



UNIVERSITY OF COPENHAGEN

DEPARTMENT OF GEOSCIENCES AND NATURAL RESOURCE MANAGEMENT (IGN)

# A plastic archive in Greenland: micro and nanoparticles in marine sediment

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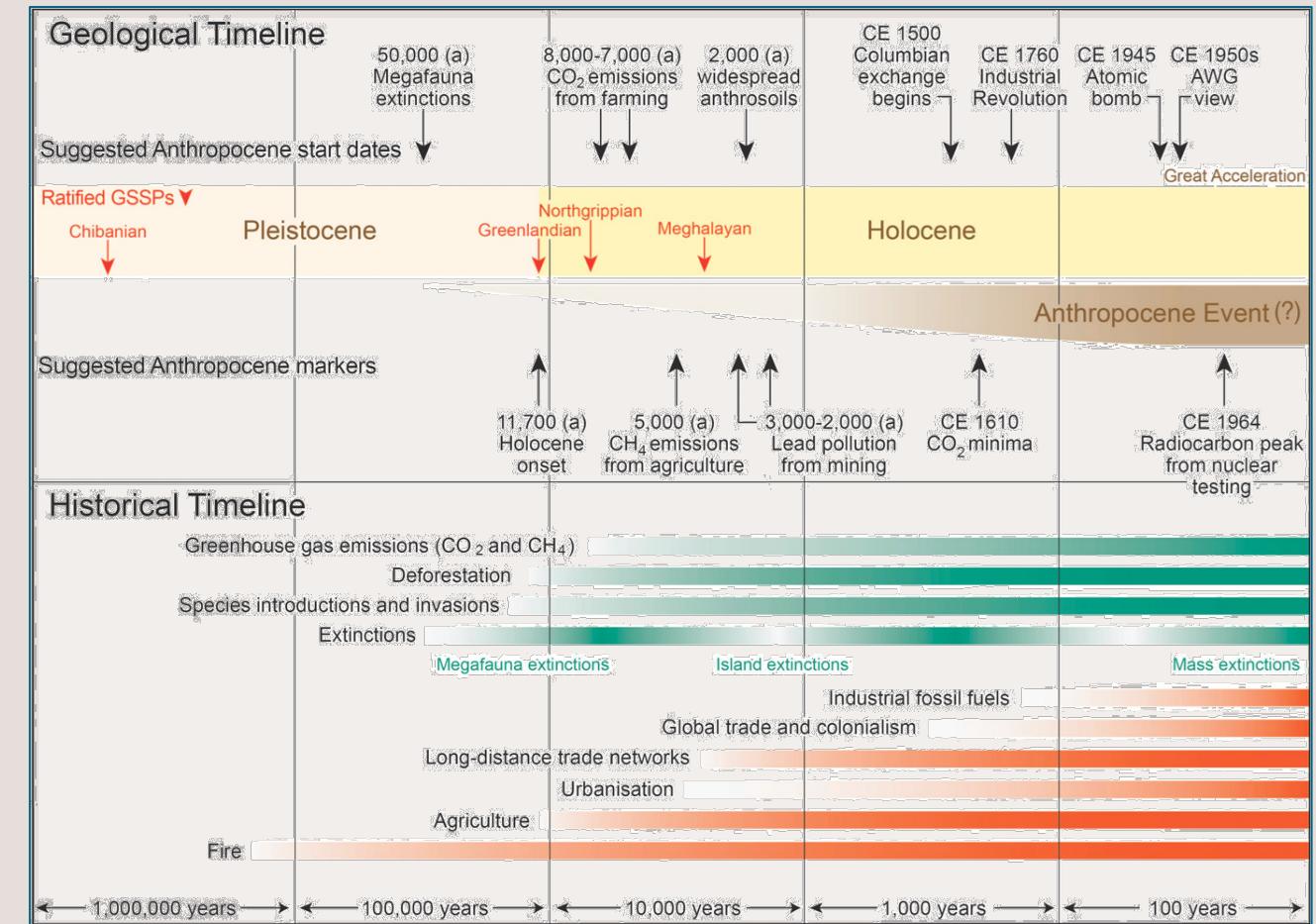
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Photo: Felix Tulac

# Anthropocene

- Start point ~1950 Great Acceleration
- Markers
  - Biostratigraphic e.g. crop pollen
  - Chemostratigraphic e.g. radioisotopes
  - New materials e.g. plastics
- Plastics in the sedimentary record
  - Diachronic signal



