Microplastic pollution in sediments around Svalbard

From sea-ice covered areas on the continental shelf to deep slope gullies

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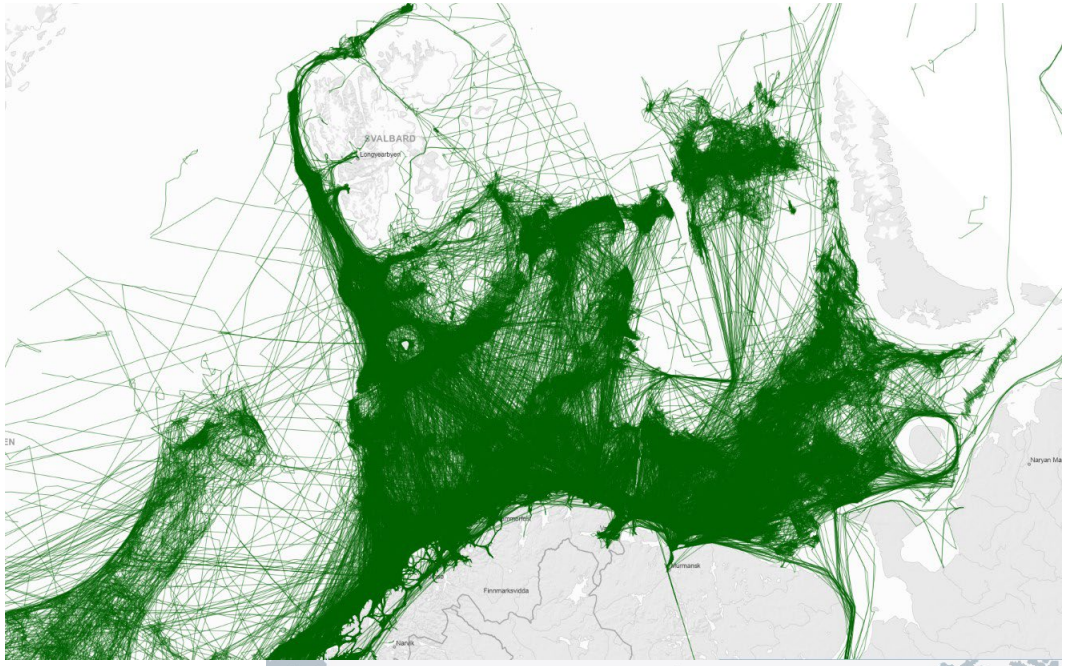
Symposium on Plastics in the Arctic and Sub-Arctic Region

Context

- Barents Sea, along the coast of Svalbard
- Influence of sea ice
- Fisheries
- Similar study in Kongsfjorden in 2018

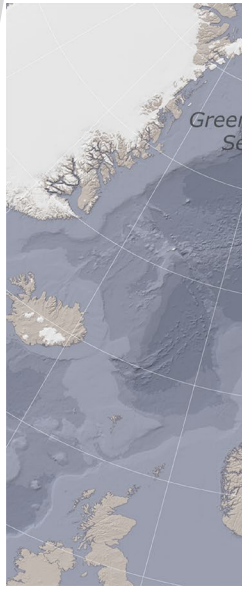
Havbase.no, 2022



Marinetraffic.com, 15.11.23

Hypotheses

- Fishing activity is one of the main sources → thread-like particles?
- Higher concentrations than in Kongsfjorden (2018 study)?
- Shallow waters and deep sea + LYR settlement → gradient of MP concentration?



