Vast Quantities of Microplastics in Arctic Sea Ice—A Prime Temporary Sink for Plastic Litter and a Medium of Transport

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Although the Arctic covers 6% of our planet's surface and plays a key role in the Earth's climate it remains one of the least explored ecosystems. The global change induced decline of sea ice has led to increasing anthropogenic presence in the Arctic Ocean. Exploitation of its resources is already underway, and Arctic waters are likely important future shipping lanes as indicated by already increasing numbers of fishing vessels, cruise liners, and hydrocarbon prospecting in the area over the past decade. Global estimates of plastic entering the oceans currently exceed results based on empirical evidence by up to three orders of magnitude highlighting that we have not yet identified some of the major sinks of plastic in our oceans. Fragmentation into microplastics could explain part of the discrepancy. Indeed, microplastics were identified from numerous marine ecosystems globally, including the Arctic.

Here, we analyzed horizons of ice cores from the western and eastern Fram Strait by focal plane array based micro-Fourier transform infrared spectroscopy to assess if sea ice is a sink of microplastic. Ice cores were taken from land-locked and drifting sea ice to distinguish between local entrainment of microplastics *vs* long-distance transport. Mean concentrations of 2×10^6 particles/m^3 in pack ice and 6×10^5 particles/m^3 in land-locked ice were detected (numbers of fibers will soon be added). Eleven different polymer types were identified; polyethylene was the most abundant one. Preliminary results from four further ice cores from the central Arctic range in a similar order but the microplastics composition was very different. Calculation of drift trajectories by back-tracking of the ice floes sampled indicates multiple source areas, which explains the differences in the microplastic composition.

Preliminary analysis of snow samples taken from ice floes in the Fram Strait showed numerous fibers of yet unknown but most likely anthropogenic origin indicating atmospheric fallout as a possible pathway.

Our results exceed concentrations from the North Pacific by several orders of magnitudes. This can be explained partly by the process of ice formation, during which (organic) particles tend to concentrate by 1–2 orders of magnitude compared with ambient seawater. However, the magnitude of the difference indicates that Arctic sea ice is a temporal sink for microplastics. Increasing quantities of small plastic litter items on the seafloor nearby, which is located in the marginal ice zone corroborate the notion that melting sea ice releases entrained plastic particles and that sea ice acts as a vector of transport both horizontally and vertically to underlying ecosystem compartments.

Microplastics in the Bay of Brest (Brittany, France): Composition, Abundance, and Spatial Distribution

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World production of plastics has increased from 1.7 to 311 million tons between 1950 and 2014. This led to a major contamination of the worldwide marine ecosystems, recently estimated at more than 5 trillion plastic pieces floating the surface of the oceans. Microplastics (MP, <5 mm) are introduced into aquatic environments both directly in industrial raw material (plastic pellets, cosmetics, and clothing) and from the fragmentation of larger plastics into MP. At the European level, the Marine Strategy Framework Directive has defined marine litter as a full descriptor of the marine environment with a focus on MP and degradation products as a main issue. The present study focused on the composition and characteristics of microparticles collected, and their spatial distribution within surface water of the Bay of Brest (Brittany, France). Distinct