Gibbard et al., 2022

# Plastics in the Arctic

Marine litter in all environmental compartments

Beach



Photo: Wouter Jan Strietman

Seabirds



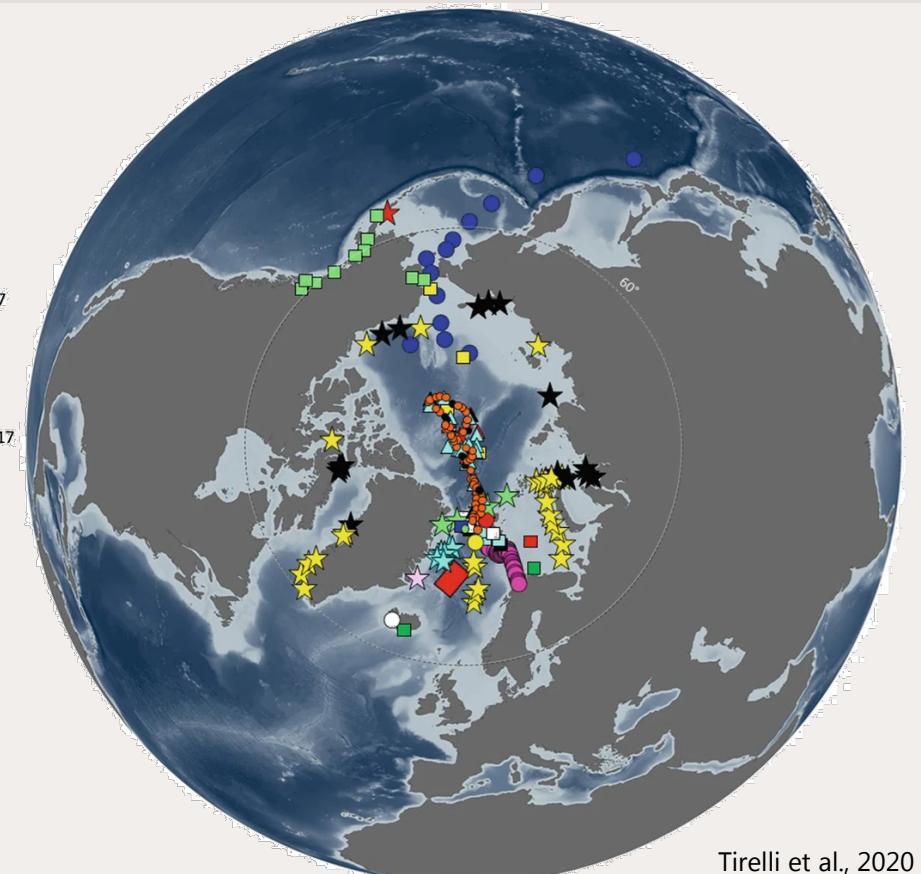
Photo: PAME (GettyImages)

Water



Photo: PAME (GettyImages)

- ★ Doyle et al., 2011
- Dippö, 2012
- Obbard et al., 2014
- Woodal et al., 2014
- Lusher et al., 2015
- ☆ Amélineau et al., 2016
- Sundet et al., 2016 and 2017
- Bergmān et al., 2017
- ★ Cōzar et al., 2017
- Lots et al., 2017
- Whitmire and Van Bloem 2017
- Kanhai et al., 2018
- ★ Morgana et al., 2018
- Moskeland et al., 2018
- ★ Peekin et al., 2018
- Bergman et al., 2019
- Granberg et al., 2019
- ▲ Kanhai et al., 2019
- Mu et al., 2019
- ◆ Jiang et al., 2020
- Tekman et al., 2020
- △ Kanhai et al., 2020

