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Paris, May 26, 2008

# EPOCA : ocean acidification and its impact on ecosystems

**Emissions of carbon dioxide (CO<sub>2</sub>) through human activities have a well known impact on the Earth's climate. What is not so well known is that the absorption of this CO<sub>2</sub> by the oceans is causing inexorable acidification of sea water. But what impact is this phenomenon having on marine organisms and ecosystems? This is a question to which researchers have few answers as yet. That is why the European Union has recently given its support to EPOCA, the European Project on Ocean Acidification, which will be launched in Nice (France) on 10 June 2008.**

**EPOCA's goal is to document ocean acidification, investigate its impact on biological processes, predict its consequences over**

**the next 100 years, and advise policy-makers on potential thresholds or tipping points that should not be exceeded. The project is coordinated by Jean-Pierre Gattuso, a CNRS researcher at the Oceanography Laboratory at Villefranche-sur-mer (LOV(1)), and brings together a consortium of 27 partners, including CNRS and the French Atomic Energy Agency (CEA), from 9 countries. Many of the leading oceanographic institutions across Europe and more than 100 permanent scientists are involved. The budget is €16.5 million over 4 years, including €6.5 million from the European Commission.**

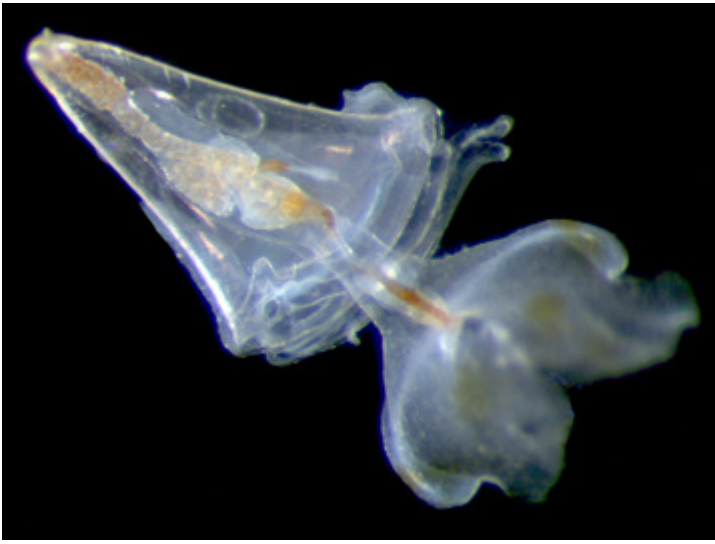
Over 71% of the Earth's surface is covered by the oceans, which are home to an incredibly diverse flora and fauna. They play a key role in regulating the climate and levels of carbon dioxide (CO<sub>2</sub>), one of the main greenhouse gases. Over the last 200 years (since the beginning of the industrial revolution), the oceans have absorbed about one third of the carbon dioxide produced by human activities, a total of 120 billion tons. Without this absorption, the amount of CO<sub>2</sub> present in the atmosphere and its effects on the climate would undoubtedly be far greater.

In fact, over 25 million tons of CO<sub>2</sub> dissolve in seawater every day. However, the oceans do not escape unscathed. When CO<sub>2</sub> dissolves in sea water, it causes the formation of carbonic acid, which leads to a fall in pH (the pH scale is used to measure acidity(2)). This change is called "ocean acidification" and is happening at a rate that has not been experienced probably for the last 20 million years.

The effects of this huge input of CO<sub>2</sub> into the oceans only began to be studied in the late 1990s(3) and are still poorly understood. One of the most likely consequences will be slower growth of organisms with calcareous skeletons, such as corals, mollusks, algae, etc(4). Obtaining more information about ocean acidification is a major environmental priority because of the threat it poses to certain species and ecosystems.

EPOCA should help us to understand the effects of the acidification of sea water as well as its impact on marine organisms and ecosystems. More specifically, the project has four goals:

