

Microplastics

Unveiling the Invisible Threat in a VUCA World

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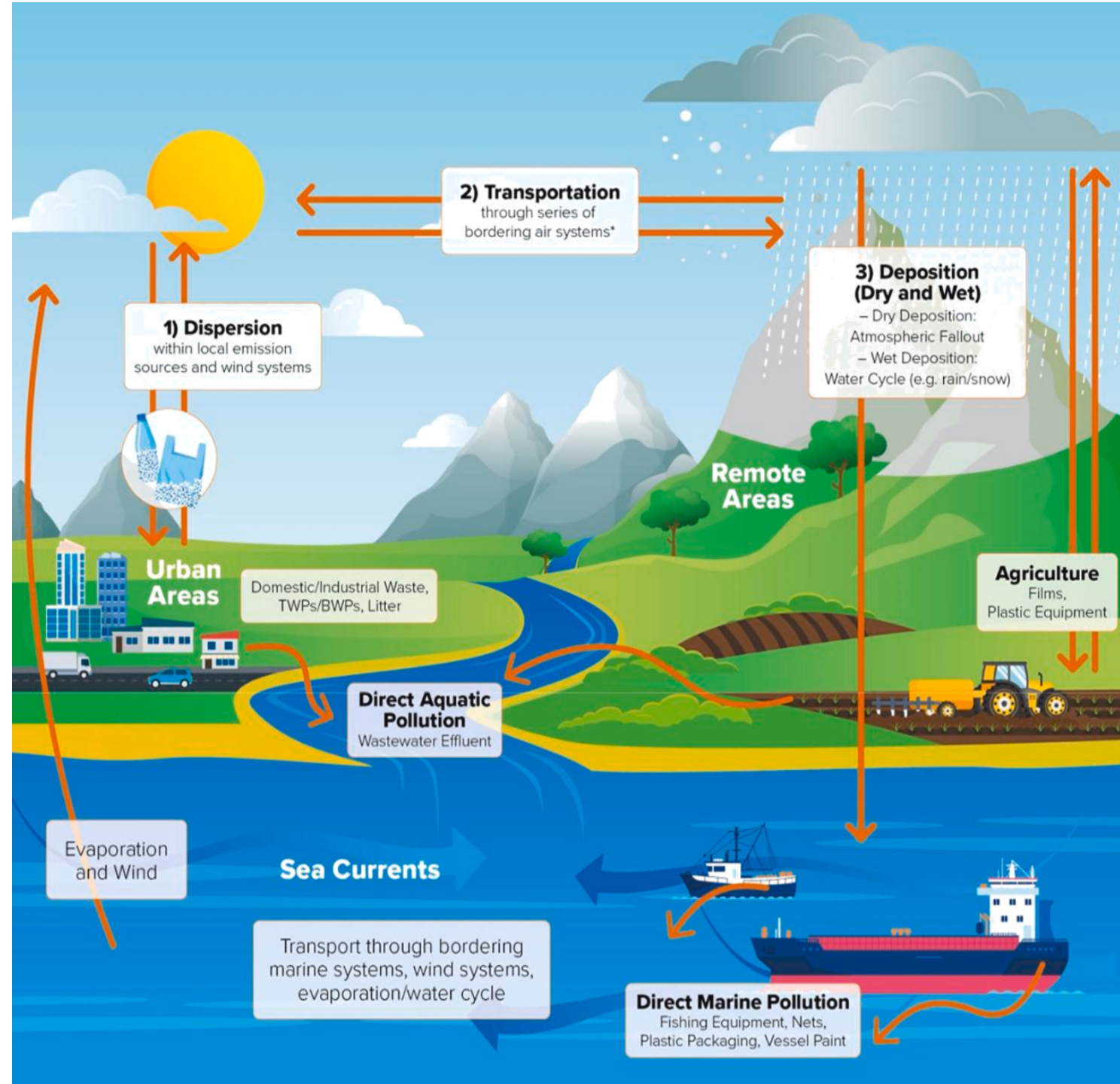
Microplastics