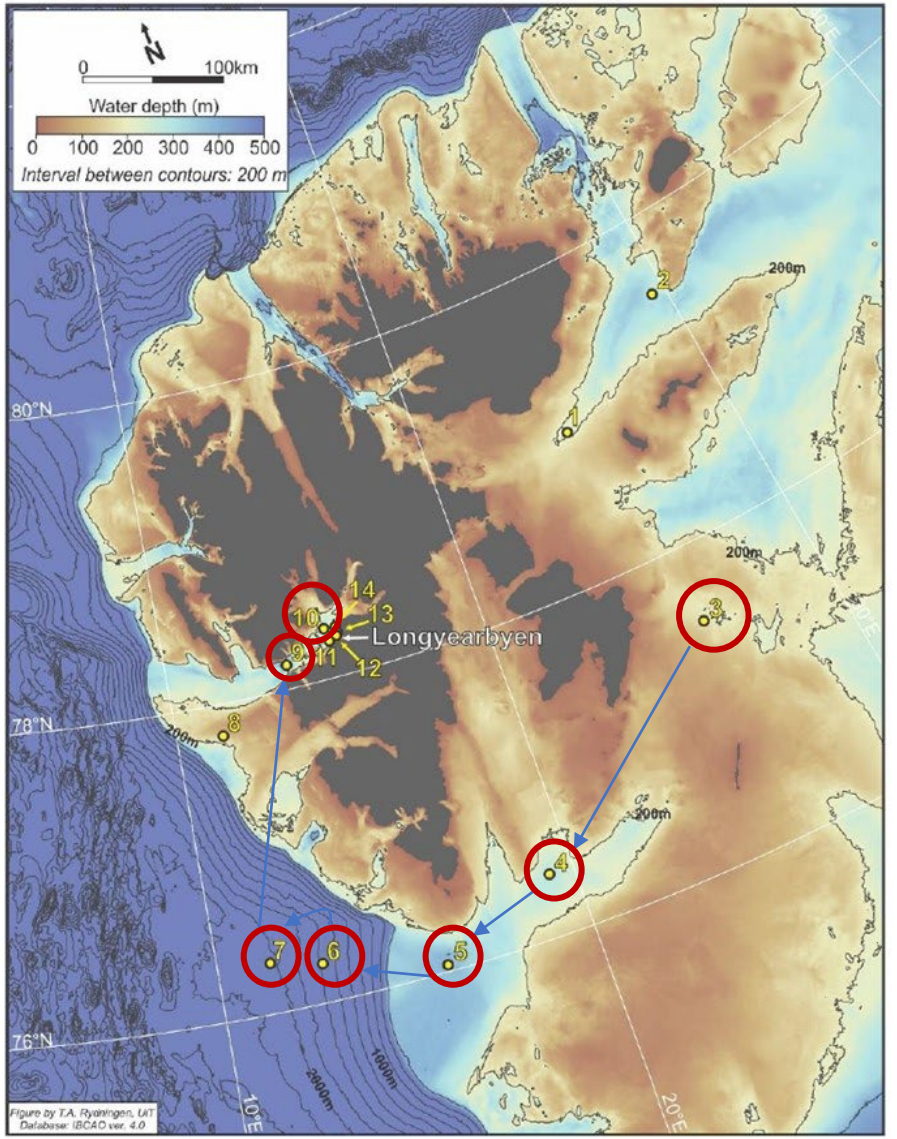


Figure 1. Bathymetric map showing all stations sampled during the cruise.

Sampling

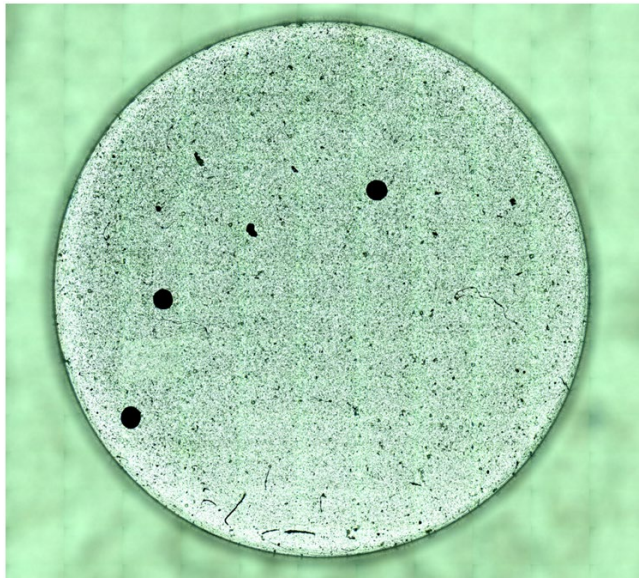
- Box-corer
- 3 casts per station, 7 stations
- Top 5 cm collected with a metallic spoon (4 subsamples per cast)
- Stored in a glass jar
- ~500 g