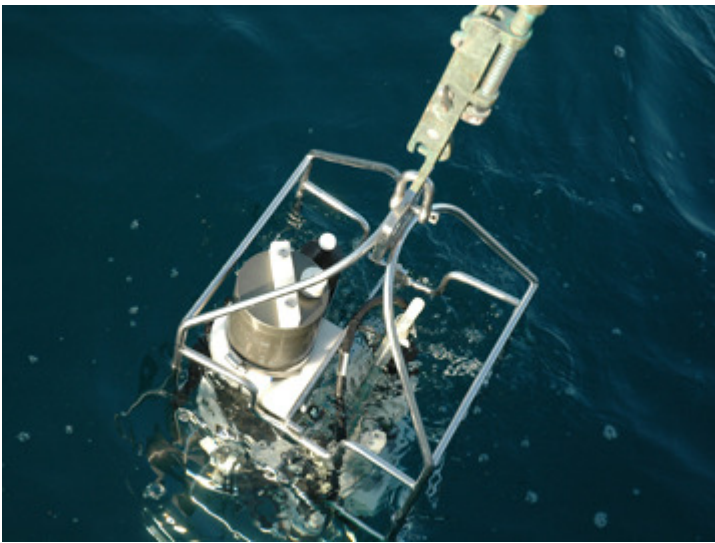
- Document the changes in ocean chemistry and biogeography across space and time. Paleo-reconstruction methods will be used on several natural/biological archives, including foraminifera and deep-sea corals, to determine past variability in ocean chemistry and to tie these to present-day chemical and biological observations.
- Determine the sensitivity of marine organisms, communities and ecosystems to ocean acidification. Molecular to biochemical, physiological and ecological approaches will be combined with laboratory and field-based perturbation experiments to quantify biological responses to ocean acidification, assess the potential for adaptation, and determine the consequences for biogeochemical cycling. Laboratory experiments will focus on key organisms selected on the basis of their ecological, biogeochemical or socio-economic importance. Field studies will be carried out in systems (areas/regions) deemed most sensitive to ocean acidification.
- Integrate results on the impact of ocean acidification on marine ecosystems in biogeochemical, sediment, and coupled ocean-climate models to better understand and predict the responses of the Earth system to ocean acidification. Special attention will be paid to the potential feedbacks of the physiological changes in the carbon, nitrogen, sulfur and iron cycles.
- Assess uncertainties, risks and thresholds ("tipping points") related to ocean acidification at scales ranging from sub-cellular to ecosystem and local to global. It will also assess the decrease in CO<sub>2</sub> emissions required to avoid these thresholds and describe the change and the subsequent risk to the marine environment and Earth system, should these emissions be exceeded.



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*Cavolinia inflexa*, a mollusk that lives in open water, has a calcareous shell that is very sensitive to pH.

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The probe that will carry out measurements of pressure, temperature, salinity and fluorescence parameters is lowered into the water.

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#### **EPOCA's 27 partners France**

Centre national de la recherche scientifique (CNRS) :

Laboratoire d'océanographie de Villefranche (CNRS / Université Pierre et Marie Curie-Paris 6)  
Centre européen de recherche et d'enseignement des géosciences de l'environnement (CNRS / IRD /  
Collège de France / Universités Aix-Marseille 1 et 3)  
Station biologique de Roscoff (CNRS / Université Pierre et Marie Curie-Paris 6)

Commissariat à l'énergie atomique (CEA) :

Laboratoire des sciences du climat et de l'environnement, Gif-sur-Yvette (IPSL, CNRS / CEA / Université  
Versailles Saint Quentin)

Philippe Saugier International Educational Projects

## **Germany**

Leibniz Institute of Marine Sciences (IFM-GEOMAR)  
Alfred-Wegener-Institut für Polar- und Meeresforschung (AWI)  
Max-Planck Institute of Meteorology (MPG)  
GKSS-Forschungszentrum Geesthacht GmbH (GKSS)

## **Norway**

University of Bergen (UiB)

## **UK**

Natural Environment Research Council (NERC)  
University of Cambridge (UCAM)  
Plymouth Marine Laboratory (PML)  
Scottish Association for Marine Science (SAMS)  
The Marine Biological Association of the United Kingdom (MBA)  
Sir Alister Hardy Foundation for Ocean Science (SAHFOS)  
University of Bristol (UNIVBRIS)  
University of Southampton (SOTON-SOES)  
University of Plymouth (UoP)

## **Netherlands**

Nederlands Instituut Voor Ecologie (NIOO-KNAW)  
NIOZ Royal Netherlands Institute for Sea Research (NIOZ)  
University of Utrecht (UU)  
VU University Amsterdam (VUA)

## **Sweden**

Göteborg University (UGOT)

## **Belgium**

Université Libre de Bruxelles (ULB)

## **Switzerland**

University of Bern (UBern)  
Swiss Federal Institute of Technology Zürich (ETH ZURICH)

## **Iceland**

Hafrannsóknastofnunin - Marine Research Institute (HAFRO-MRI)

## **International organizations**

Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO)

## Notes :

- 1) LOV, a component of the Observatoire océanologique de Villefranche-sur-Mer, CNRS / Université Pierre et Marie Curie-Paris VI
- 2) The lower the pH of a solution, the higher is its acidity.
- 3) This area of research has been receiving backing at national level for several years through INSU's project-based actions.
- 4) See the press release "Moules et huîtres menacées par l'acidification des océans" ('Mussels and oysters endangered by the acidification of the oceans') [View web site](#)

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