- Tiny plastic particles, sizes from 1 μm to 5 mm
- Mass production of plastic materials from petrochemicals is relatively inexpensive and has grown massively since it started in around 1950
- Some of the most important compounds used by modern societies
- Either produced for a specific purpose or due to the degradation of larger plastic elements
- Microplastic pollution expected to triple in the next 20 years



Emerging Threat

- Environmental pollution
 - Marine pollution
 - Terrestrial pollution
- Global distribution
 - Ubiquitous presence
 - Atmospheric transport
- Long-term consequences
 - Persistence
 - Ecological disruption
- Human health concerns
 - Food chain contamination
 - Health risks, including hormonal disruption and toxicity



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Microplastics particles discovered in Europe's largest ice cap

Traces found at Vatnajokull in Iceland could affect melting and shifting behaviour of glaciers

Joe Sommerlad • Tuesday 04 May 2021 17:37 BST • [Comments](#)



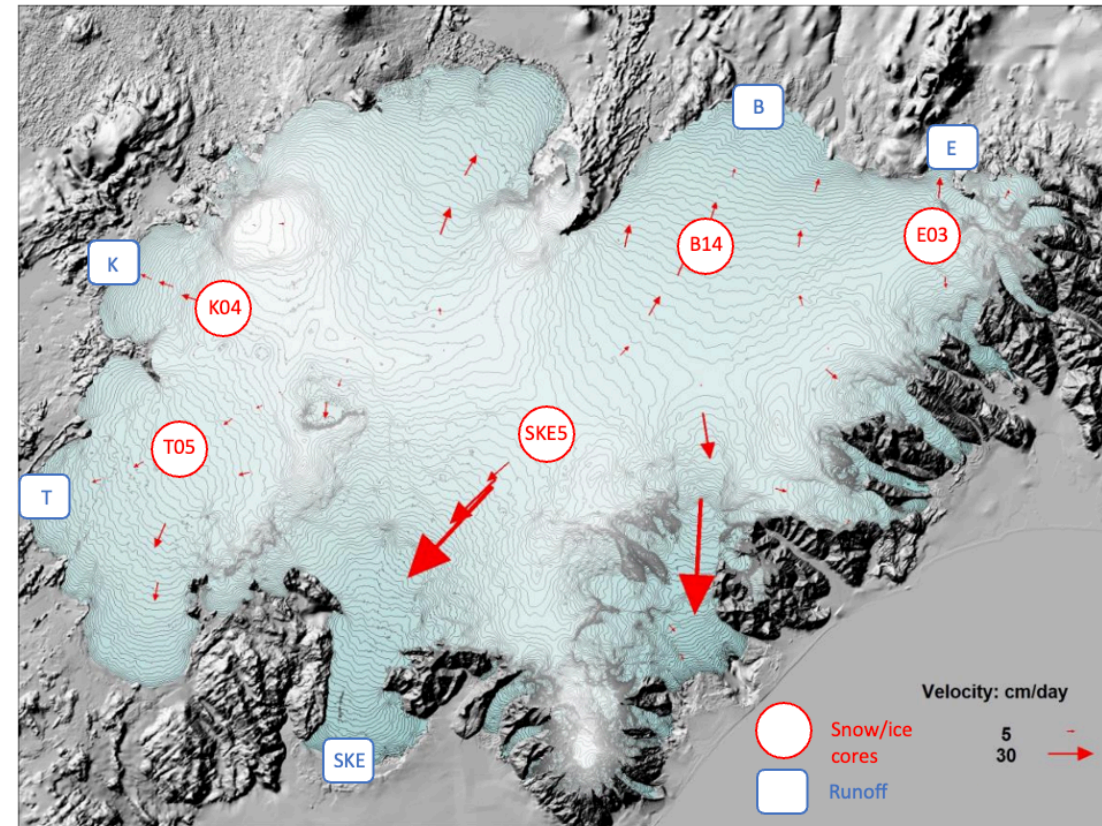
| 2021

Microplastics in Glaciers



Microplastics in Glaciers

- Objective of current work is to estimate for the first time microplastics (MP) concentration, particle types, and quantity in Vatnajökull ice cap's annual snow layer
- Research questions:
 - What is the number of MP particles, their size, shape, material type, and colour in snow/ice cores from selected locations on the Vatnajökull ice cap?
- Samples have already been collected from four locations (F04, E09, T4, and K4)

