Microplastics pollution detected in pristine lakes in the Arctic region

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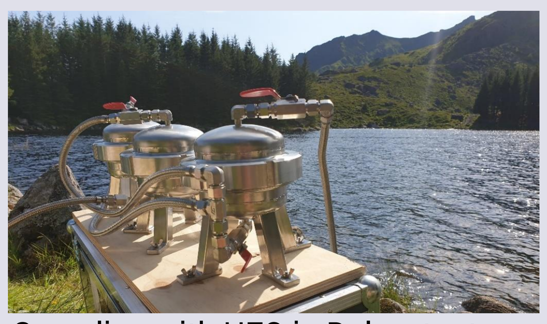
Introduction

Microplastics (MP) have been detected worldwide, even in remote areas. Up to date, it is unclear whether there still exist pristine environments or MP pollution has become a ubiquitous global issue. To better understand the extent of this issue and to assess the baseline concentration of MP in pristine environments, we investigated three lakes in the arctic region (Lofoten Islands, Norway) with low levels of anthropogenic impact.

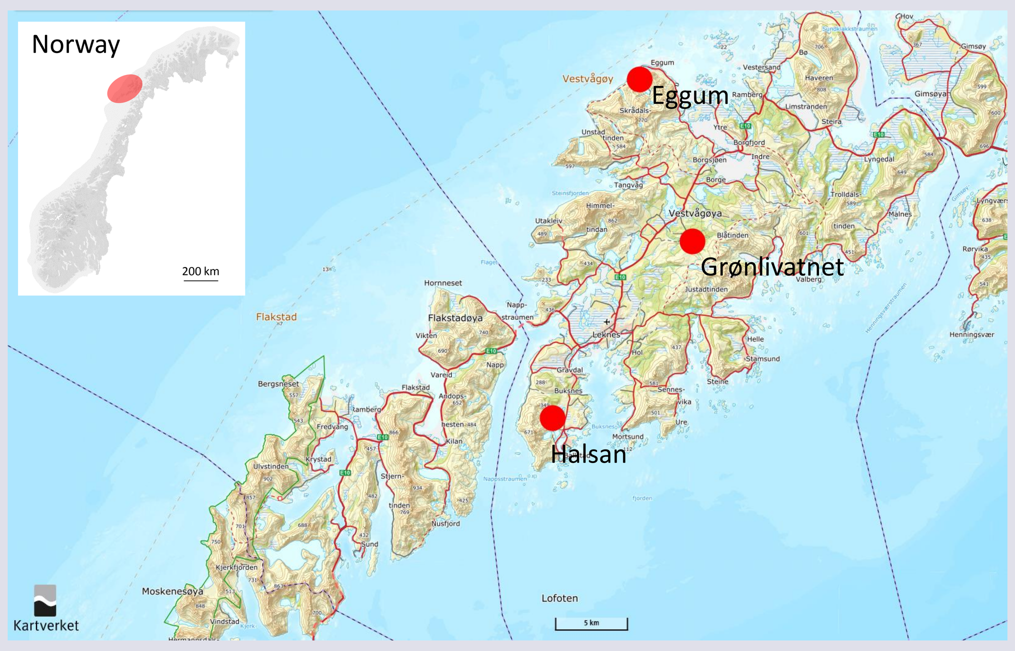
Sampling

Surface water samples were taken at two points at each of the lakes utilizing a custom-built and already well-established filtration device[1] (UFO system), enabling sampling of MP in the range of 10–5000 µm. Field blanks for airborne contamination were collected at each location.

