in the ice.

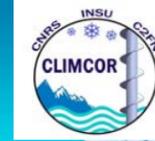


### Improvement of the Subglacier drilling probe



Subglacier is a new generation of drilling probe currently under development by C2FN-ICE (funded by the ERC Ice&Lasers and the ANR Subglacier projects). This revolutionary probe embedding a spectrometer will allow to measure CH4 concentration and H2O isotopes while drilling. CLIMCOR will support the integration of additional instruments in the probe, for measuring e.g. dust and conductivity.

A: drill head, B: gas/fluid splitting line, C: embedded laser spectrometer. <http://www.iceandlasers-subglacier.org>



# CLIMCOR

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## WP2: CONTINENT

### C2FN - CONTINENT

C2FN - CONTINENT is a national coordination structure for continent, lacustrine and sea shore coring created by CNRS INSU in 2009. It is based at DT INSU in La Seyne sur Mer (France) and at EDYTEM in Le Bourget du Lac (France). C2FN - CONTINENT deals with R&D on coring technology and also performs operational support and logistics.

### Logistic equipment

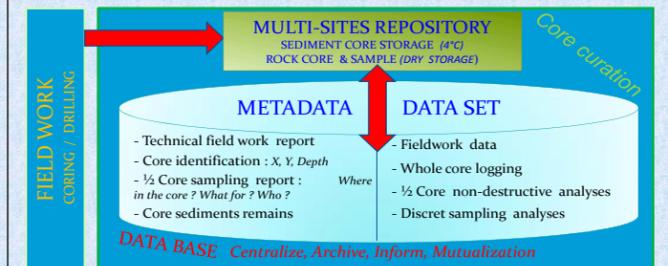
Truck 19T, 4x4 hydro: Equipped with: hoiclift system, 19T trailer, open container with an auxillary crane and a 20' closed container.



Compact telehandler: Operating weight = 2.55T, max payload = 1.2T, max range = 2.29m, payload for max range = 0.44T.

### Core curation

To enhance the quality of the sampled sediment and data curating and sharing: Within CLIMCOR, a careful attention is paid to post-coring/drilling procedures. CLIMCOR provides to researchers community guidelines and software tools in the aim of improving and homogenising their curating process. This implies both to disseminate existing software and to develop our own tools (databases).



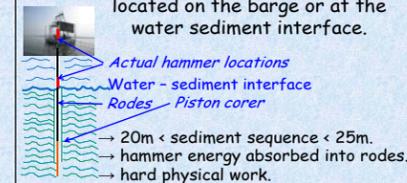
This project is animated by a curator, based at EDYTEM laboratory, in link with DT-INSU, users and the International Core-curators Consortium.

### CLIMCOR - CONTINENT 2012-2019

The goal of this project is the improvement of both length of sequences and quality of the sediment cores. These two objectives rely on two main changes: the coring efficiency and core curation that enhance the quality of the sampled sediment.

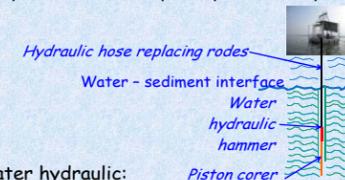
### Lake

UWITEC principle: Manual hammering onto rodes located on the barge or at the water sediment interface.



### 1) Hammering system improvement

A water hydraulic hammer following the piston corer inside the bore hole will provide longer sediment records by more efficiency and productivity.

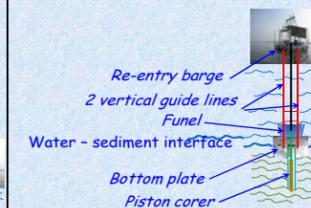


- Water hydraulic: Innovative & environmentally friendly.
- Hydraulic hose: Time saving.
- Hydraulic hammer: More efficiency
- Less energy loses: Longer sediment sequence

### 2) New Re-Entry barge

To accomodate the new hammering system a new Re-entry barge will be designed with 1 bottom plate, 1 fanel, 2 vertical guide lines.

Principle: The piston corer is guided by the vertical lines down to the fanel to Enter into the hole.



UWITEC Re-entry barge: funnel



### Land

Drilling machine: Sédidril 250-90

Specifications: Total weight: 5.8T Motor: diesel, 84hp Mast stroke: 3.8m pulling force: 5kN pushing force: 4kN Transport: 20' container



### Operated tools:

- Retractable nozzle
- WireLine drills:
  - PWL 3, Ø core: 85 mm.
  - HWL 3, Ø core: 63 mm.
  - NWL 3, Ø core: 47 mm.



Sediment core & carbide bits

### Shore line

Sand vibra-coring:



"Amaury" corer

"Amaury" & Zenkovitch technologies