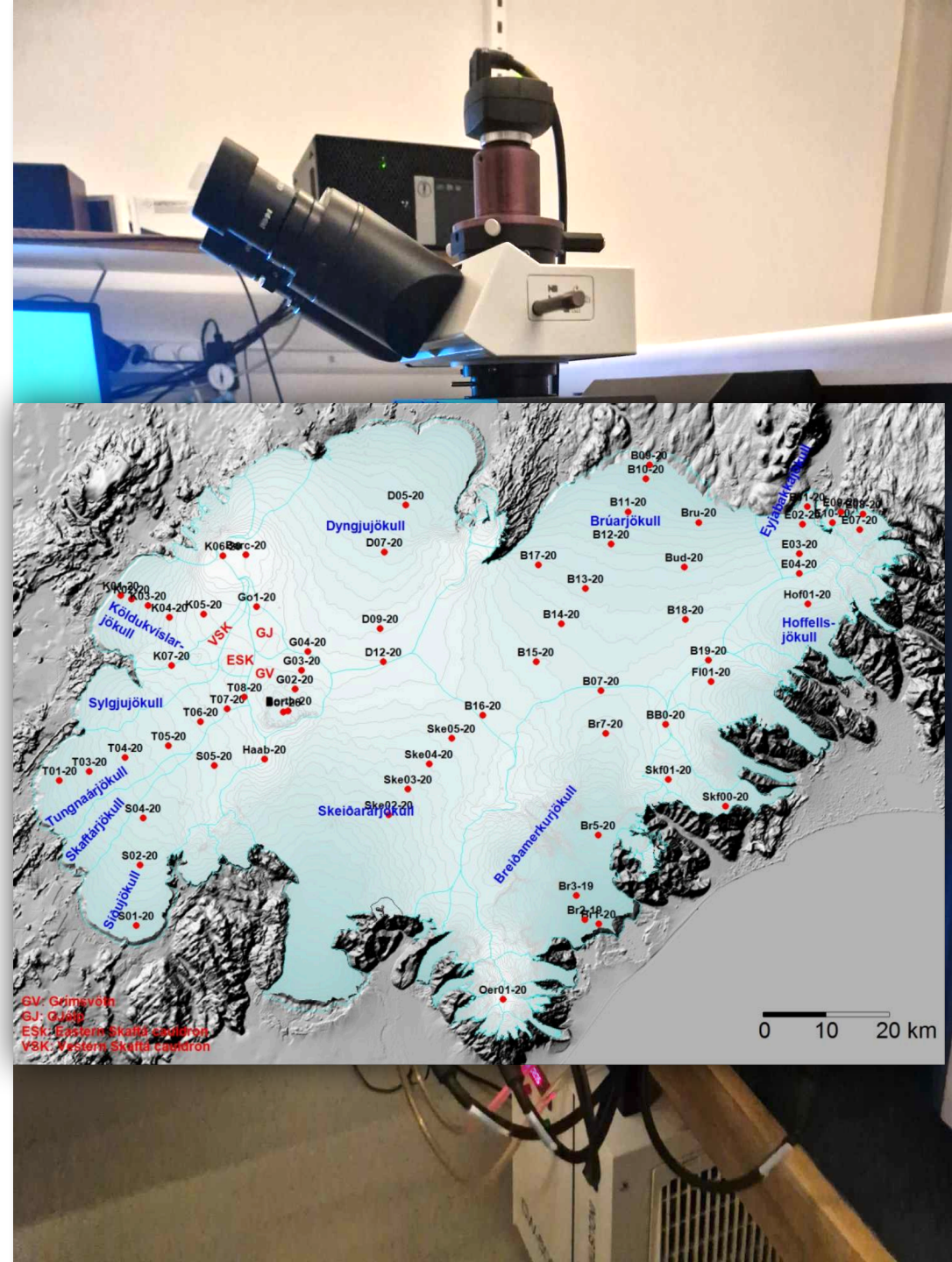


Microplastics in Glaciers

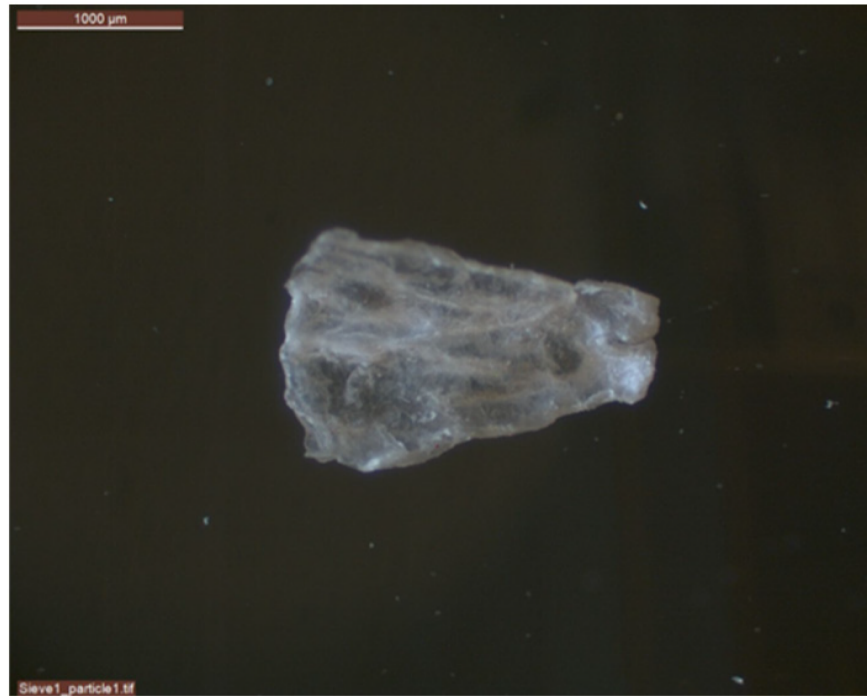
Main steps of the process for analysis

1. Cores melted in a clean lab and filtered into three size fractions: $>800\ \mu\text{m}$, $800\text{-}180\ \mu\text{m}$, and $180\text{-}50\ \mu\text{m}$, using sieves made of stainless-steel mesh
2. Microplastic particles separated from heavier particles such as dust and volcanic ashes
3. Organic matter removed
4. The number of particles in each sample quantified, their size, shape, material type, and colour using high-resolution μ -Raman spectroscopy analysis at the University of Gothenburg

