THE ROLE OF THE 'PLASTISPHERE' IN THE NORTH PACIFIC OCEAN GYRE

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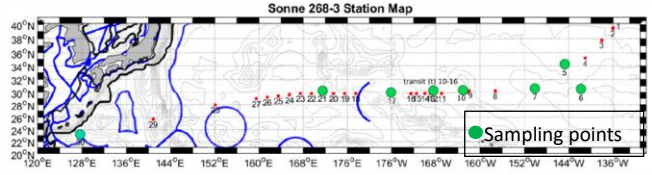
Introduction

Environmental biofilms readily form on all surfaces in aquatic systems, including plastic (Rummel et al., 2017). Consisting of microbial consortia of bacteria, archaea, autotrophic microalgae, and fungi, biofilms contribute substantially to the matter and energy cycling of aquatic systems. The importance of marine microorganisms for the global biogeochemical cycles is indisputable (Azam et al., 1983), however, the role of the 'plastisphere', the plastic-colonizing microbial community, from the North Pacific Gyre is barely investigated. High concentrations of plastics in the Pacific Gyre may create an emerging ecological environment for colonizing microbial communities. Little is known so far about the initial colonization processes and biofilm succession on plastics and the ecological functions of epiplastic communities.

RV SONNE cruise (SO268/3)



Micro-Plastic

Macroplastic

Objectives

- understanding early biofilm formation on plastic material
- structural and functional characterization of biofilms on environmental plastic
- identification of different life strategies in plastic biofilms

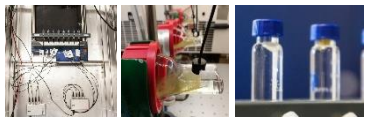
Early formation and functions of biofilms

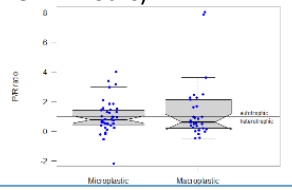
Early formation of biofilms on virgin, lab-aged plastic polymers and glass was studied in mesocosms: eco-corona of adsorbed organic matter (FT-ICR- MS) and subsequent bacterial colonisation (16S amplicon sequencing)

➔ fast colonisation of all surfaces after one hour with diverse communities, slow succession

On board quantification of primary production using contactless, non-destructive oxygen measurements (Fibox oxygen meter, light and dark cycles over 24 hours)

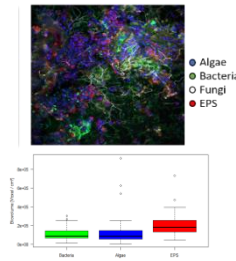
➔P/R ratios close to zero





Structural Analysis of the 'Plastisphere'

Confocal laser-scanning microscopy image of PE micro-particle



16S, 18S amplicon sequencing

➔ no differences in the community structure in dependence of the plastic type (PP and PE)

➔ distinct differences to the pelagic community of the Pacific Ocean were revealed.

Life forms

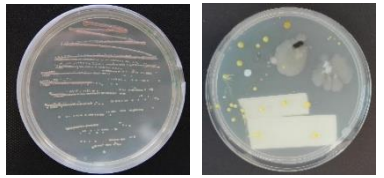
Different life strategies in plastic biofilms were traced via cultivation of microorganisms from the same material as used for structural and functional analysis.

→ Microorganisms with different morphologies were isolated from microplastics including colourful pigmentation, stalks, swarming

→ 16S rRNA gene sequencing identified members of the genera *Pseudoalteromonas, Alteromonas, Halomonas, Brachybacterium, Labrenzia, Qipengyuania, Kocuria, Vibrio* and others

→ Majority of isolates matched with OTUs from structural community analysis, indicating the viability of the microorganisms of the plastisphere.

Future work with the isolates Include whole genome sequencing and physiological tests.



Conclusions

- Plastic material of the North Pacific Ocean Gyre forms an artificial habitat readily colonized by a diverse microbial community
- The plastic colonizing community is functionally vital and active, harbouring previously undiscovered taxa

➔ The plastisphere has to be considered in all processes related to the fate and effects of environmental plastic pollution

References

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