

POST EXPEDITION REPORT

Field Expedition Terceira Islands, Portugal 4D- μ PLAST Project



PREFACE

ACKNOWLEDGEMENTS

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DISCLAIMER

The ideas and opinions expressed in this report are the authors alone. They do not necessarily reflect the opinions or ideas of the funding agencies, employers, or corporate sponsors.

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submitted by

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Abstract

This field report presents the sampling carried out in June 2022 during a mission on the island of Terceira (Azores, Portugal). The main objective of the mission was to find and probe ombrotrophic peatlands in order to reconstruct the chronology of micropollutant deposition, including microplastics, in the North Atlantic. The peatlands and cores are described, as well as the aerosol and water samples taken.

General Information

CONTACT INFORMATION

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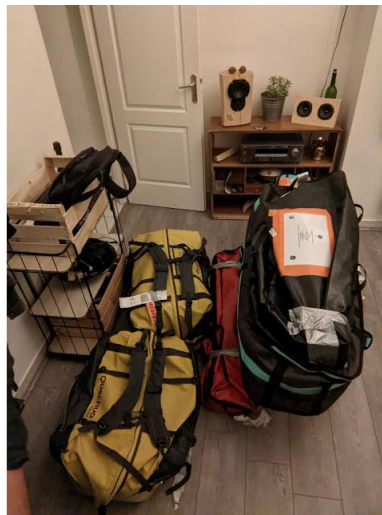
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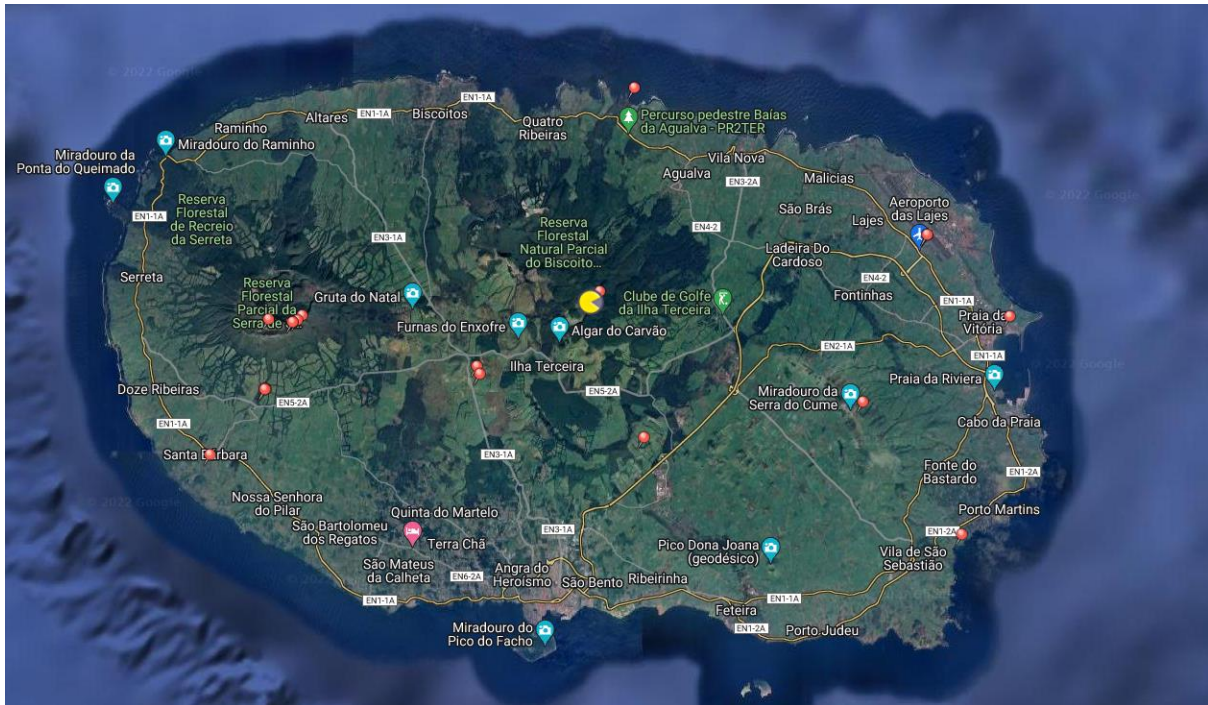
TRAVEL/ACCOMMODATION and LOGISTICS

The french team flew to Terceira Islands through Lisbon airport.