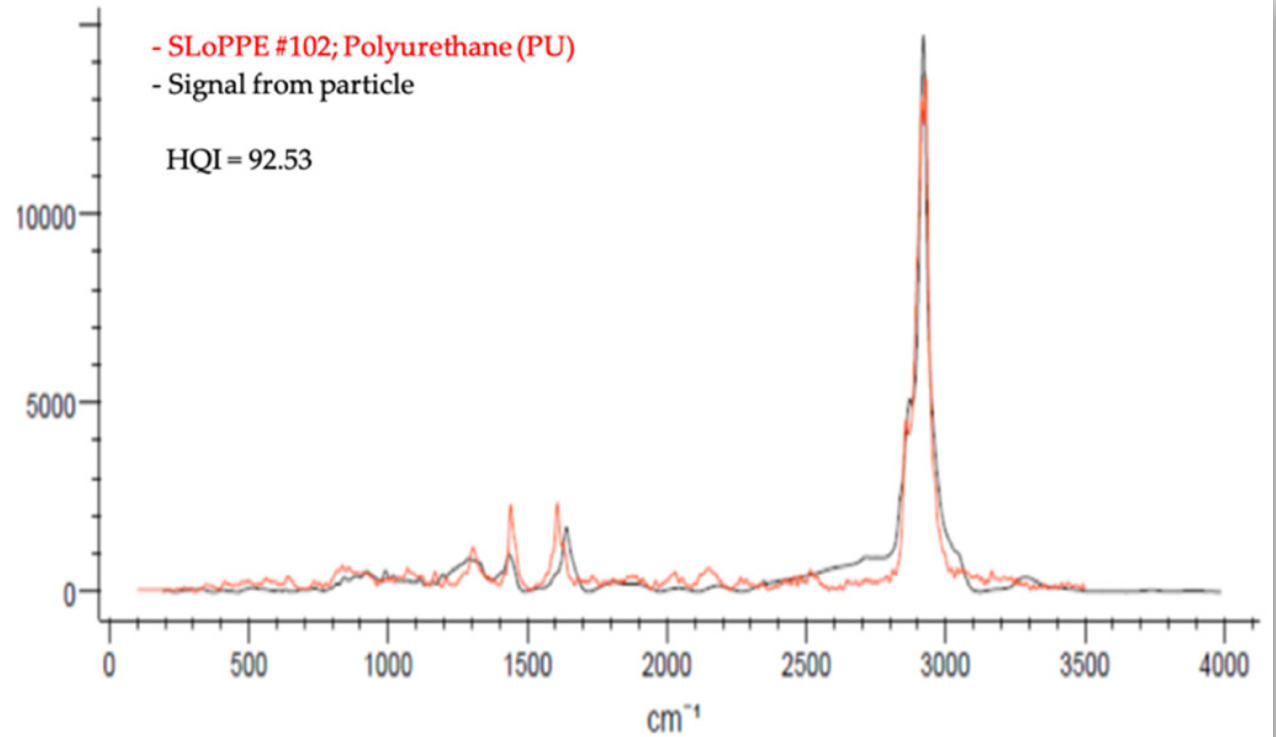
Based on results from the collected samples, and results from LV annual mass balance measurements, the overall quantity will be estimated



Example of Results



(a)



(b)

Research objectives

- Improve understanding of the pathways of MP particles onto the ice cap
- Study content in runoff water and older annual layers
- Study whether microplastics accumulate in the ice cap or are released during seasonal melting

The fate of microplastics in the ice cap and the transport pathways for microplastics from the ice cap to freshwater systems or the ocean