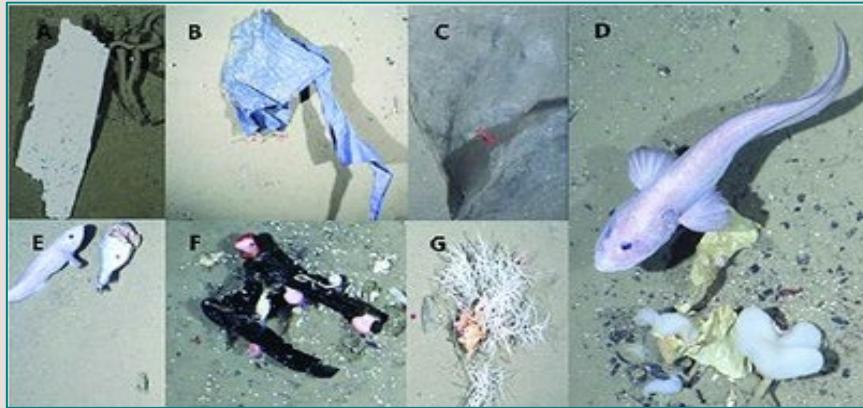


Tirelli et al., 2020

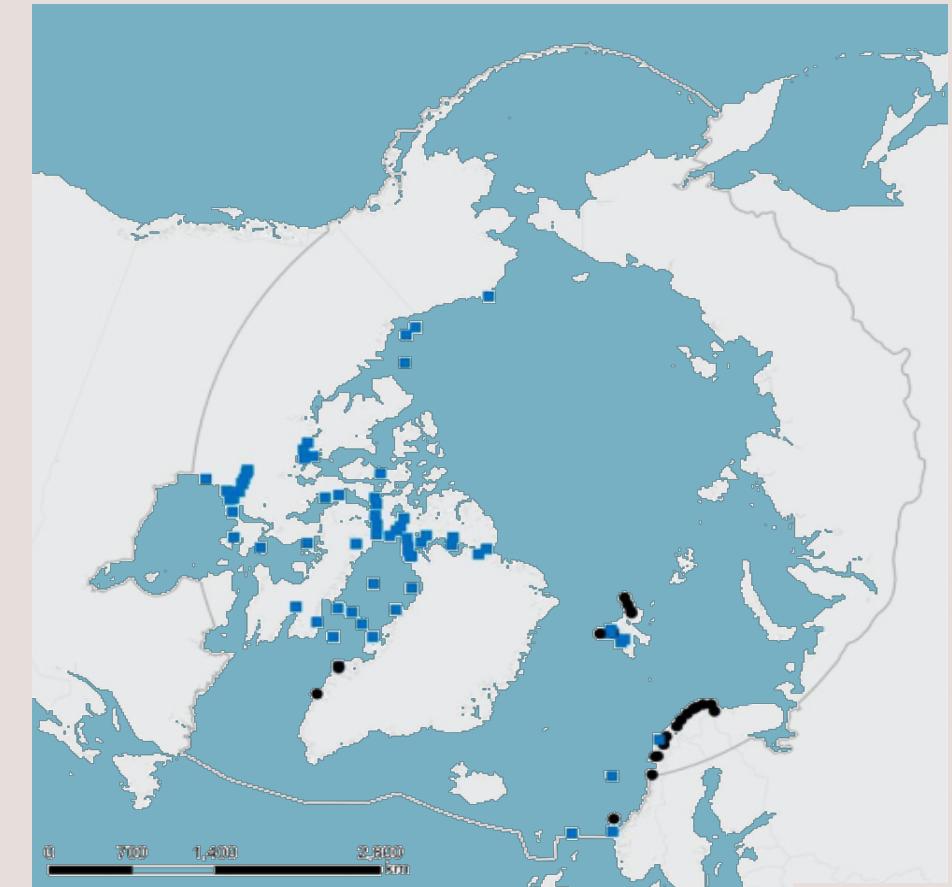
# Is there a footprint of the Anthropocene in the Arctic?

