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Using automated quantitative mineralogy (AQM) to understand microbe-mineral interactions in the *Plastisphere*

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Plastics in the aquatic environment are rapidly covered by biofilm, known as the *Plastisphere*, composed of microbes, but also organic matter, metals, minerals and salts reflective of the host environment. Defining the biotic and abiotic components of the Plastisphere and their spatial relationship to one another is required to estimate the potential for biogeochemical process mediation of plastic transport and degradation.

Utilising AQM by combining backscattered electrons and energy dispersive spectrometry on a scanning electron microscope, a false-coloured mineral map can be created. We present a novel way to investigate the mineralogical matter on plastic debris, and to improve our understanding of the microbe-metal-mineral biofilm covering.

We describe this approach here using plastic samples collected from coastal water and sediment in Tanzania and Denmark. Both locations are urban harbour areas exposed to anthropogenic pressures and concerns for environmental health are raised resulting from the input of plastics as well as other pollutants.

AQM here reveals plastic interfacial chemistry and mineralogy, providing 2D-visualization of *Plastisphere* formation within the biogeochemistry of the depositional environment. Providing a new way to investigate the occurrence of minerals in the *Plastisphere*, this methods further supports investigation into processes such as microbial element cycling, plastic degradation, and plastic transport across macro-, micro-, and nanoscale that drive behaviours and effects of plastic across environmental compartments. We demonstrate here that AQM, combined with the other methods such as FTIR and microbial DNA analysis provide a multifaceted picture of plastic pollution and allow for a more informed discussion on its environmental fate.