2 cars were rented through the travel agency of the CNRS: FCM. Cars were picked up at Terceira airport for the entire stay.

The french team stayed in the village of Santa Bárbara.



Map of Terceira with the locations of different sampling sites.

FUNDING

The field mission was supported by the CNRS Mission de l'Interdisciplinarité within the project 80 Prime 4D μ PLAST.

Introduction

In a recent paper, we demonstrated re-emissions of microplastics from surface oceans towards the atmosphere (Allen et al., 2020). Azores islands are located close to the N. Atlantic gyre and could be used as an oceanographic buoy. Our aim is to investigate atmospheric deposition of micropollutants, including microplastics, using peat cores. *Sphagnum* peatlands are ombrotrophic and could be used as natural environmental archives of atmospheric deposition including microplastics (Allen et al., 2021). The island of Terceira has many peat bogs (Mendes et al., 2019) that offer great potential of reconstructing the history of microplastics in relation to the Atlantic Gyre.

Fieldwork

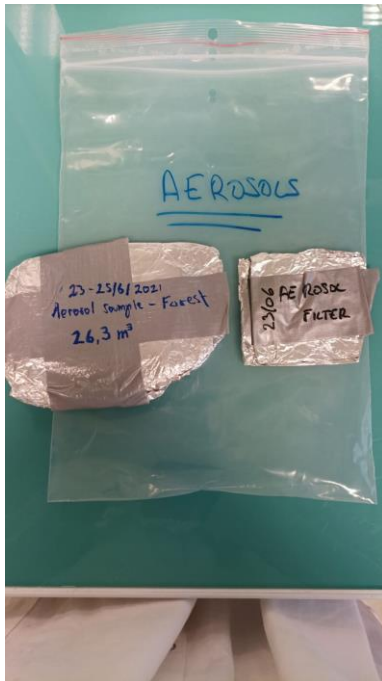
Methods

Priority was given to surface cores which will record the last 200 years but when possible, long cores were also taken as a paleo-archive. Surface peat cores were taken using a box corer

and long cores using an Eijkelkamp russian corer (De Vleeschouwer et al., 2010; Shotyk and Noernberg, 2020).

On the field, we use cardboard boxes to transport the peat monoliths that were then stored in plastic

Regarding aerosol sampling; due to a pump failure only one sample was collected with a known volume of air at the forest station during 3 days (23-26/06/2021 vol=26.3 m³).



Aerosol filters are stored in Aluminium film before preparation in a clean air cabinet under a laminar flow.



Aerosol sampling at the forest station

sea water sampling

To get an overview of the plastic composition of coastal waters around Terceira islands, we collected seawater samples using a home-made device. After water collection using a titanium bucket, we pre-filtrate seawater through a cascading filter device¹ using cleaned nylon filters of 100 and 50 μm respectively, and then filtrate the final sample using a PTFE Teflon membrane filter. All the equipment was either pre-cleaned in the lab or pre-cleaned using seawater at each location.