Marine sediment

- Scarce data
- Difficult access
- Complex matrix for MP extraction



Parga Martínez et al., 2020



# Disko Bay, West Greenland

## Above the Arctic Circle

Largest settlements: Aasiaat & Ilulissat

Iceberg discharge from Sermeq

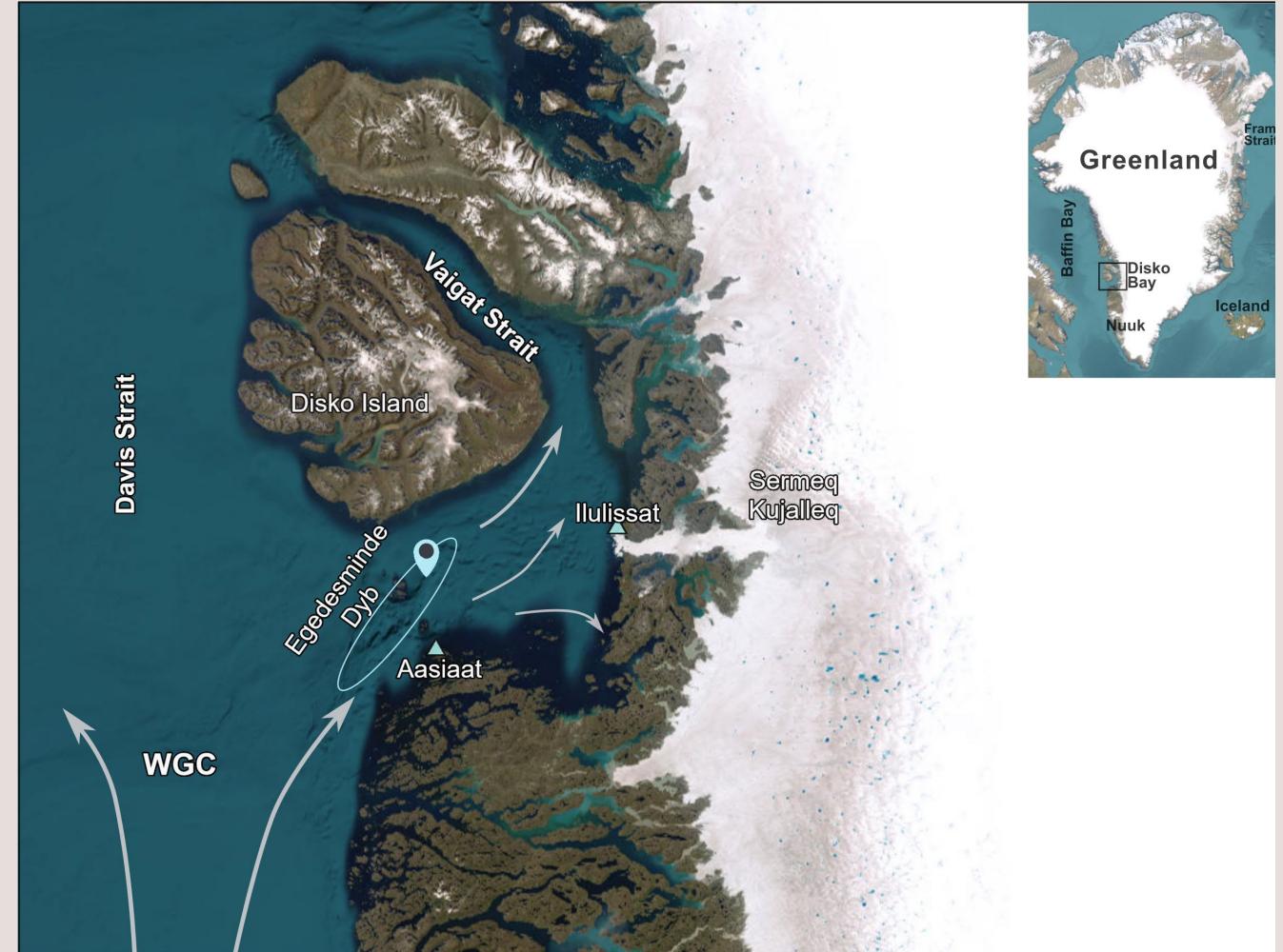
West Greenland Current

## Glacimarine sediment core

August 2015

Egedesminde Dyb

850m depth





# Chronology

Dated  $^{210}\text{Pb}$  &  $^{241}\text{Am}$

1860 – 2015

## Composition

75% Silt | 22% Clay | 3% Sand