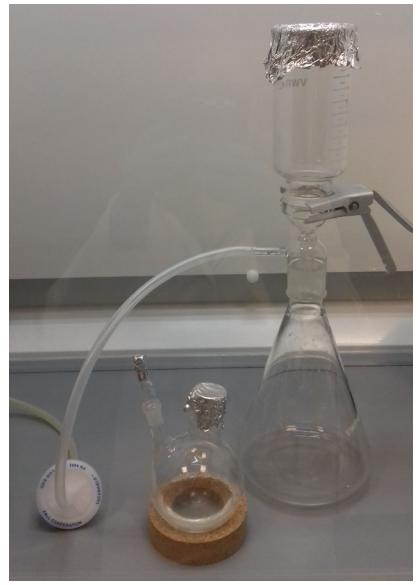
Lab work

- Density separation with NaCl (1.2 g/L)
- Supernatant pumped out and transferred to a filtration unit
- Filtration through a 5-µm mesh filter
- Rinsing step with pure ethanol
- Stored in microtubes

- Raman spectroscopy (~33% of the sample)

  Lower size limit = 50 µm





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France Collard [a,*], Katrine Husum [a], Gauthier Eppe [b], Cédric Malherbe [b], Ingeborg G. Hallanger [a], Dmitry V. Divine [a], Geir W. Gabrielsen [a]

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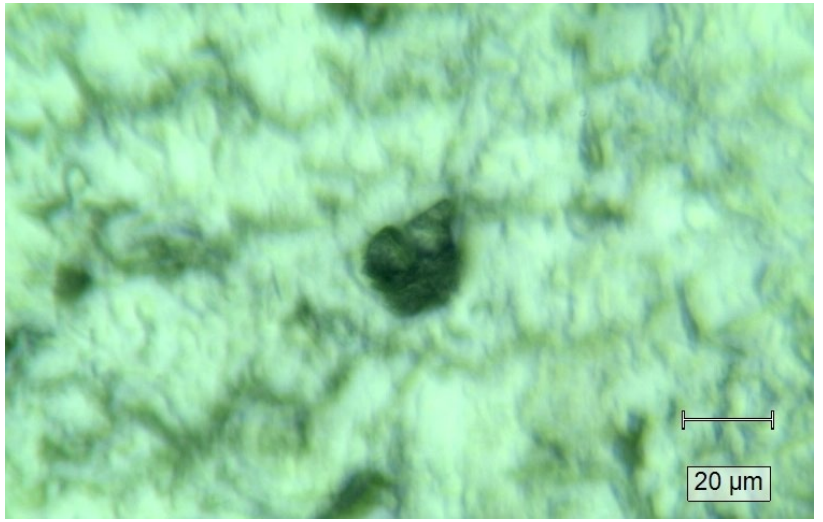
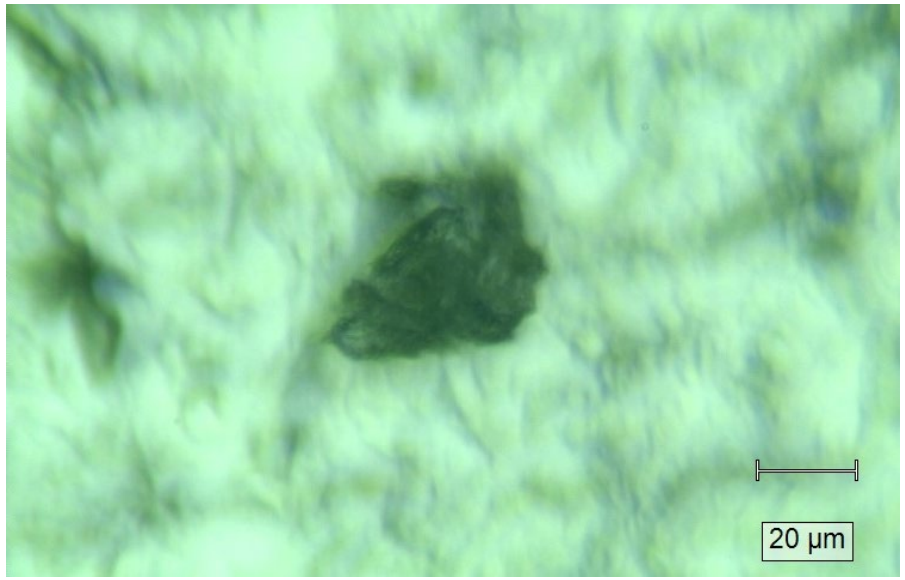
Blanks