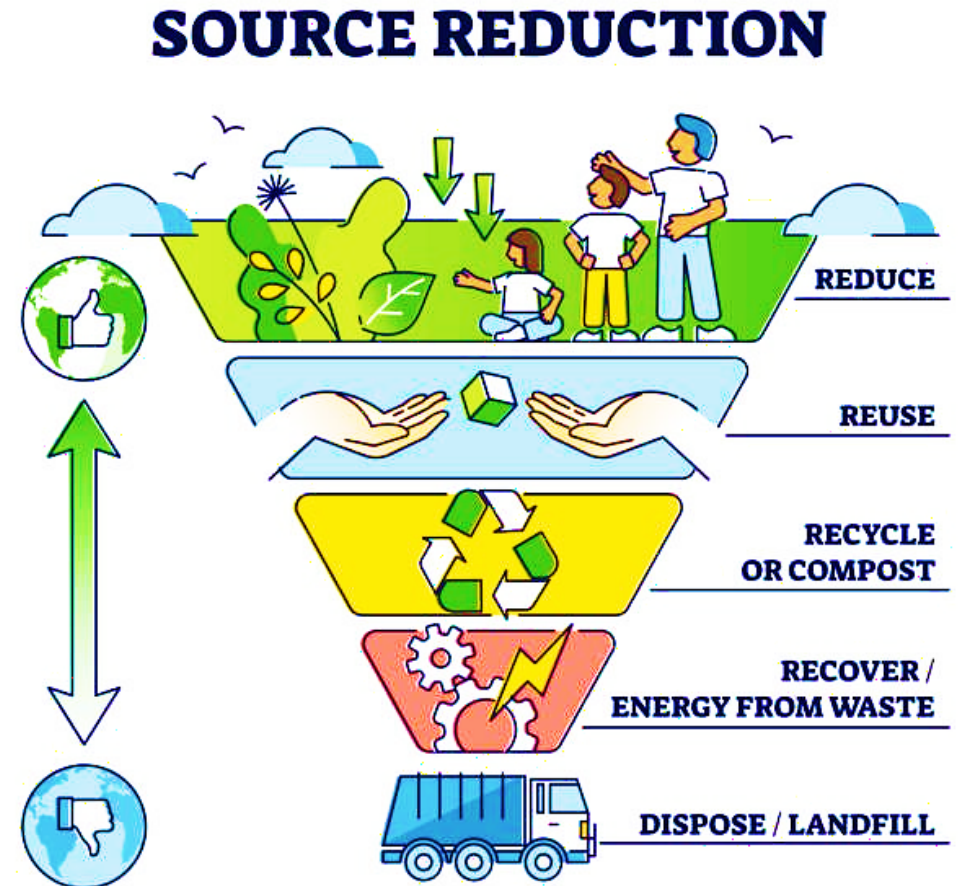
Novelty and Scientific Contribution

- First attempt to estimate the quantity of MP particles in a glacier
- Around 10% of the earth's land surface is covered by glaciers, Arctic and Antarctica, Himalayas, and elsewhere
- Very important freshwater resources
- Glaciers and Arctic areas are particularly interesting terrestrial systems for studying emerging MP pollution
 - MP particles well preserved
