Beneath the Waves: Vertical and Horizontal Microplastic Distribution in the Gulf of Panama

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Abstract

The seafloor is considered the final sink for microplastics (MPs). Understanding the governing factors leading their export from the ocean surface to the seabed is crucial to estimating sinking fluxes and marine organisms' exposure levels along the water column. In the last decades, MPs have been widely investigated in surface waters. However, little is known about the vertical distribution and the properties of MPs below the mixed layer and down to the deep sea. In this study, we investigate the horizontal and vertical distribution of MPs (> 10 μm) in the Gulf of Panama, aiming to enhance our understanding of the processes governing MPs export from the coast to the open sea and from the surface to the seafloor. Samples from sub-surface waters, above and below the pycnocline, were collected in seven stations along a transect of 126 nautical miles from coastal waters, impacted by the high maritime traffic off the Panama Canal, to open waters. Additionally, a high-resolution profile targeting six different depths down to 3600 m was obtained to provide a more detailed snapshot. The sub-surface water was sampled using AAU-UFO, a custom-filtering device feeding from the ship intake, whereas deeper waters were in-situ filtered using a large volume pump (McLane Lab). Advanced analytical methods (FPA-μFT-IR Imaging) followed by systematic identification of microplastic (siMPLe software) were used to gather data on MPs abundance, polymer type, and size distributions. Preliminary findings reveal elevated concentrations of microplastics in sub-surface water (43 MPs m-3) compared to those recorded below and above the pycnocline, with 19 distinct polymer clusters identified in the samples. Further analysis aims to provide new insights into how specific microplastic properties (polymer type, size, degradation status) interact with environmental parameters, influencing the mechanisms driving the export of MPs to the seafloor.

Keywords: Microplastics, Sinking fluxes, Deep sea, Water column, μFTIR Imaging, Pacific Ocean

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