## MP analysis

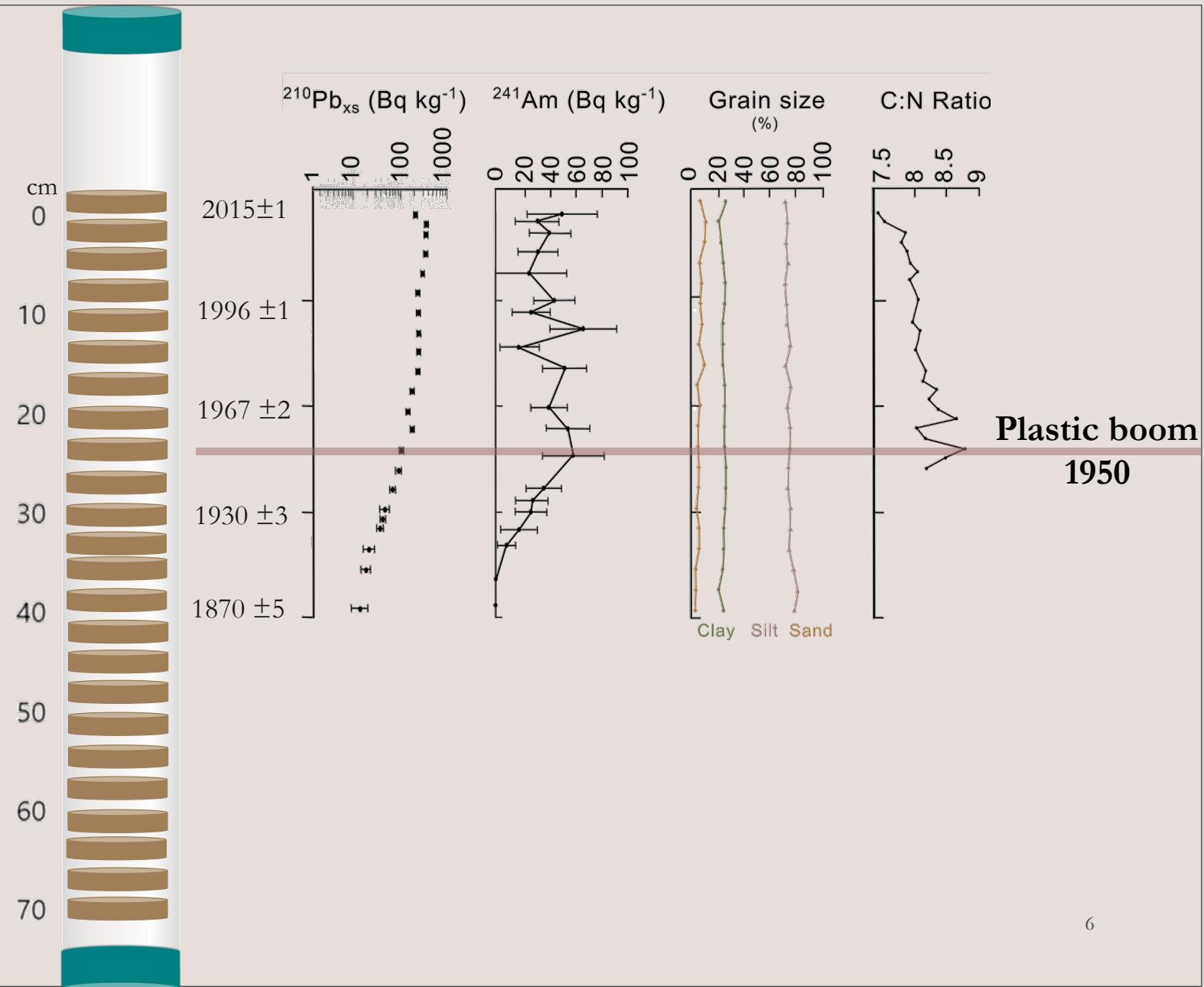
1930 – 2015

$\mu\text{FTIR}$

## NP analysis

Pyr-GC/MS

27-11-2023





# The MP sediment record

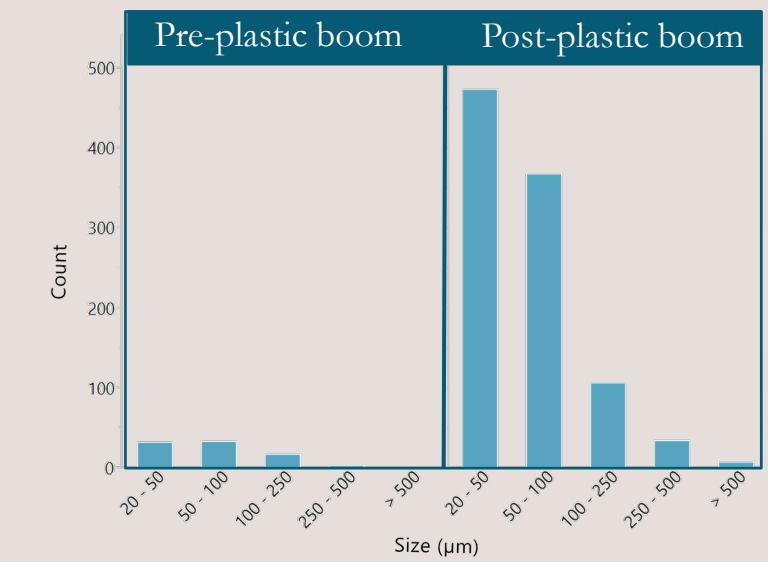
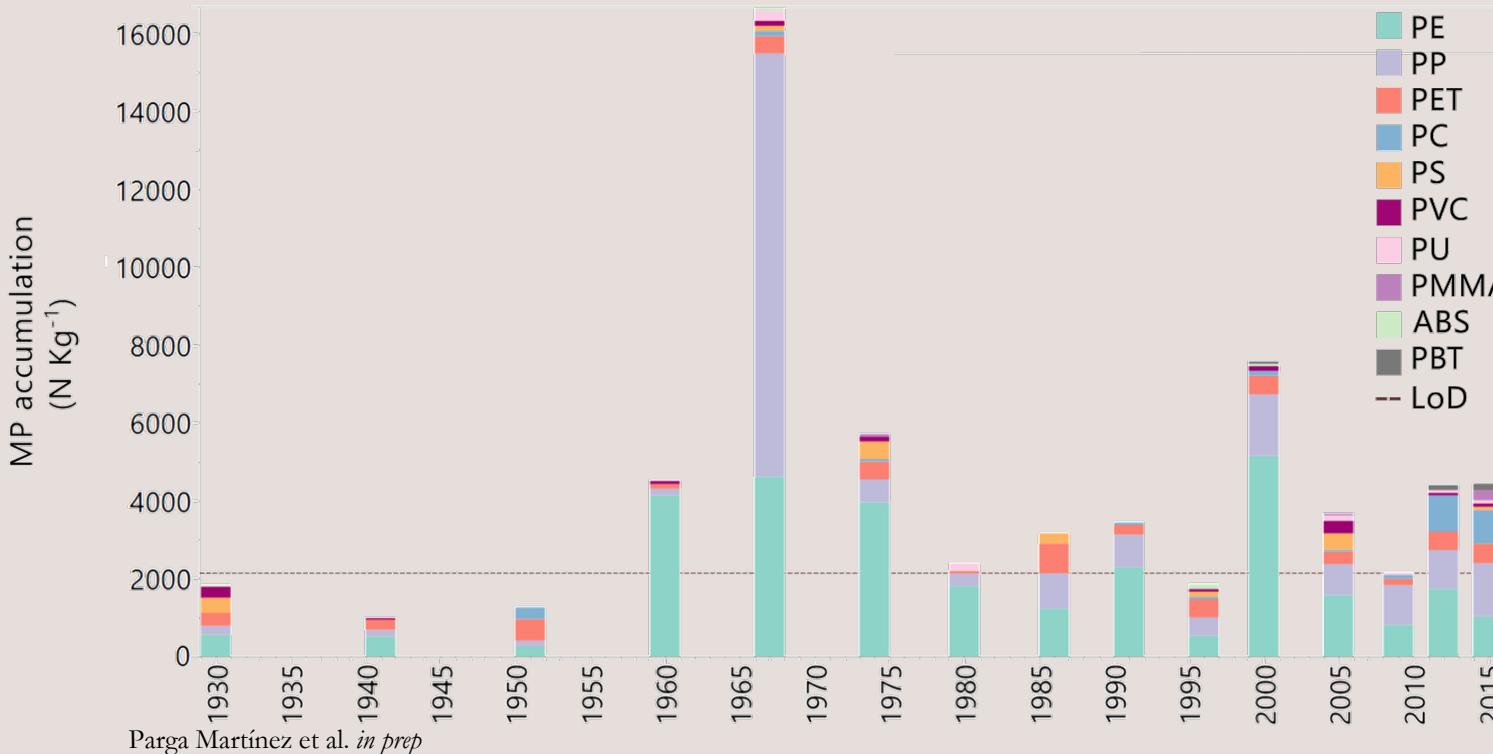
MP accumulation for 85 years