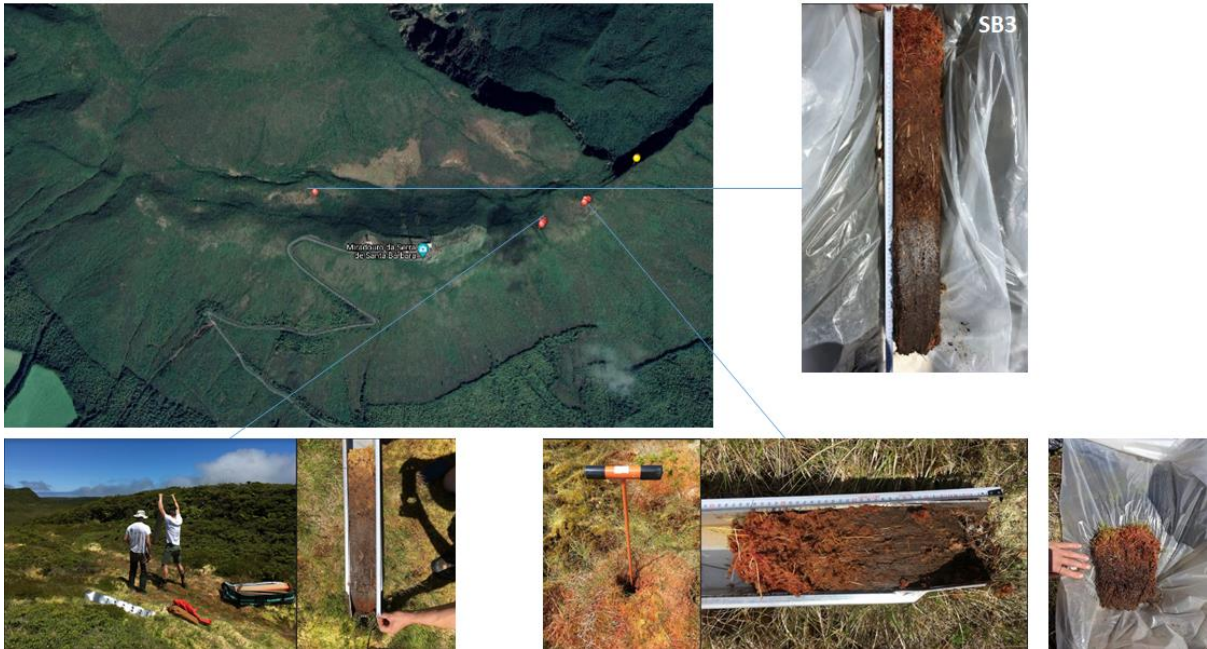
Seawater pre-filtration

¹ home-made by O. Hagelskjær & T. Camboulive

peatland sites and collected peat cores

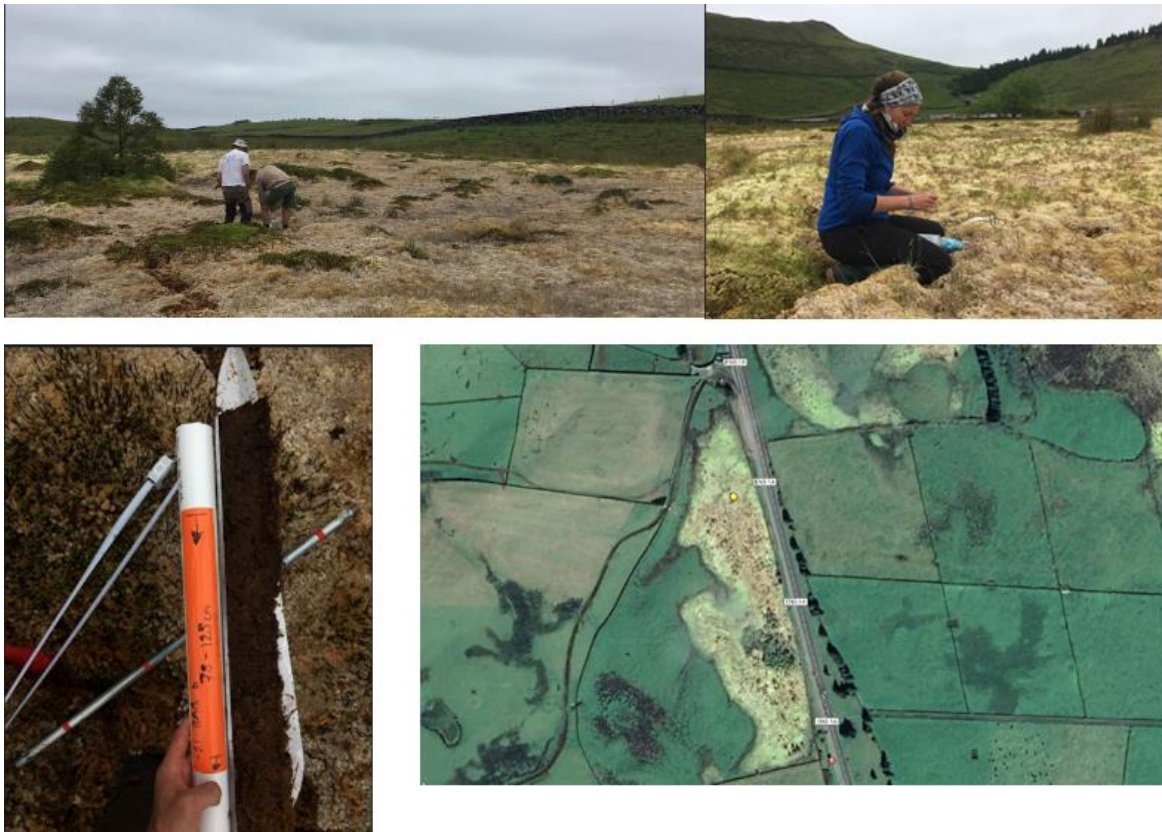
Date	Site	Code location	Corer	Core length (cm)	coordinates Lat;Lon,z
21/06/2021	Santa Bárbara	SB-1/21Az01	Monolith from Hummock		N 38° 43' 52.32"; W 27° 18' 46.25", 965.98m
21/06/2021	Santa Bárbara	SB-2/21Az02	Box corer	0-70	N 38° 43' 49.91" ; W 27° 18' 51.99" Altitude : 989.81m
21/06/2021	Santa Bárbara	SB-3	Box Corer		N38° 43' 53.11" W 27° 19' 22.51" Altitude : 966.20m
22/06/2021	Pico da Bagacina	BAG/21Az03	Box Corer	0-100	N 38° 43' 4.96"; W 27° 14' 54.86" Altitude : 508.19m
		BAG	Russian Corer B	75-125	""
			Russian Corer A	100-150	""
22/06/2021	Terra Brava	TB/21Az04	Monolith	0-29	N 38° 44' 20.48"; W 27° 12' 15.67" Altitude : 647.69m
		TB	Box corer	0-85	""
		TB	Russian Corer A (yellow)	115-165 195-245	""
		TB	Russian Corer B (white)	75-125 155-205 235-295	""

Santa Bárbara mountain:



Santa Bárbara peatlands are located around the Santa Bárbara mountain mirador. The eastern peatlands are smaller mainly due to the more variable topography of the eastern slope. On the aerial picture, relatively large peatlands can also be seen north of the mirador that surely developed on three or four former topographic plateaus. From this area, we collected the SB3 core, which seems highly promising and could be considered as pure ombrotrophic. SB2 was collected along the path in a small depression. The peat accumulation chronology may be different there.

