Modern equatorial carbonates from the Java Sea: Facies distribution and microplastic as sedimentary component

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Carbonates in the humid equatorial zone have characteristics that distinguish them from their sub-tropical counterparts and should therefore be re-examined as a distinct depositional system. Equatorial carbonates are known to share some similarities with cool water systems that can complicate the distinction between non-tropical and equatorial carbonates. Kepulauan Seribu is an isolated patch reef complex located in the Java Sea (Indonesia) and is a typical example of a humid, equatorial carbonate system.
Kepulauan Seribu provide a useful modern analogue for buried carbonate systems in Indonesia and other similar Cenozoic carbonates from Southeast Asia and northern Australia. Statistical analysis based on texture and composition revealed that there are four sedimentary facies in Kepulauan Seribu; coral grainstone, coral packstone/grainstone, coral-mollusc packstone, and mollusc wackestone. The occurrence of mollusc wackestone in the lagoon is controlled by water depth, while sand apron and reef front do not show significant facies separation with water depth. Co-occurrence of different facies in the same depth window is contrary to the common thought that changes in bathymetry should be reflected in facies changes. A satellite-derived environmental facies map generated by an image analysis algorithm indicates that environmental facies distribution is mainly controlled by water depth, density of seagrass cover and coral abundance.
Microplastic pollution has recently been reported from coral reef systems throughout the tropics, including Indonesia which is known to be the second-largest contributor of mismanaged plastic waste to the ocean. Exposure to microplastics have negative impacts on coral health that in the long run threatens its ability to act as framework builders in coral reef systems.
Microplastics are present as a sedimentary component in Kepulauan Seribu. Phthalates, a common plastic additive, were detected on the surface of microplastic particles indicating that contaminants associated with microplastics could become bioavailable to corals after ingestion. All recovered microplastics were classified as secondary microplastics, likely derived from marine and local sources. Microplastics exhibit similar transport and accumulation behavior to fine siliciclastic grains. Abundance of microplastic is controlled by proximity to the source area of larger plastic debris and hydrodynamic processes. Processes that contribute to accumulation of microplastic in reef sediments are biofouling, interlocking, and the creation of compound grains. Microplastics are not only present at the seafloor but are often buried more than ~ 4 cm within the sediment. Microplastics from this depth are unlikely to be remobilized under modal weather conditions in the studied equatorial reefs. Therefore, microplastics in subtidal reef environments of the equatorial zone can be a good practical indicator for Anthropocene strata.