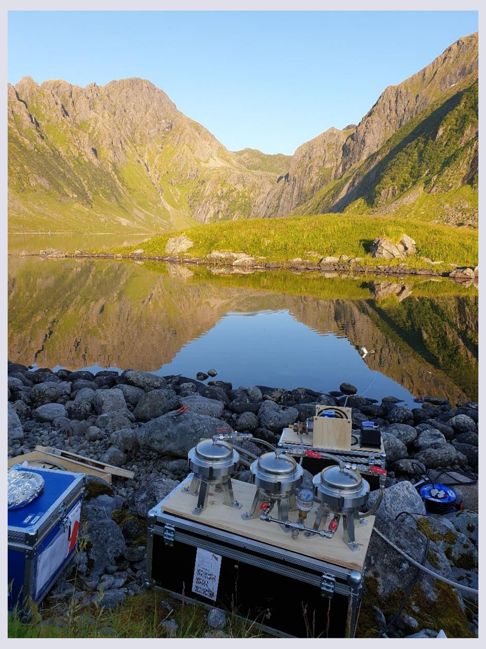
Changing filters in Grønlivatnet



Sampling with UFO in Dalsvatnet (Halsan)



Map of the sampling locations (red dots on map)

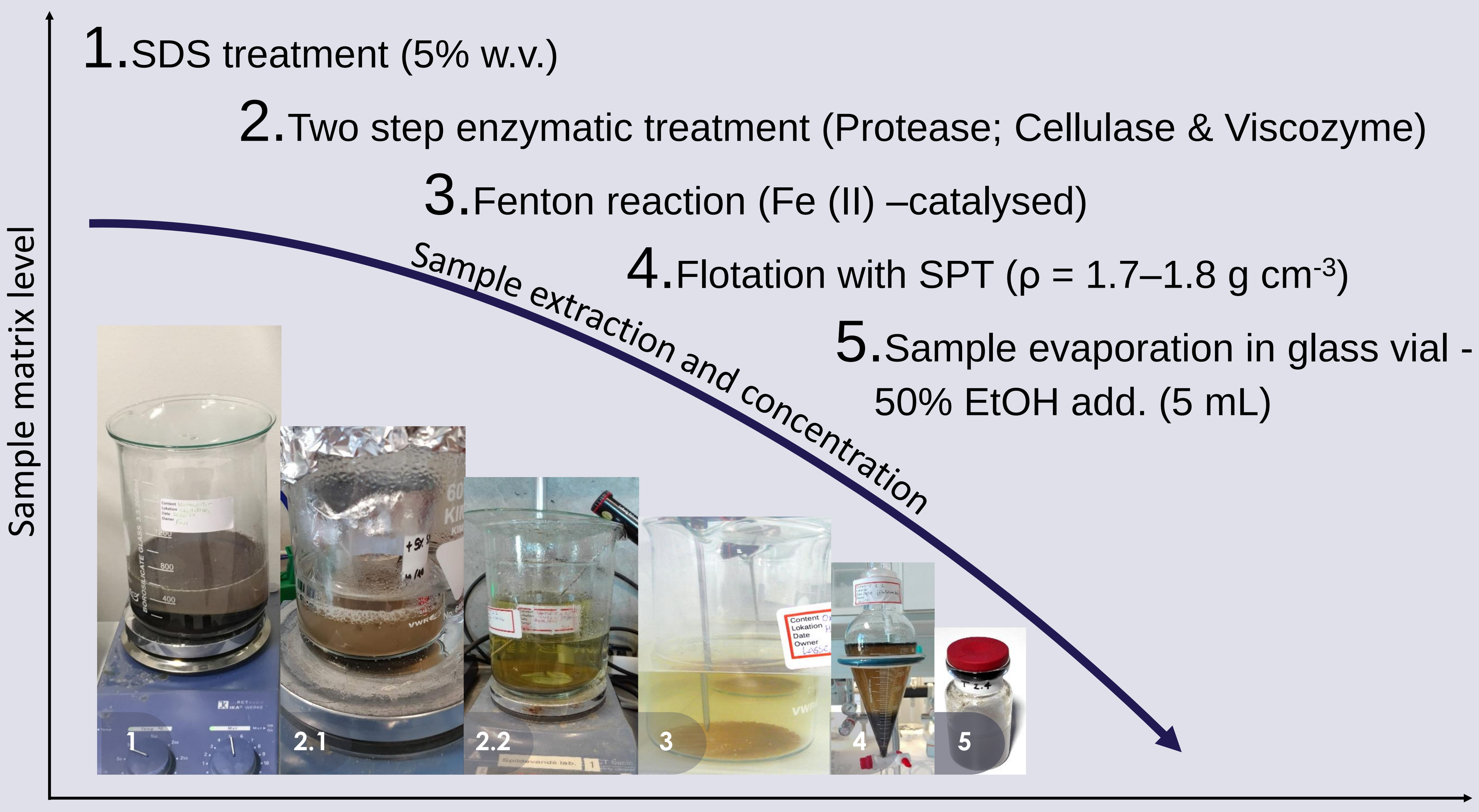


Sampling in Nedre Heimredalsvatnet (Eggum)

