**Institute of Environmental Science and Technology**

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**Objective**

Participation in the EN651 cruise is undertaken in the framework of two projects (PI: Rosell-Melé) funded by the European Research Council (PALADYN, ref. 834934; December 2019-November 2024) and the Spanish Research Ministry (PYROWIND, ref. RTI2018; January 2019-December 2021). They both share as a common objective to develop a palaeo-proxy approach to investigate the natural range of variability of the Hadley Circulation (HC) during past episodes of extreme warmth and cold. This new approach relies on the use of pyrogenic carbon (PyC) derived from savannah and grassland fires and the deposition of biomass burning aerosols (BBA) on the oceans. Two of the hypotheses to test, using samples collected during the cruise are:

* the modern deep-sea sedimentary spatial gradients of windborne PyC fluxes in the tropical ocean are related to the mean transport of BBA plumes
* the chemical composition of sedimentary windborne PyC can be related to that of its parent BBA, and preserves the mean isotopic signature of the vegetation in its source regions

**Sampling**

The aim is to to study BBA in the marine atmospheric boundary layer (MABL), and PyC in the water column and sediments. PyC will be analysed using the benzene polycarboxylic acids (BPCA) approach. The purpose of this method is to cleave the highly aromatic core of PyC through its digestion with HNO3 and to quantify the sum of the BPCAs as PyC, while the molecular pattern obtained yields structural information of the PyC. In parallel, mineral dust contributions will be assessed through the measurement of trace elements in aerosols and sediments; and terrigenous biomarkers to assess windborne inputs of soils and higher plants.

***Aerosols***: Two high volume samplers (VFC+, Tisch) placed on the ship’s flying bridge were continuously operated (12-24 hours) while in transit between stations. One was dedicated to the molecular analysis of PyC (i.e. BPCA) and terrigenous biomarkers (fitted with pre-weighted fibre glass or quartz filters), and the second to study trace metals (fitted with pre-weighted cellulose filters). On alternative sampling periods each sampler was fitted with a cascade impactor (5 stages; Tisch) to study the chemical composition of different aerosol size-fractions.

***Water particulate matter***: Surface water samples (mixed layer) were obtained from the underway seawater supply while the ship was in transit between stations (ca. 40-60 l). Water from different depths (20-30 l chiefly from the thermocline bottom and at 1000 m depth) were obtained by means of a Niskin bottles deployed on a CTD rosette. On some stations, water (20-30 l) was collected from 20 m above the sea floor, at 5 m depth or at the oxygen minimum in the water column. After recovering the CTD-rosette, water from Niskin bottles was placed in plastic carboys and filtered shortly after (within 0.5-2 hours) in one of the ship’s lab. Water was filtered using 47 mm GF/F filters placed on filter holders, using the pump pressure of the underway seawater supply, or under vacuum for water collected using Niskin bottles.

***Surface sediments***: Two cores recovered using a multicorer sampler were sectioned in 1 cm slices for the top 5 cm using a metacrilate and polyethylene materials (sediments for trace metal analysis) or glass/aluminium utensils (sediments for BPCAs and biomarkers). In each core, two further sections of 5 and 10 cm were taken to further study in the home laboratory.