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Ship Recycling: Reducing Human and Environmental Impacts

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Small plastic fragments found in intertidal sediment from world's largest shipbreaking zone: over 80 mg/kg of sediment

Plastic pollution is a threat to marine ecosystems, as plastics are persistent, toxic and can accumulate up the food chain. This study assessed the abundance of small pieces of plastic in Alang, India. The authors found, on average, 81 mg of small plastic fragments per kg of sediment, which they say is the direct result of shipbreaking.

The waste generated by the shipbreaking industry is diverse, and includes asbestos, scrap paint, broken wood and an array of chemicals. Plastics contribute an estimated 40-50% of shipbreaking waste that enters the marine environment. They pose a particular challenge to the marine environment as they can drift between areas and are notoriously persistent.

Although they do not degrade easily, plastics do eventually break down into smaller pieces, which can remain suspended in water or settle in sediments. Pieces smaller than 5 mm are commonly called microplastics. Plastic debris of this kind can have a significant negative effect on the health of marine ecosystems by reducing the amount of available oxygen in the water and accumulating up the food chain (bio-magnification). Furthermore, microplastics have been found to attract and transport hazardous chemicals, notably persistent organic pollutants (POPs), including polychlorinated biphenyls (PCBs) and dichlorodiphenyldichloroethylene (DDE), both of which may have adverse effects on animals (including humans).

Although many studies have attempted to quantify the plastic debris in marine ecosystems, none have looked specifically at shipbreaking yards. Addressing this knowledge gap, this study evaluated plastic pollution around the Alang shipbreaking yard in India, one of the world's largest shipbreaking zones due to its high tidal range, wide continental shelf, mud-free coast, gentle slope and firm seabed. The researchers built on past research conducted in the area to identify the small pieces of plastic present in the sediment between tide marks (known as the intertidal zone).

The researchers separated the shipbreaking yard into 10 sampling locations and quantified the microplastics at each location in 2004. Fragments were collected, evaluated under a microscope and identified using infrared spectroscopy (a technique which measures the infrared light that is emitted, absorbed or scattered by objects to identify molecules).

The plastics included polyurethane, nylon, polystyrene and polyester. The most abundant plastics were transparent plastic fragments, such as polystyrene, followed by nylon. Glass wool was the least abundant type of fragment. The individual weight of fragments varied from 15.8 mg for transparent plastics to 8.9 mg for glass wool. There were, on average, 81 mg of small plastic fragments found per kg of sediment.

The least polluted stations were those located at the ends of the beach, 10 km away from the yard. As expected, the highest amount of plastic fragments was found in the stations located at the centre of the yard where shipbreaking activities are most intense.

The major plastics identified by the study are commonly used in the construction of ships. The authors conclude that these fragments are likely to be derived from larger items used in the ships, which have broken down into small pieces and accumulated in sediment.

The authors say the plastics they identified are unlikely to represent all of the shipbreaking-related materials present in the sediments at Alang, and that more work is needed to understand their impact on marine ecosystems, but point out that their study is likely to be the first to describe and quantify small plastic pieces in intertidal sediments at Alang.