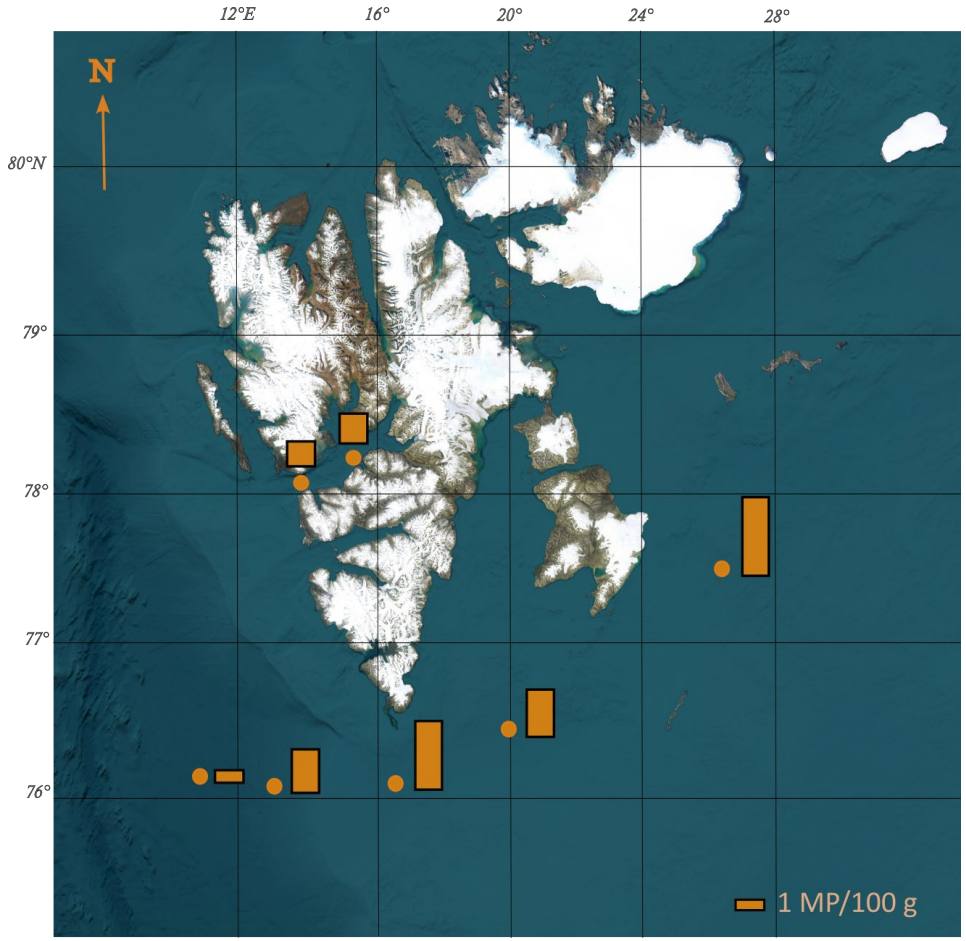
- One “field+procedural” blank per station
- If MPs were found, corresponding data were blank-corrected
- One highly contaminated blank (PP)





