
Frequent observations of novel plastic forms in the Ariho River estuary, Honshu, Japan

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Abstract

Pyroplastic and plastiglomerate have been recorded along marine coastlines worldwide. Pyroplastic is burned plastic with a rock-like appearance. Plastiglomerate is a solid bond consisting of either melted plastic firmly attached to rock (in-situ plastiglomerate) or a melted plastic matrix containing (in)organic material (clastic plastiglomerate). In this presentation, we show the first records of pyroplastic and plastiglomerate from estuarine habitats. For that, we surveyed the strandline and the intertidal zone of the Ariho River estuary (Japan) for these two novel plastic forms over seven months and examined the collected samples macro-, micro- and spectroscopically at the lab in Koblenz (Germany). We detected 37 pyroplastics (consisting of polyethylene, polypropylene, polystyrene, alkyd resin, polyacrylate styrene and polyvinyl chloride) and seven plastiglomerates (consisting of polyethylene and polypropylene). Pyroplastics occurred frequently and plastiglomerates occurred occasionally which shows that both plastic forms are common. Pyroplastic occurrence and density (items / m²) were related to intertidal elevation with most pyroplastics occurring along the strandline. Floating tests and bulk density measurements showed that pyroplastics and plastiglomerates (with a bulk density ≤ 1 g / cm³) floated in seawater. Strandline pyroplastic density significantly increased under persisting onshore winds. In combination, these findings revealed floatability and winds as two drivers of pyroplastic dynamics in estuarine habitats. Interestingly, all pyroplastics and plastiglomerates showed little signs of weathering which suggested that they likely derived from regional sources. Furthermore, we detected snail egg capsules and a barnacle on non-floating pyroplastic and plastiglomerate, respectively. These findings indicated that floatability hampers interactions between invertebrates and both plastic forms. Additionally, we detected the first plastiglomerate with clastic and in-situ features (a plastic matrix containing (in)organic material firmly melted to a rock) that we termed "clastic/in-situ plastiglomerate". Overall, our study started to develop the fundamental understanding of pyroplastic and plastiglomerate dynamics and the underlying drivers in estuaries.

Keywords: Pyroplastic, Plastiglomerate, FTIR, Environmental drivers, Seto Inland Sea

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