KYUSHU UNIVERSITY

Public Relations Office, Kyushu University
744 Motooka Nishi-ku Fukuoka, 819-0395
TEL: +81-92-802-2443 FAX: +81-92-802-2139
E-MAIL: koho@jimu.kyushu-u.ac.jp
URL: https://www.kyushu-u.ac.jp

PRESS RELEASE (2025/12/02)

Where do microplastics go once they sink into the ocean?

Researchers succeed in detecting and tracking microplastics across varying ocean depths

Fukuoka, Japan—Publishing in the journal *Environmental Science & Technology*, researchers at Kyushu University report that they have developed a new method to more accurately analyze the distribution of small microplastics in the ocean at various depths. Their findings showed that concentrations of small microplastics suspended in the ocean range from 1,000 to 10,000 particles per cubic meter. The team also discovered that small microplastics sink to the depths of the ocean in two distinct ways: some attain near-neutral buoyancy and drift at specific depths, while others sink rapidly to the deep sea.

Since the advent of plastic in the early 20th century, plastic waste and pollution have been a global issue. As plastics degrade, they break off into smaller pieces. When they reach less than 5 mm in size, they are called microplastics.

"When these microplastics degrade further to 10-300 μm, we call them small microplastics. Many researchers are investigating the distribution and movement of microplastics in the ocean. However, when they reach that size, they become harder to collect and analyze," explains Professor Atsuhiko Isobe of Kyushu University Research Institute for Applied Mechanics and one of the researchers who led the study. "There was no standardized protocol to evaluate the presence of small microplastics in the ocean that could minimize contamination, particle loss, and potential fragmentation."

Most ocean microplastics are made of polyethylene and polypropylene. These materials are less dense than seawater, so they float near the sea surface. However, over time, algae, bacteria, and other marine organisms attach to their surface in a process called biofouling. This results in the microplastic increasing in weight and sinking toward the seafloor.

Past studies that collected small microplastics from the ocean used net tows or pumped ocean water from different depths. However, researchers still lacked a detailed view of the distribution of small microplastics at different ocean depths.

"To achieve this clearer view, we developed a protocol that collected seawater from 12 ocean layers (from 0 to 1,000 m) across 4 regions in the North Pacific Ocean," explains Isobe. "Our method required only about 50 liters of seawater, which is one to two orders of magnitude less than conventional pump sampling."

To ensure accurate detection and prevent contamination from airborne microplastics, the analysis was conducted inside a clean booth installed on the surveying vessel. The team also developed a protocol designed to minimize the destruction of these fragile microplastics.

"Our findings revealed that small microplastics reach sea depths via two distinct pathways: drifting and sinking. In the first pathway, small microplastics reach neutral buoyancy with the seawater. They then drift in an area of the ocean where water density is between 1,023 and 1,025 kilograms per cubic meter at depths of about 100 to 300 meters," Isobe continues. "These small microplastics will drift through this layer for approximately 20 to 40 years."

The other way small microplastics reach the depths of the sea is by increasing their density

through biofouling, causing them to sink to the seafloor. The team observed that the concentration of small microplastics drifting in the ocean ranged from 1,000 to 10,000 particles per cubic meter of seawater.

"Moving forward, we want to collect more data to clarify how widely microplastics are distributed throughout the ocean. We also intend to investigate their impact on the marine environment," concludes Isobe. "Understanding the environmental impact of microplastics will require more time, but our findings show that the marine environment is becoming irreversibly polluted and necessitates urgent countermeasures."

###

For more information about this research, see "Settling and Along-Isopycnal Subduction of Small Microplastics Into Subsurface Layers of the Western North Pacific Ocean" Mao Kuroda, Atsuhiko Isobe, Keiichi Uchida, Ryuichi Hagita, and Satoru Hamada, *Environmental Science & Technology*, https://doi.org/10.1021/acs.est.5c08983

About Kyushu University

Founded in 1911, Kyushu University is one of Japan's leading research-oriented institutions of higher education, consistently ranking as one of the top ten Japanese universities in the Times Higher Education World University Rankings and the QS World Rankings. Located in Fukuoka, on the island of Kyushu—the most southwestern of Japan's four main islands—Kyushu U sits in a coastal metropolis frequently ranked among the world's most livable cities and historically known as Japan's gateway to Asia. Its multiple campuses are home to around 19,000 students and 8,000 faculty and staff. Through its VISION 2030, Kyushu U will "drive social change with integrative knowledge." By fusing the spectrum of knowledge, from the humanities and arts to engineering and medical sciences, Kyushu U will strengthen its research in the key areas of decarbonization, medicine and health, and environment and food, to tackle society's most pressing issues.