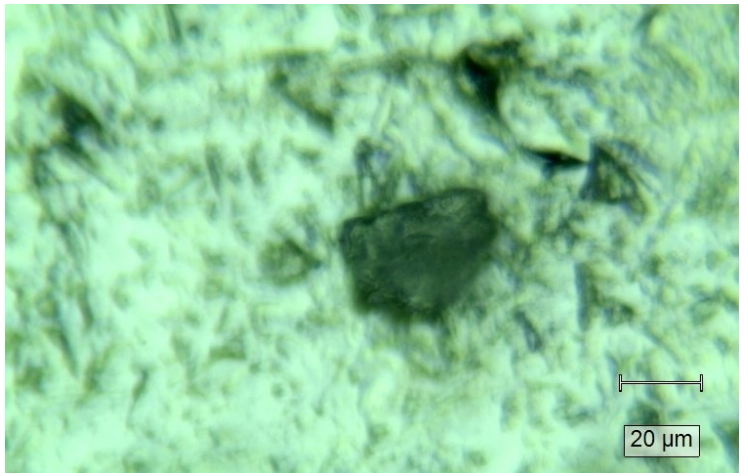
Results

- Mean concentrations ranged between 1.1 and 6.4 MP/100 g dw
- Deepest station = least contaminated
- No difference in numbers of fibres

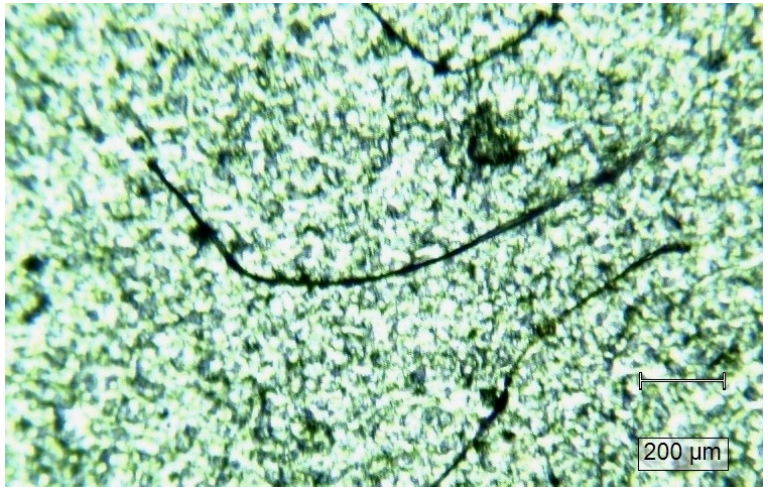


Results

- Sizes ranged between 51.2 and 1381.6 µm (average ± SD: 373 ± 291 µm)



One of the smallest MPs, Station 6



The largest MP, Station 3

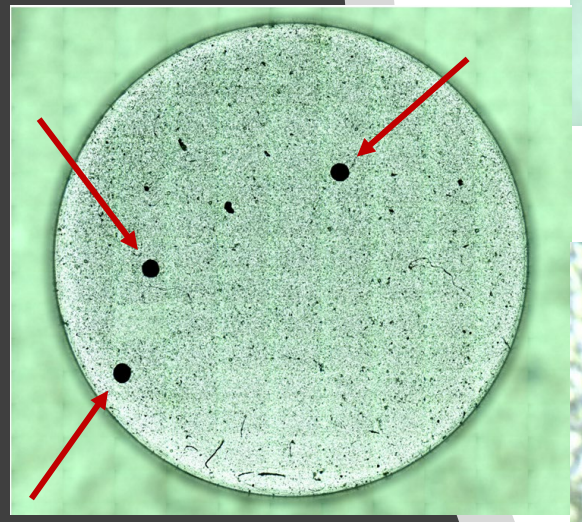
Results & Discussion

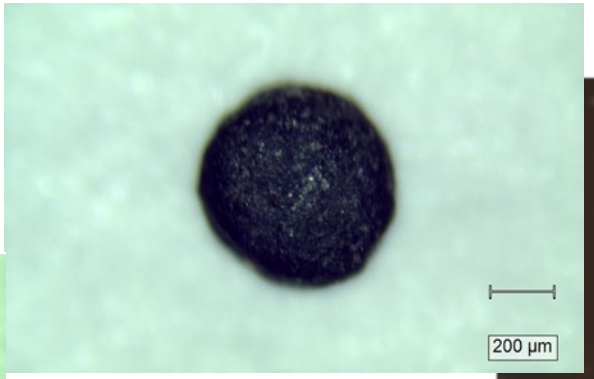
The most interesting (but also frustrating) part: the “pellet case”