Bagacina peatland (aerial map from google map, yellow dot: sampling site)



Bagacina peatland is surely a remaining part of a peatland sampled by Svante Björck et al. in 2001, which is described as “*The longest sequence collected was from the so-called Bagacina bog, situated at 504m a.s.l. on the central part of the island in a depression between two volcanic craters, where 3.75m of peat, silt and coarse pyroclastic material was penetrated. The lowermost 45 cm consists of a fining upwards pyroclastic unit, overlain by organic silt dated to 3560±50 14Cyr BP.*” ([Björck et al., 2006](#)).

To avoid unnecessary disturbance, we minimized the probe locations and were only able to sample 1.5m of peat (compared to the 3.75 m mentioned by Björck et al.). This discrepancy might be due to the reduced probing locations and that we therefore did not locate the deepest section of the bog, or it could be that the location sampled by Björck’s team was destroyed during recent land-use changes (ie: on the other side of the road, there is a wet pasture and remaining peatland as seen with the aerial photo).

Terra Brava peatland

Hole B



Hole A

Terra Brava is located in a wet depression along a paved road. Geographically interesting for the deposition variability of micropollutants on Terceira islands, it appears to represent more than 2.5 m of peat accumulation. We cored this site using an overlapping technique of 10_cm to avoid disturbance by the tip of the russian corer. The site was really boggy and hard to probe thus we are not sure that we sampled the deepest part of this small isolated peatland.