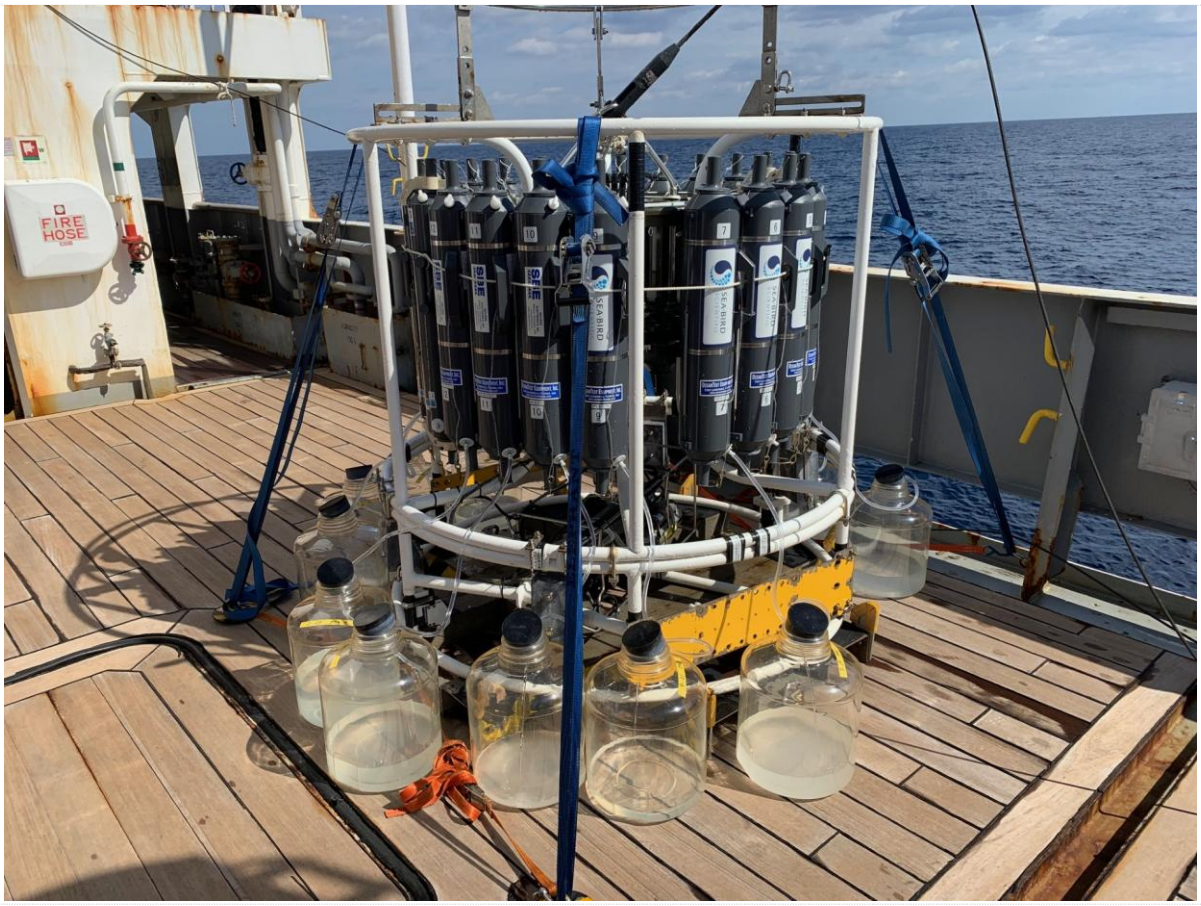

Fig. 1. The water sampler. The multilayer water sampler that was installed on the training vessel Umitaka-maru. The device can collect about 50 L of seawater at different ocean depths then analyzed for small microplastics. (Atsuhiko Isobe/Kyushu University)

[Contact]
Atsuhiko Isobe, Professor
Center for Oceanic and Atmospheric Research, Research Institute for Applied Mechanics
Tel: +81-92-583-7726
aisobe@riam.kyushu-u.ac.jp