

Floating microplastics in the Eastern South Pacific and the Southern Ocean

Ryota Nakajima¹, Hidetaka Nomaki¹, Maki Aita Noguchi¹, Takuya Ohnishi², Hayao Yokochi³, Kazutaka Takahashi⁴, Minoru Ikehara⁵, Atsushi Tsuda²

¹Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

²Atmosphere and Ocean Research Institute, The University of Tokyo

³Kindai-University

⁴Graduate School of Agricultural and Life Sciences, The University of Tokyo

⁵Kochi University

The distribution of the surface microplastic in the open ocean is crucial information to estimate their source, pathway, and subsequent sedimentation to the seafloor. Substantial numbers of studies on microplastics have been reported in the North Pacific and Atlantic Oceans, yet very few data are available in the Southern Pacific and the Southern Ocean. In the present study, we conducted microplastic surveys during the R/V *Hakuho-maru* cruises (KH-19-6 and KH-20-1) in the Southern Pacific off the west coast of Chile and the Southern Ocean to fill gaps in these oceans. Floating microplastic samples were collected using a neuston net with a rectangle mouth opening of 1.0 m width and 0.75 m height, equipped with a 333 μm mesh opening net. The trawl speed ranged between 1 and 2 knots and typically 3 cast of 15-20 min towing were conducted at each site. A flow meter was installed at the net mouth to calculate the volume of seawater filtered during each tow, which was then converted to towed area (km^2) by dividing the submerged depth of the net mouth (average 0.4 m). The collected samples were dried and then soaked in 30% H_2O_2 for 7 days to remove organic matters. Microplastics including microplastic-like particles were sorted out under a dissecting microscope. Polymer types of collected particles were analyzed using an ATR-FTIR, then the number of microplastic particles were enumerated by polymer type such as polyethylene (PE) and polyethylene terephthalate (PET). We detected microplastics from all the surveyed sites including the Weddell Gyre, one of the most isolated oceans in the world, reconfirming that the microplastics are ubiquitous pollutants. The highest number of microplastics were observed at the site off the coast of Valparaiso, Chile (148,900 particles km^{-2}), due to the accumulation nature of microplastics at the convergence zone in the South Pacific subtropical gyre. Although PE was the dominant component of polymer type in the convergence zone, PET significantly dominated the plastic composition in the Southern Ocean and the other surveyed sites. Considering the relatively isolated nature of the Southern Ocean due to the Antarctic Circumpolar Current, ships including cargo ships, fishing activities and tourism may be a significant source of these plastic debris.

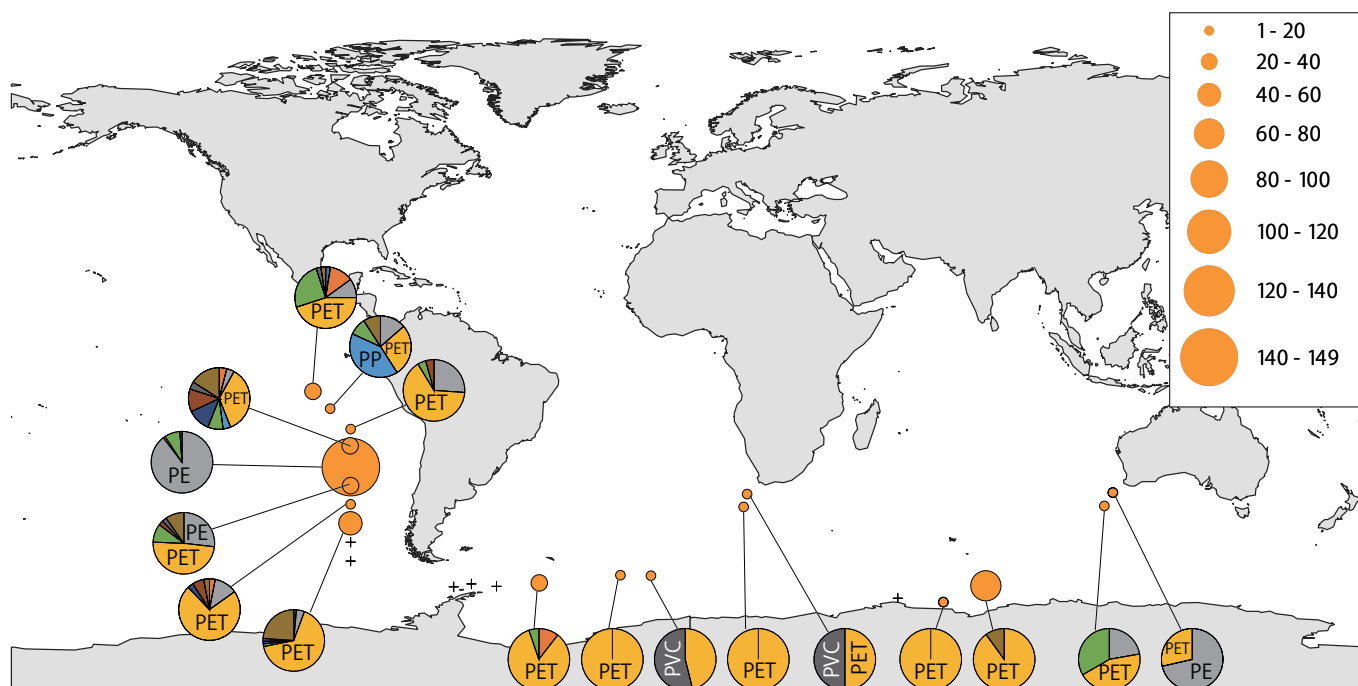


Figure 1. The orange circles indicate the density of microplastics ($\times 1,000$ particles km^{-2}) at the sampling sites during the KH-19-6 and KH-20-1 cruises. Pie charts indicate plastic composition at each site: PE, polyethylene; PP, polypropylene; PVC, polyvinyl chloride; and PET, polyethylene terephthalate. Crosses indicate the sampling sites where the microplastic count is currently undergoing.