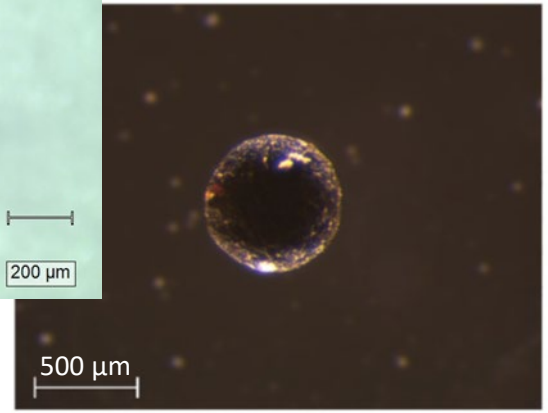
2018: Raman & FTIR, PE+acrylate

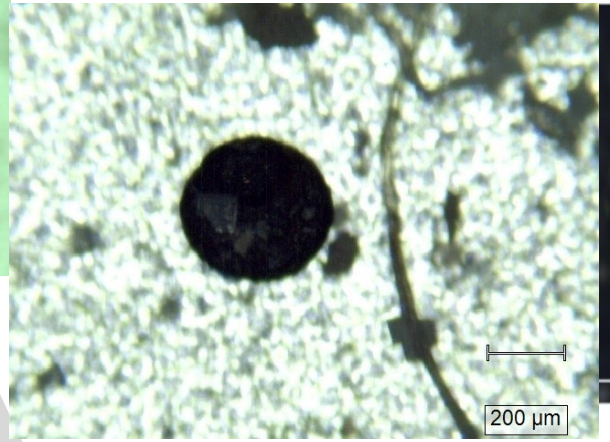
2021: Raman & FTIR, pyrolysis, p-phenylenediamines (PPD) extraction

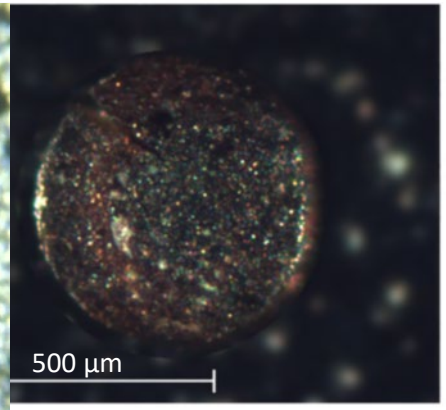
Both years are directly comparable, except spectro











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The most interesting (but also frustrating) part: the “pellet case”

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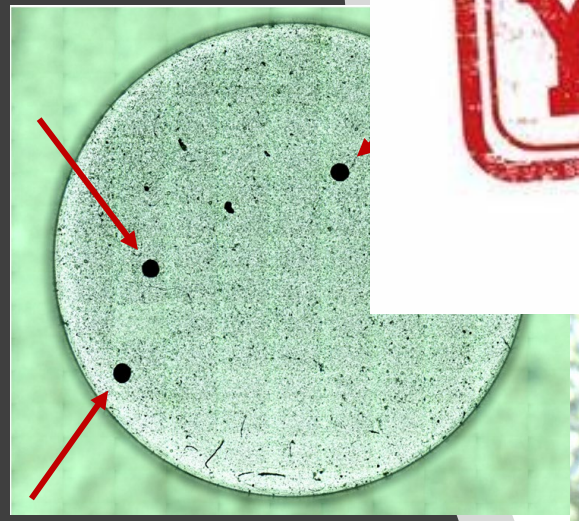
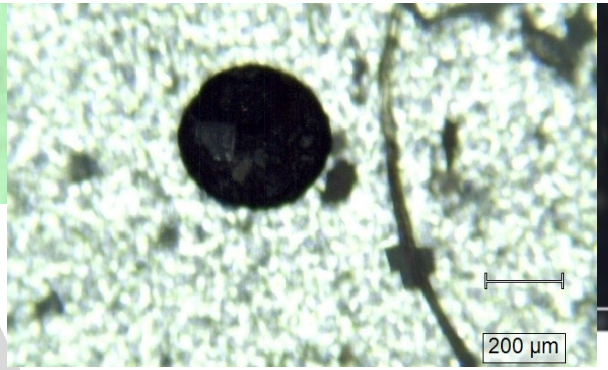
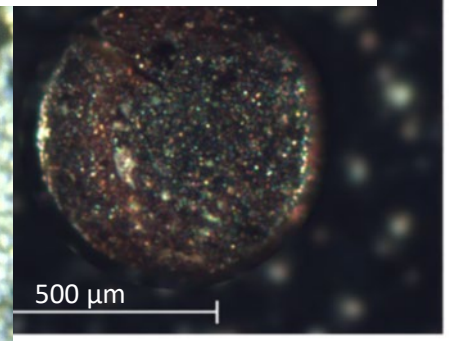