Sampling in Grønlivatnet inlet with UFO system

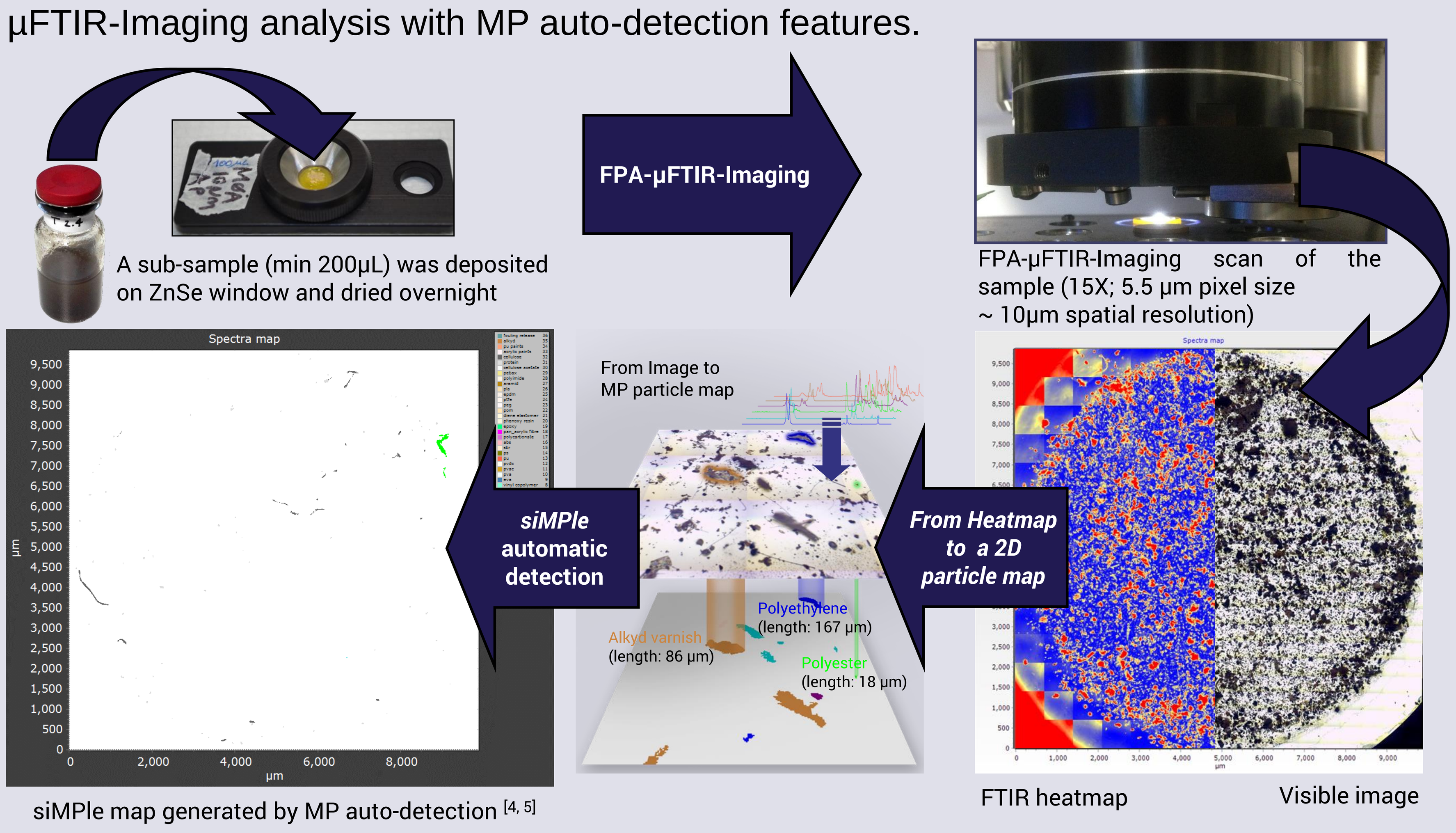
Sample preparation

The samples and a procedural lab blank were processed through a well established multi-step enzymatic-oxidative sample treatment [2,3].