Number of particles: 1064 particles

Accumulation rate:  $0.76 - 2.71$  particles  $\text{m}^{-2} \text{y}^{-1}$

Large fraction ( $>100\mu\text{m}$ ) 15%

Small fraction (20-100 $\mu\text{m}$ ) 85%

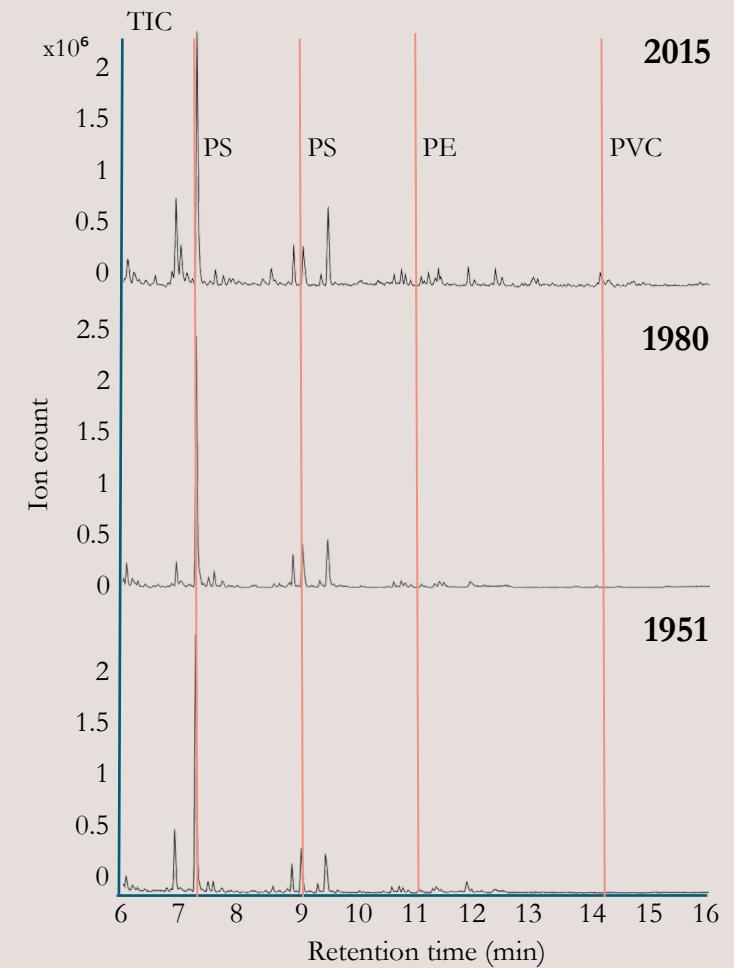




# Nanoplastics in the sediment record

Constant presence through the depth profile  
PE, PS & PVC

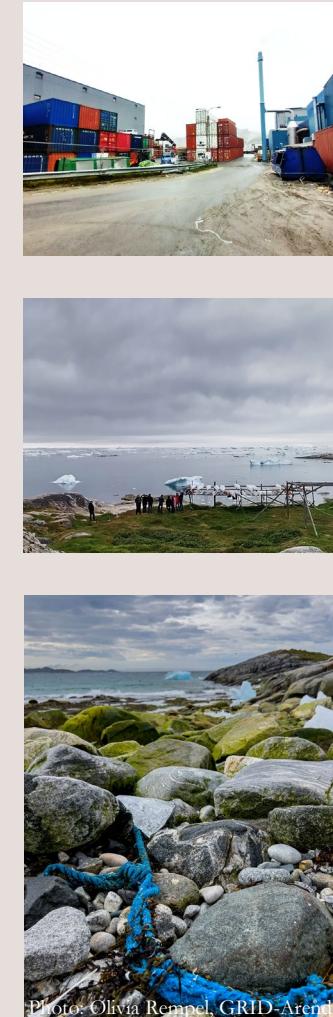
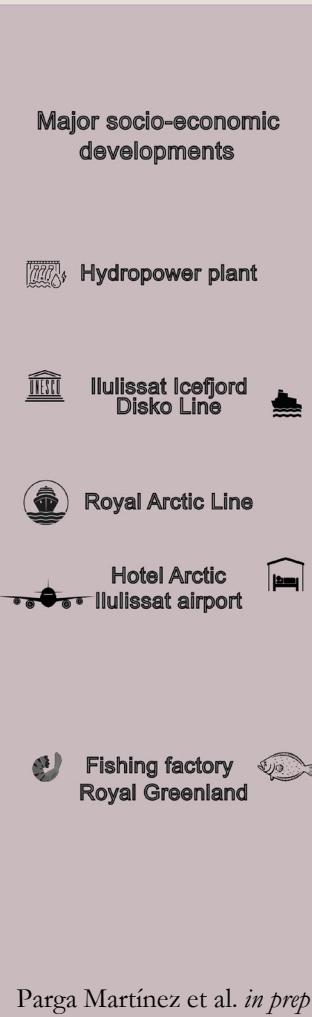
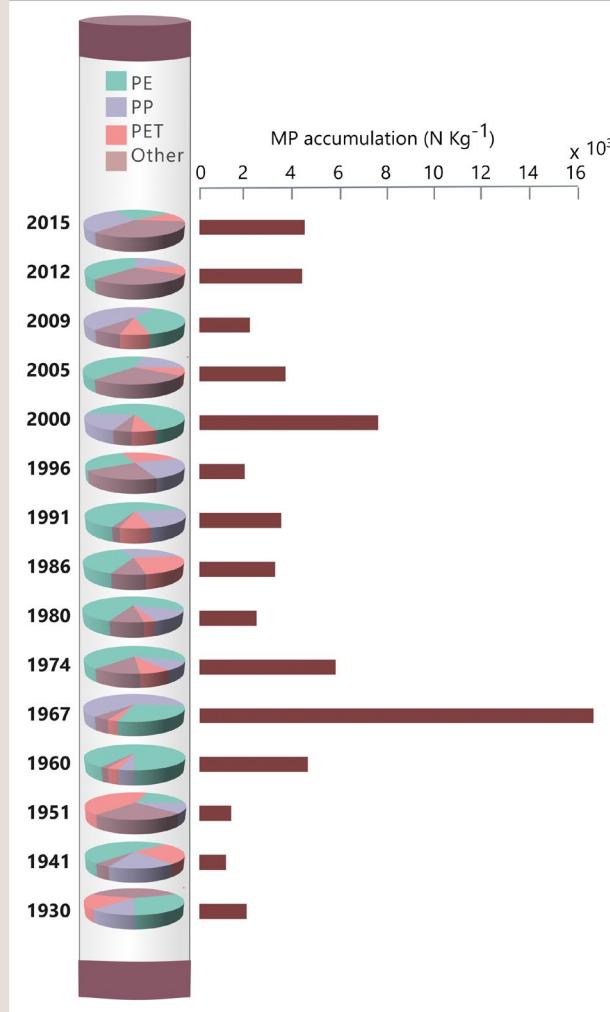
Polymer	Pyrolysis products	Ion markers (m/z)	Retention time (min)
PE	Decadiene	55, 57	11.2
	Decene		
	Decane		
PP	2,4-dimethyl-1-heptane	70	7.6
	2,4,6-trimethyl-1-nonene		
PS	Toluene	92	7.3
	Styrene		
PVC	Naphthalene	128	14.7
	Naphthalene-1-methyl		



Parga Martínez et al. *in prep*



# Marine litter in Greenland



Shipping



Tourism



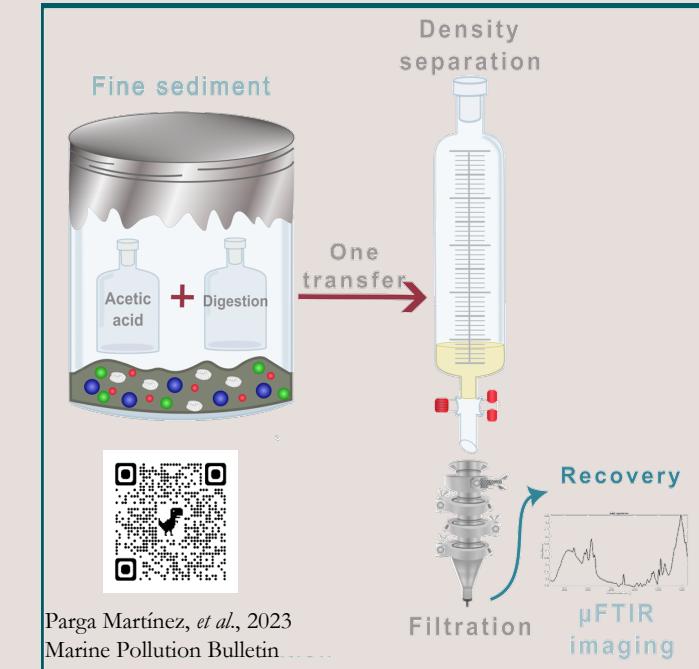
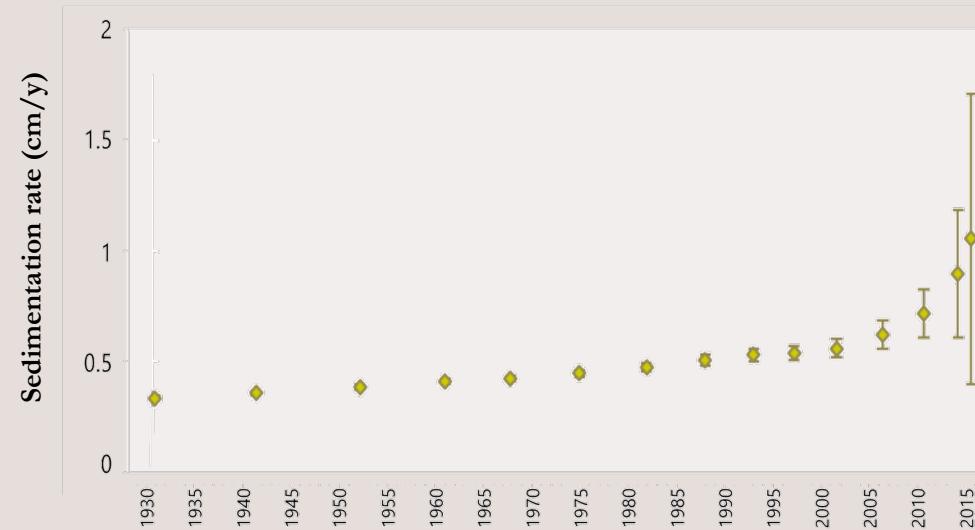
Household waste

Fisheries



# A footprint of the Anthropocene in Greenland

- High sedimentation rate (centimetre resolution)
- Reliable MP extraction
- Regional influence: disturbances in the chronology and anomalies in MP accumulation
- Regional records to build a global horizon



# THANK YOU FOR LISTENING!



Vitor da Silva  
Jakob Strand

AARHUS  
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