 - Relatively remote and high-altitude locations far away from sources of MP pollution allow improving understanding of the transport pathways
- Furthermore, a preliminary microscopic study of the bounding of MP particles with snow/ice structures will be performed and could provide insight into the potential effect on melting



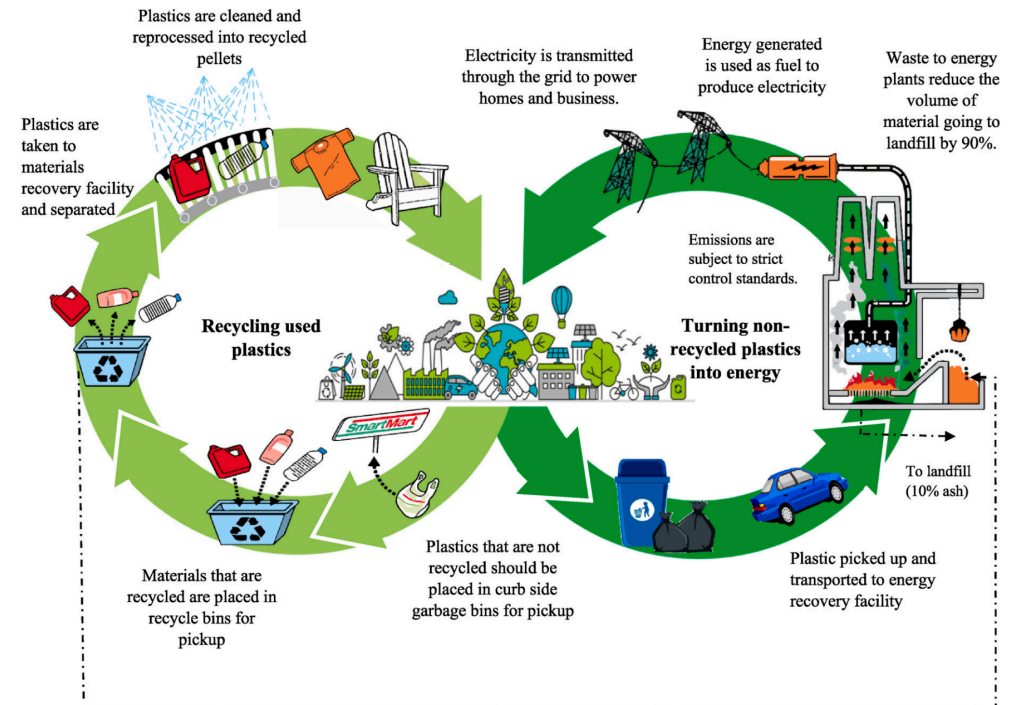
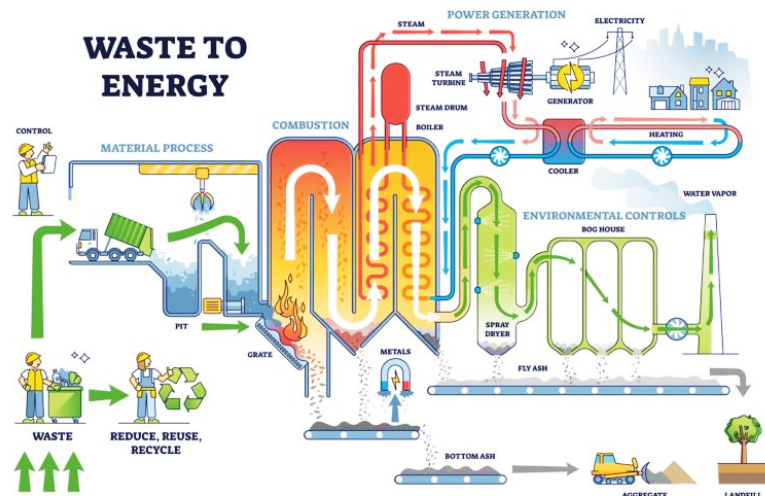
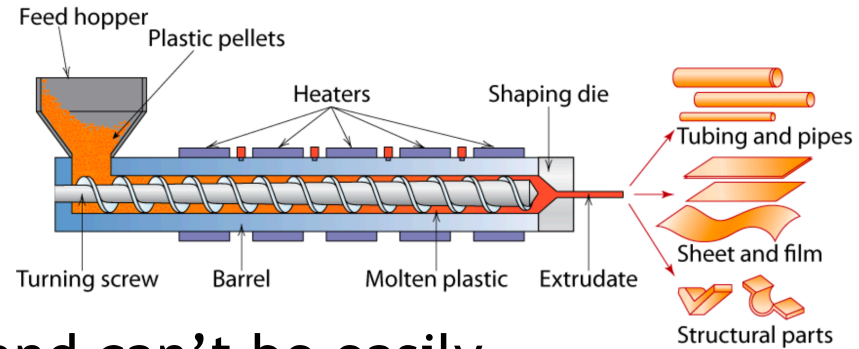
How can we reduce MP Pollution?

