Press Release

GEOMAR
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Hitching a ride to the deep sea
First in-situ measurements of microplastic fluxes help answer “missing plastic” question

28.10.2022/Kiel/Oldenburg/Fort Pierce. **In-situ sampling carried out on an expedition and subsequent measurements shed new light on the downward flux of microplastics from the ocean surface to the deep. The particles were proven to become part of the marine snow, as suggested by earlier modelling approaches, an international team of researchers led by GEOMAR Helmholtz Centre for Ocean Research Kiel confirms in a new publication in the scientific journal *Environmental Science and Technology*. The findings support a better understanding of the vertical transport dynamics and related risks for the food web. In addition, they illustrate the noticeable overprint of the natural marine carbon by anthropogenic microplastics.**

150 million tons of plastic are polluting the ocean today – and because of its slow decay, the amount keeps growing. Current model calculations indicate that only about one per cent of the plastic can be detected at the ocean surface, where it is supposed to float due to its buoyancy. About 10,000 times more is found at the sea floor. So how exactly does it get there? A better understanding of the underlying dynamics helps to protect the ocean against plastic pollution as well as related risks for marine life, the food web and material cycling, including the carbon pump that is crucial for the ocean’s ability to take up carbon dioxide and mitigate climate change.

Presenting for the first time data of plastic export from the ocean surface to the deep for the North Atlantic Gyre based on in-situ measurements, scientists from Germany and the United States of America shed new light on the vertical fluxes of microplastics. In the scientific journal *Environmental Science and Technology*, they explain how the particles are entrapped in marine snow – organic material that sinks down the water column and serves as food for plankton and larger animals. Confirming earlier results of modelling approaches, the observations help answer the “missing plastic” question.

“The sampling campaign carried out during an expedition with the German research vessel POSEIDON off the Azores Islands in 2019 adds important details to estimates derived from model simulations”, says Dr. Luisa Galgani. The Marie Curie Global Fellow at GEOMAR Helmholtz Centre for Ocean Research Kiel (Germany) and the Harbor Branch Oceanographic Institute of Florida Atlantic University (USA), is the lead author of the recent publication. “Tiny plastic particles that are between 0.01 and 0.1 millimetres in size disappear from the ocean surface because they become part of the marine snow. Bigger pieces can take the same route, but also sink faster due to their larger mass.”

Using special sediment traps and various optical and chemical analyses, Galgani and her colleagues located the highest concentrations of plastic polymers in depths between 100 and 150 metres. A highly sensitive analytical method developed at the Institute for Chemistry and Biology of the Marine Environment (ICBM), University of Oldenburg, enabled the quantification of even the smallest amounts of microplastics. In the surface-near layers, also high concentrations of organic material and marine gels were discovered – the natural glue that helps form the larger aggregates that are also known as marine snow. These allow for effective downward transport. In the sunlit upper few

hundreds of metres, also plankton and other marine life find their food. “The more plastic particles are included in the marine snow, the greater the risk for marine life that feeds on it”, says Dr. Galgani.

In addition, the abundance of microplastics in the seawater makes them a new component of the marine carbon cycle. In the samples from the North Atlantic Gyre, a hot spot of plastic litter, up to 3.8 percent of the organic carbon downward flux could be traced back to carbon originating from plastic. “Our results show that plastic not only pollutes the environment, but also penetrates the natural carbon cycle. Future studies must take into account that a presumably significant and increasing proportion of organic carbon in the ocean is not due to uptake of carbon dioxide via photosynthesis, but comes from plastics in human waste”, resumes Professor Dr. Anja Engel, Head of the Research Division Marine Biogeochemistry at GEOMAR and leader of the study.

Original publication:
Galgani, L., Goßmann, I, Scholz-Böttcher, B. Jiang, X., Liu, Z., Scheidemann, L., Schlundt C. and Engel, A. (2022): Hitchhiking into the Deep: How Microplastic Particles are Exported through the Biological Carbon Pump in the North Atlantic Ocean. Environmental Science and Technology, doi: https://doi.org/10.1021/acs.est.2c04712

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