µFTIR-Imaging analysis & siMPle automated analysis

The samples and the blanks were analysed by FPA-µFTIR-Imaging (Agilent Cary 620-670). The FTIR-Imaging data were analysed using siMPle, a freeware software for µFTIR-Imaging analysis with MP auto-detection features.

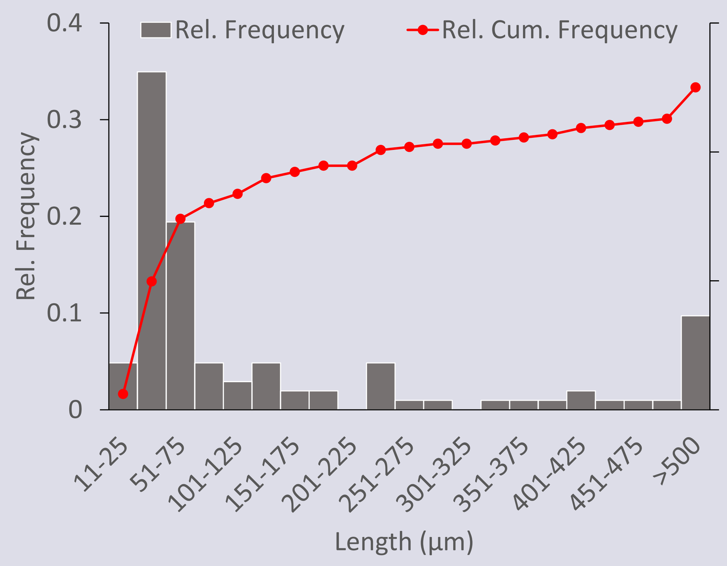


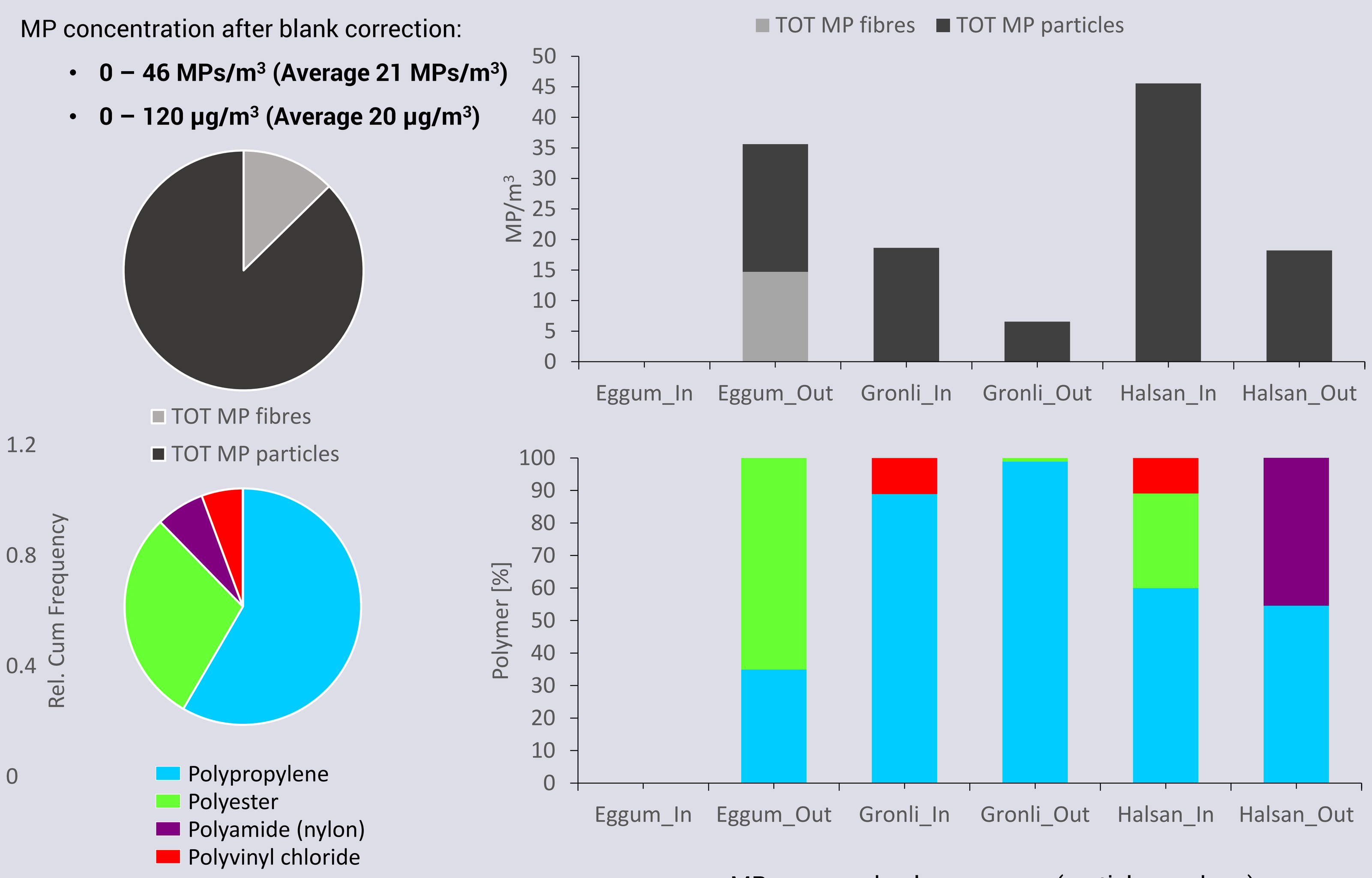
Results & Discussion

Preliminary results revealed low MP concentrations ranging from 0 to 46 MP/m³ after performing blank correction. The average concentration of 20 MP/m³ was comparable to the lower concentrations detected in marine water and drinking water studies. Most of the detected MP (59%) were in the size range of 11–75 µm, and only 10% was larger than 500 µm. Polypropylene (PP) and polyester (PEST) dominated the polymer composition with a lower contribution of polyamide (PA) and polyvinyl chloride (PVC). The polymer composition and overall small particle size are hinting towards atmospheric deposition as a major source of the MP accumulating in these lakes.

Sample matrix	MP concentration	Unit
Treated wastewater (Simon et al. 2018) [6]	1.9×10^4 – 4.5×10^5	MPs/m³
	500 – 1.2×10^4	µg/m³
Stormwater ponds – water (Liu et al. 2019) [3]	490 – 2.3×10^4	MPs/m³
	85 – 1.1×10^3	µg/m³
Stormwater ponds – sediment (Liu et al. 2019) [7]	1.5×10^3 – 1.3×10^5	MPs/kg
	115 – 2.9×10^4	µg/kg

MPs concentration in other environmental and anthropogenic matrices according to recent publications





MP conc. and polymer comp. (particle numbers)

Conclusion

MP pollution, in very low concentrations, has reached even pristine freshwater environments in the Arctic, although the main sources are likely linked to airborne deposition. Furthermore, the results highlight the importance of sample contamination prevention and assessment, especially when dealing with low-level MP concentrations.

References

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[3] Liu et al. 2019 (a), https://doi.org/10.1016/j.scitotenv.2019.03.416
[4] Primpke et al. 2020, https://doi.org/10.1177/0003702820917760
[5] https://simple-plastics.eu/index.html
[6] Simon et al., 2018, https://doi.org/10.1016/j.watres.2018.05.019
[7] Liu et al., 2019 (b), https://doi.org/10.1016/j.envpol.2019.113335

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Find the project here: