

Scientific study

Microplastic drifting down with the snow

In the Alps and the Arctic, experts confirm the presence of plastic in snow

[14. August 2019] Over the past several years, microplastic particles have repeatedly been detected in seawater, drinking water, and even in animals. But these minute particles are also transported by the atmosphere and subsequently washed out of the air, especially by snow - and even in such remote regions as the Arctic and the Alps. This was demonstrated in a study conducted by experts at the Alfred Wegener Institute and at the Swiss WSL Institute for Snow and Avalanche Research SLF, recently published in the journal *Science Advances*.



The fact that our oceans are full of plastic litter has by now become common knowledge: year after year, several million tonnes of plastic litter find their way into rivers, coastal waters, and even the Arctic deep sea. Thanks to the motion of waves, and even more to UV radiation from the sun, the litter is gradually broken down into smaller and smaller fragments - referred to as microplastic. This microplastic can be found in marine sediment, in seawater, and in marine organisms that inadvertently ingest it. In comparison, there has been little research to date on whether, and if so, to what extent, microplastic particles are transported by the atmosphere. Only a handful of works are available, e.g. from researchers who were able to confirm the particles' presence in the Pyrenees and near major urban centres in France and China.

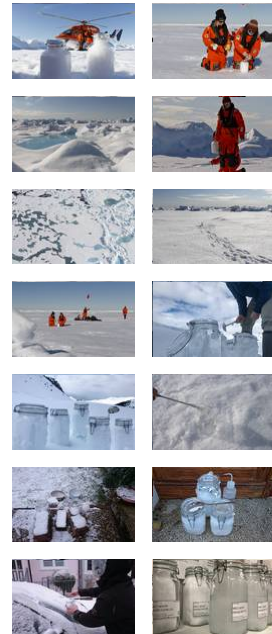
A team of experts from the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) has now found that microplastic particles can apparently be transported over tremendous distances by the



Snow samples from Arctic sea ice (Photo: M. Tekman)



atmosphere and are later washed out of the air by precipitation, particularly snow. As the team led by Dr Melanie Bergmann and Dr Gunnar Gerdt's report in the journal *Science Advances*, the analyses they conducted on snow samples from Helgoland, Bavaria, Bremen, the Swiss Alps and the Arctic confirm that the snow at all sites contained high concentrations of microplastic - even in remote reaches of the Arctic, on the island Svalbard, and in snow on drifting ice floes. "It's readily apparent that the majority of the microplastic in the snow comes from the air," says Melanie Bergmann. Her hypothesis is supported by past research conducted on grains of pollen, in which experts confirmed that pollen from the middle latitudes is transported by the air to the Arctic. These grains are roughly the same size as the microplastic particles; similarly, dust from the Sahara can cover distances of 3,500 km or more, reaching the




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northeast Atlantic.

The AWI researchers found the highest concentration in samples gathered near a rural road in Bavaria – 154,000 particles per litre. Even the snow in the Arctic contained up to 14,400 particles per litre. The types of plastic found also varied greatly between sampling sites: in the Arctic, the researchers chiefly found nitrile rubber, acrylates and paint, which are used in a host of applications. Given its resistance to various types of fuel and broad temperature range, nitrile rubber is often used in gaskets and hoses. Paints containing plastic are used in several different areas, e.g. to coat the surfaces of buildings, ships, cars and offshore oil rigs. Near the rural road in Bavaria, the samples especially contained various types of rubber, which is used in countless applications, such as automotive tyres.



AWI scientists use Polarstern's helicopters to take snow samples on the sea ice. (Photo: M. Tekman)

One intriguing aspect of the AWI study: the microplastic concentrations found are considerably higher than those in studies conducted by other researchers, e.g. on dust deposits. According to Gunnar Gerdt, this could be due to one of two reasons:

“First of all, snow is extremely efficient when it comes to washing microplastic out of the atmosphere. Secondly, it could be due to the infrared spectroscopy we used, which allowed us to detect even the smallest particles – down to a size of only 11 micrometres.” Gerdt and his colleagues melt the snow and pour the meltwater through a filter; the residue trapped in the filter is then examined with an infrared microscope. Depending on the type of plastic, different wavelengths of the infrared light are absorbed and reflected; in this way, an optical fingerprint can be used to determine what type of plastic they've found.

Whereas other experts sort out microplastic from their samples by hand under the microscope, which can easily cause some particles to be overlooked, Gerdt uses his infrared microscope to test all of the residue, ensuring that he and his team hardly miss a thing. “We've automated and standardised the technique so as to rule out the errors that can creep in when manual analysis is used.” As such, it's hardly surprising that the analyses conducted at the AWI yielded especially high particle concentrations.

In light of the meteorological realities, the AWI experts are convinced that a major portion of the microplastic in Europe, and even more so in the Arctic, comes from the atmosphere and snow.

According to Melanie Bergmann: “This additional transport route

could also explain the high amounts of microplastic that we've found in the Arctic sea ice and the deep sea in previous studies.”



Snow sampling in Tschuggen, Switzerland (Photo: Jürg Trachsel, WSL-Institut)

Lastly, there's another key question that motivates her work. “To date there are virtually no studies investigating the extent to which human beings are subject to microplastic contamination.” In addition, most research has focused on how animals or human beings absorb microplastic from what they eat. As Bergmann explains: “But once we've determined that large quantities of microplastic can

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The Institute

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also be transported by the air, it naturally raises the question as to whether and how much plastic we're inhaling. Older findings from medical research offer promising points of departure for work in this direction." Yet another aspect that warrants a closer look in the future.

Original publication

The study will be published on August 14, 2019 as an open access article in the [online portal Science Advances](#).

Her original title is: Melanie Bergmann, Sophia Mützel, Sebastian Primpke, Mine B. Tekman, Jürg Tachsel, Gunnar Gerdt: White and wonderful? Microplastics prevail in snow from the Alps to the Arctic, Science Advances, DOI: 10.1126/sciadv.aax1157