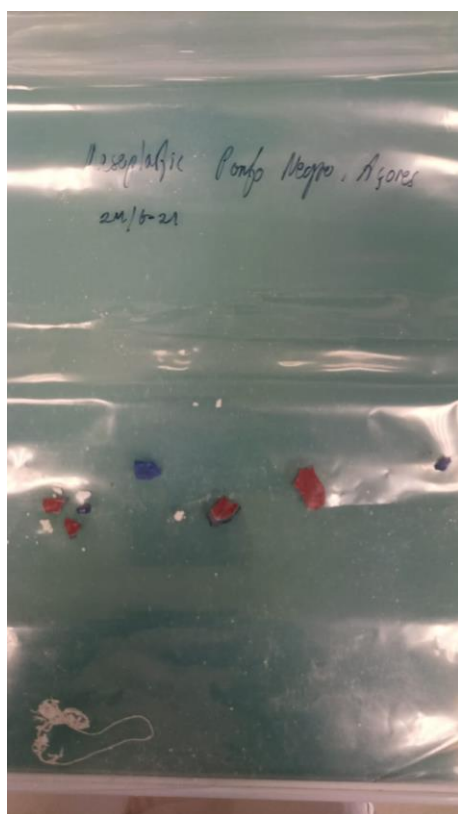
Chemical data for the three locations

	21Az04	21Az03	21Az02	21Az01	
Temp	17.1	16.5	22.6	18.8	
pH	4.47	4.31	4.09	4.07	
Cond	61.5	94.4	55.8	50.8	
F-	0.09	0.22	0.08	0.01	mg/L
Cl-	7.36	14.92	8.70	7.99	mg/L
Br-	0.011	0.009	0.006	0.009	mg/L
N-NO3-	0.0453	0.006	0.0113	0.0062	mg/L
S-SO42-	0.2398	0.8792	0.2168	0.3298	mg/L
Na+	4.59	10.86	6.19	6.15	mg/L
N-NH4+		1.10		0.02	mg/L
K+	0.87	1.42	0.93	1.58	mg/L
Mg2+	1.27	1.53	0.96	1.07	mg/L
Ca2+	0.41	0.55	0.29	0.32	mg/L
DOC	4.174	28.36	16.47	8.376	
TDN	0.3	1.3	0.3	0.4	

A volume of surface water was collected at each coring site to characterize the chemical conditions of the sites. All the sites are acidic typical of Sphagnum dominated peatland. Cation and anion concentrations are typical of bog waters.

Collected seawater filters

Location/filter size	Day	volume (L)	100µm	50µm	0,45µm
Blank	24/06/2021		x	x	x
Santa Bárbara	24/06/2021	5.5	x	x	x
Salgueiro	23/06/2021	2	x	x	x
Escalearas	23/06/2021	2	x	x	x
Zone Balnear do Negrito ("labeled Porto Negro")	24/06/2021	4.5	xx	xx	x



mesoplastic and paint fragment @Zone Balnear do Negrito

Perspectives

Due to the Covid-19 pandemic, our work is currently behind schedule. More specifically, specific instruments that are to be purchased or have been ordered are not available or are suffering from extended delivery times which have been slow down since 2020.

Peat cores collected in 2021 will be sliced frozen using state of the art protocol (Givelet et al., 2004) using a stainless steel bandsaw. Sub-samples will be taken for age dating (^{210}Pb , ^{14}C), chemical analyses (P-XRF, ICP-MS) and microplastic analyses (Light microscopy, COLSPEC darkfield microscopy, FT-IR and Raman) after adequate preparation. Archived sub-samples will be stored in Toulouse in the [PEAT](#) library.

Seawater and aerosol samples are surely not representative of an entire year of microplastic collection and will be mostly used to identify potential major local sources of microplastics. We have already identified boat and harbor paints as potential sources of local polymers into the coastal environment of Terceira island. We hope to get first results on the environmental history of microplastics in Terceira islands by the end of 2022.

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