

SONAR-CO₂ - Southern Ocean Nanoplankton Response to CO₂

Principle Investigator

Andrés, S. Rigual Hernández (Universidad de Salamanca, Spain)
Contact: andres.rigualhernandez@gmail.com / arigual@usal.es

Other key participants

José Abel Flores Villarejo (Universidad de Salamanca, Spain)
Tom Trull (Antarctic Climate and Ecosystems Cooperative Research Centre and CSIRO, Australia)
Scott Nodder (National Institute of Water and Atmospheric Research, New Zealand)
Fátima Abrantes (Instituto Português do Mar e da Atmosfera, Portugal)

Project Description

The impact of anthropogenic ocean acidification on calcifying organisms is expected to be imminent, particularly in high latitude ecosystems. Coccolithophores, unicellular eukaryotic algae that secrete calcite plates (coccoliths), are the most abundant marine calcareous phytoplankton and play a key role in the global climate by contributing to the oceanic pumps of organic matter and carbonate.

Satellite imagery reveals extensive coccolithophorid blooms in the Southern Ocean resulting in high concentrations of particulate inorganic carbon (PIC) that extend along the circumpolar Subtropical, Subantarctic and Polar Fronts during austral summer, a feature referred to as the "Great Calcite Belt". Changes in coccolithophore abundance, composition and degree of calcification may potentially impact the entire marine ecosystem and ocean chemistry, ultimately affecting the climate.

The Marie Curie-funded project SONAR-CO₂ aims to shed light on the ongoing debate whether or not ocean acidification will lead to a replacement of heavily-calcified coccolithophores by lightly-calcified ones in subpolar ecosystems. SONAR-CO₂ aims to answer the call by the Southern Ocean Observing System Science Strategy for urgent and increased effort in research initiatives that address the impacts of ocean acidification on marine and coastal ecosystems and resources. Moreover, long-term studies on key environmental variables and organisms are crucial for establishing a baseline against which projected changes can be assessed.

Project summary and objectives

Australian and New Zealand sediment trap programs were launched in the late '90s along two latitudinal transects (140°E and 178°E meridians). These collections represent the longest deep Southern Ocean time-series and provide an exceptional opportunity to examine the response of marine calcifying organisms to ocean acidification. Indeed, a previous comparison of the planktonic foraminifera communities captured by the Australian subantarctic traps with those from the underlying Holocene-aged sediments have revealed a shell weight reduction of 30-35%, consistent with reduced calcification today induced by ocean acidification.

In this project, cutting-edge and traditional microscopy techniques combined with biogeochemical analyses will be applied to the longest existing subantarctic time-series records and sediment samples from two sectors of the Southern Ocean in order to achieve the following objectives:

1. Detect changes in the calcification response of the dominant coccolithophore species *Emiliana huxleyi* in relation to changes in the CO₂ concentration in the surface waters of the SAZ at different time scales (i.e. along the time series, between industrial and pre-industrial data sets, and in the sedimentary record).
2. Determine the diversity, abundance and temporal community changes of coccolithophores, comparing them across different sectors and placing these into context with observations of [CO₂], nutrients and other data already published.
3. Estimate, for the first time, the partial contribution of coccolithophores to total carbonate export at different depths of the water column and in sediments of the Subantarctic Zone.
4. Explore the potential impacts of environmental stressors (e.g. temperature and ocean acidification) on the biomarker signature of coccolithophores.

Project Timeline

2018 – 2020

Key deliverables

- Publications in the scientific literature.
- AAD and OceanSITES project Metadata, linked through to International species inventory sites.
- Scientific collaboration between Salamanca University, ACE-CRC, NIWA and IPMA.
- New capability building for PhD and Master students at Salamanca University.
- Conference Presentations
- Scientists in schools exposure of the project.
- GBIF taxonomy submissions

Funding

Marie Skłodowska-Curie Individual Fellowship

Data Management

Data resulting from the publications will be managed in appropriate formats as required for the international data repositories. The data will be lodged into the OceanSITES project (<http://www.oceansites.org/>) and the Australian Antarctic Data Centre (<https://data.aad.gov.au/>).

Biodiversity data will be provided to the Global Biodiversity Information Facility (GBIF). Meta-data will also be compatible with the SCAR Data Policy requirements.