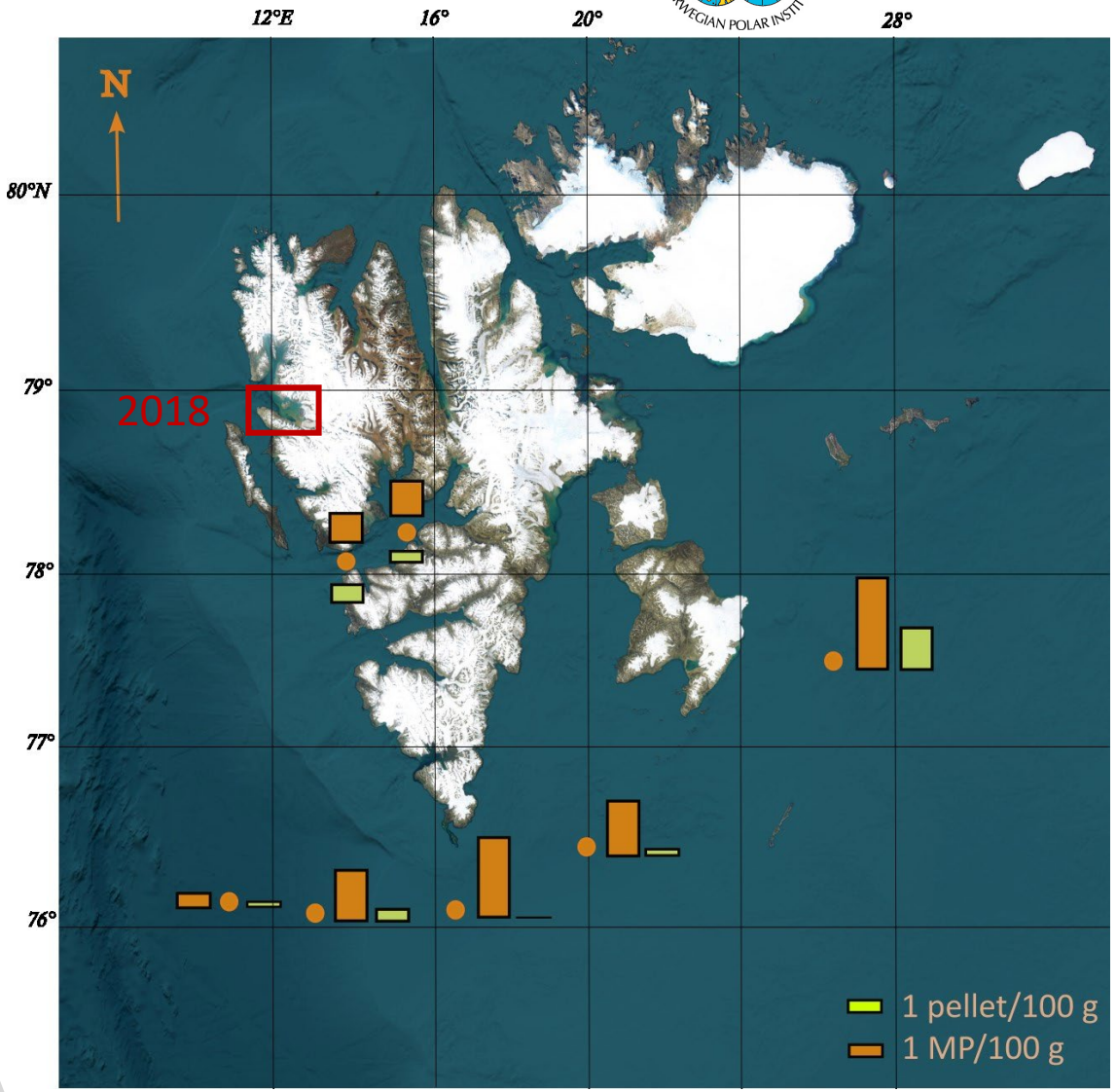


Discussion

Pellets present “all around” Svalbard

Common sources or common processes?

Result of interactions with geological formations?



Svalbard is ~62,000 km^2

Rangel-Buitrago et al. (2022). The Plasticene: Time and rocks, Marine Pollution Bulletin, 185. 10.1016/j.marpolbul.2022.114358

Discussion

Degradation products of plastirocks (Rangel-Buitrago et al. 2022)?

- Plastitar (e.g. Dominguez-Hernandez et al. 2022)
- Plastiglomerate (e.g. Corcoran et al. 2014)
- Plasticrusts (e.g. Gestoso et al. 2019)

Rangel-Buitrago et al. (2022). The Plasticene: Time and rocks, Marine Pollution Bulletin, 185. DOI: 10.1016/j.marpolbul.2022.114358
Corcoran et al. (2014). An anthropogenic marker horizon in the future rock record. GSA Today 24 (6), G198A. DOI: 10.1130/GSAT-G198A.1
Dominguez-Hernandez et al. (2022). Plastitar: a new threat for coastal environments. Sci. Total Environ. 839. DOI: 10.1016/j.scitotenv.2022.156261
Gestoso et al. (2019). Plasticrusts: a new potential threat in the Anthropocene's rocky shores. Sci. Total Environ. 687. DOI: 10.1016/j.scitotenv.2019.06.123

Composition	Texture	Name	
Plastics with rock fragments, quartz, feldspar grains and clay minerals.	Mostly angular and/or subangular gravel with plastics	Plastibreccia	Detriplastic rocks
	Mostly subround and/or well-rounded gravel with plastics	Plastiglomerate	