1. Reduce use of plastic
2. Avoid releasing any plastic into the environment
3. Reuse
4. Recycle
5. Plastic Waste to Energy (WtE)



Plastic Waste Recycling / Energy Recovery

- Two main categories of plastics:
 - Thermoplastics: can be melted and recycled
= **Recycling**
 - Thermosets: do not soften or melt when reheated and can't be easily recycled
 - Can be converted into energy or fuel



Waste to Energy

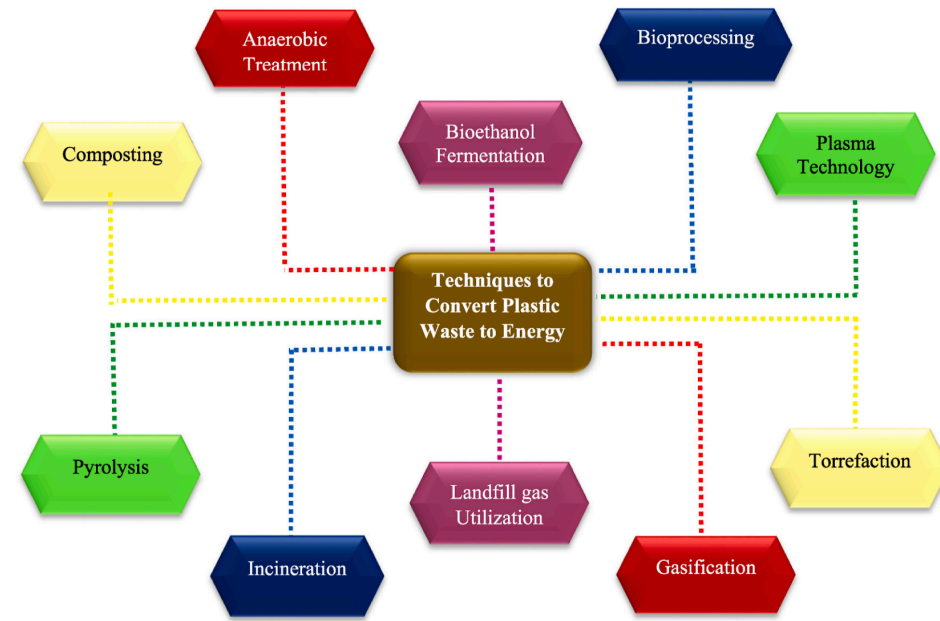
- Plastic high energy content can be transformed into usable forms such as electricity, heat or fuel with processes such as:

- **Incineration:**

- Plastic waste burned at high temperatures in a controlled environment
- The heat generated is used to produce steam, which can then drive turbines to generate electricity.

