

Beyond biofilm: the role of metals and minerals in plastic's environmental fate

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A key concern related to plastics is their potential to act as vectors for the transport and uptake of (in)organic contaminants. In particular, the distribution of (heavy) metals through plastic debris has significant implications for both ecological and human health [1].

Here, we summarize current knowledge on how metals associated with plastic surfaces are transported across environments and contribute to metal bioaccumulation within trophic and biogeochemical networks. Specific focus is thereby put on the role of the plastisphere—the microbial biofilm community that colonizes plastic debris—in the sorption and incorporation of metals and metal-bearing minerals. Furthermore, we explore how plastic-associated metals influence local trace element dynamics and availability, thereby shaping microbial community structure and function.

Presenting our recent research on the co-occurrence of plastics and metals across coastal redox regimes, we highlight our use of methodologies such as Confocal Laser Scanning Microscopy (CLSM) and Automated Quantitative Mineralogy (AQM) to investigate metals and minerals on plastic surfaces and within plastic-associated biofilms. Additionally, we discuss our ongoing work on how metal-bearing minerals affect plastic stability and degradation, as well as our efforts to define the influence of metals in the plastisphere on ecological interactions, diversity, and health.

[1] Peydaei A., Dodhia M.S., Schmidt D., Hendiani, S., Neu T.R., Sand K.K., Posth N.R., Beyond Biofilm - The role of Bio-Minerals and Metals in the Plastisphere – Implications for Elemental Cycling, Biogeochemical Processes, and Human Health; Taylor and Francis (accepted)