	Mostly quartz sand with plastics	Quartz plastisandstone	
	Mostly feldspar sand with plastics	Plastiarkose	
	Mostly rock fragments with plastics	Lithic plastisandstone	
	Sand is mixed with mud and plastics	Plastiwacke	
	Mostly silt with plastics	Plastisiltone	
	Mostly Clay with plastics (fissile – shale; blocks-clay)	Plastishale Plasticlaystone	
Plastics with plants fragments and/or charcoal	Plastics inside a porous brown rock with visible plat fragments	Plastipeat	Bioplastic rocks
	Plastics inside a dull, dark brown, brittle, organic-rich rock	Plastilignite	
	Plastics inside a black, layered, brittle coal rock.	Plasticoal	
Plastics with shells/coral fragments and calcareous items	Plastics with a mostly gravel-sized shells or coral fragments	Anthropoquinas	
	Plastics with a mostly sandy-sized shells or coral fragments	Plasticalcarenite	
	Plastics with microscopic shells of calcareous phytoplankton	Plastichalk	
Plastics with specific calcite or aragonite fabrics	Plastics with calcareous oolite (spherical) grains	Plasticoolitic limestones	Chemiplastic rocks
	Plastics with masses of visible crystals of $CaCo_3$as in cave and spring deposits	Plastitravertine	
Plastics in salt deposits (e.g, halite; gypsum)	Plastics combined with visible cubic crystals of NaCl or other precipitated salts	Plastihalite	

Rangel-Buitrago et al. 2022

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