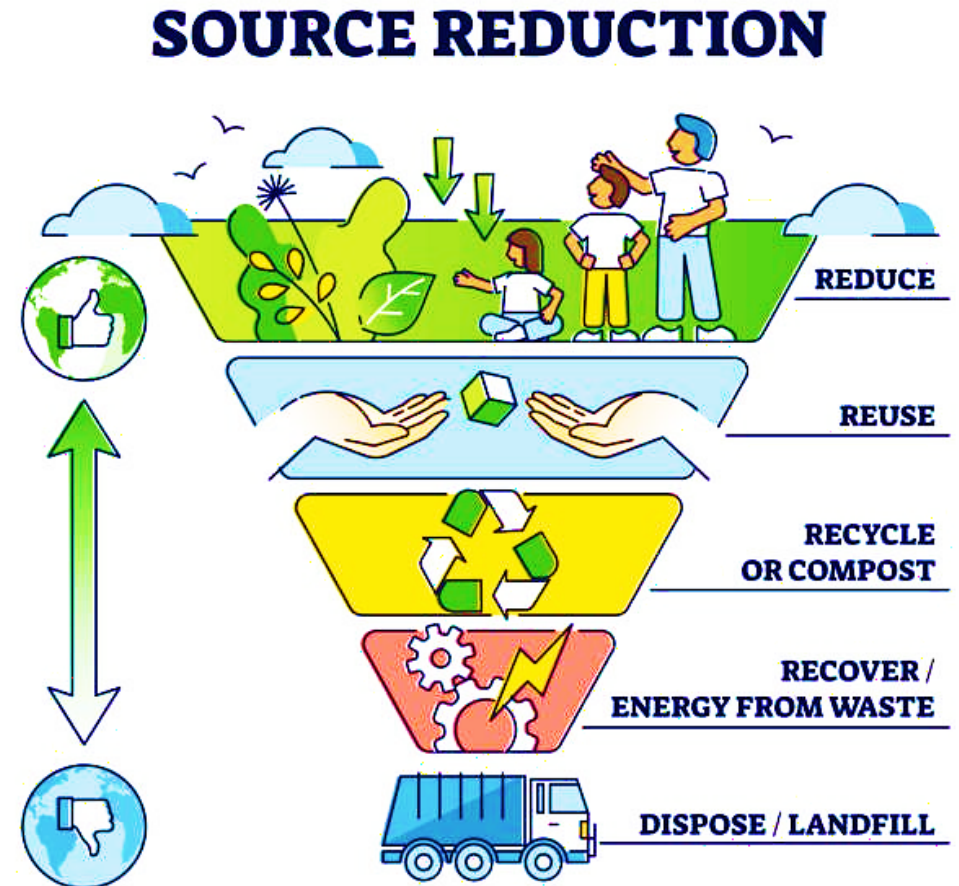
- **Pyrolysis:**

- Involves heating plastic in the absence of oxygen, which breaks it down into various by-products including synthetic gases, oils, and char
- The gases and oils can be refined into fuels like diesel or used directly to generate energy, while the char can be used as a carbon-rich material in various applications.



~~How Can We Reduce MP Pollution?~~ We Can Reduce MP Pollution

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Conclusion

- Plastic pollution is being committed on a catastrophic scale: *tiny plastic - big problem*
- Sustainability in the VUCA World
- Need for:
 - Improved understanding
 - Continued innovation
 - Policy support
 - General participation in reducing plastic waste
- We must adapt through innovative leadership, strategic thinking, and a deep understanding of the complex



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