SCIENCE FOR ENVIRONMENT POLICY

High levels of microplastic pollution found in the Antarctic and Southern Ocean deep sea

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Cunningham, E., Ehlers, S., Dick, J., Sigwart, J., Linse, K., Dick, J. and Kiriakoulakis, K. (2020) High Abundances of Microplastic Pollution in Deep-Sea Sediments: Evidence from Antarctica and the Southern Ocean. *Environmental Science & Technology*, 54(21): 13661–13671.

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Marine plastic pollution has been found in the remote Antarctic peninsula and Southern Ocean since the 1980s, but microplastic pollution in this region is less well understood. To find out more about this emerging environmental hazard, scientists have analysed the deep-sea sediments of the Antarctic and Southern Ocean regions for the presence of microplastics.

Despite being one of the most remote parts of our planet, the Antarctic and Southern Ocean region contains large amounts of plastic pollution, with an estimated 1 794 items of plastic floating in each square kilometre of sea around Antarctica. This material entangles fur seals and is ingested by species from all levels of the food chain, from small invertebrates on the seafloor to top predators such as penguins and petrels. It includes microplastics: pieces of less than 5 millimetres in size that, while being widely deemed a threat to marine biodiversity and ecosystem functionality, are less understood in terms of their environmental presence, accumulation and effects.

Microplastics have been found in the air, drinking water and foods such as salt and honey, thereby entering the food chain for a range of species — including people. These tiny synthetic molecules are harmful to biodiversity as they resist biodegradation, block the digestive tracts of aquatic creatures, turtles and birds, and facilitate the bioaccumulation of pollutants in animals and plants.

Between 75 000 and 300 000 tonnes of microplastics are thought to be released into the environment each year in the EU alone[1]. In 2020 the European Chemicals Agency proposed a restriction to phase out the intentional addition of microplastics in many European products[2]. The intended restriction (due to be adopted by end of 2021, or early 2022) covers many sectors and it could prevent about half a million tonnes of microplastics entering into the environment over 20 years. Additionally, this year the European Food Safety Authority is holding a colloquium to assess the current situation and research regarding micro and nanoplastics in food[3].

European Commission

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High levels of microplastic pollution found in the Antarctic and Southern Ocean deep sea (continued)

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To determine the presence of microplastics in the deep-sea sediments of the Antarctic and Southern Ocean regions, and to assess if their presence is affected by depth or sediment type, this study collected sediment cores from 2017–2019 from 30 individual sites in three Southern Ocean regions: the Antarctic Peninsula (six cores), South Georgia (13 cores) and the South Sandwich Islands (11 cores). Samples were collected at depths ranging from 136 to 3 633 metres. Microplastic particles in the samples, were found and analysed using infrared spectroscopy (an analytical method that identifies the matter present, by the way it interacts with infrared light). Sediment characteristics were examined according to mean grain size and makeup i.e. clay, silt or sand.

Microplastic particle (MP) pollution was found in 28 of the 30 cores, with a mean abundance ranging from 1.04 (South Georgia) to 1.3 MP/gram (Antarctic Peninsula)[4]. The abundance of MP among regions was similar, but amounts were much higher than those reported in less remote ecosystems. This implies that the Antarctic and Southern Ocean deep-sea accumulates more MP pollution than previously expected, say the researchers. The distribution and accumulation of MP pollution correlated with the clay content of the cores — with more MP fragments found in high-clay cores — suggesting that these particles may disperse similarly to low-density sediments like clay.

Seven types of MP were found in the cores, the most abundant being blue polyester. Other studies have found blue polyester in the scat of gentoo penguins[5], and revealed that 83% of Antarctic macrobenthic (larger bottom-dwelling) organisms had ingested MPs[6]. The researchers, therefore, suggest that MPs are likely entering the food chain and travelling across trophic levels. The source of the MP pollution in the Southern Ocean is unknown, but the levels are higher than in shallow water near to human settlements in riverine catchments.

The findings of this study broaden the knowledge about the long-term pollution of Antarctic areas, which is important on a global scale for biodiversity protection and environmental policy planning.

1. See: European Strategy for Plastics in a Circular Economy: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN

2. For further information see: https://echa.europa.eu/hot-topics/microplastics

3. To find out more: https://www.foodpackagingforum.org/news/efsa-colloquium-on-micro-and-nano-plastics-rescheduled

4. For context, the Pacific deep-sea shows MP pollution abundances of 0.03–0.13 MP/g; the North Atlantic of 0.04–0.197 MP/g; and the Arctic (a known MP 'sink') of 0.04–13.33 MP/g.

5. Bessa, F.; Ratcliffe, N.; Otero, V.; Sobral, P.; Marques, J. C.; Waluda, C. M.; Trathan, P. N.; Xavier, J. C. (2019) Microplastics in gentoo penguins from the Antarctic region. *Sci. Rep*, 9 (1): 1–7.

6. Sfriso, A. A.; Tomio, Y.; Rosso, B.; Gambaro, A.; Sfriso, A.; Corami, F.; Rastelli, E.; Corinaldesi, C.; Mistri, M.; Munari, C. (2020) Microplastic accumulation in benthic invertebrates in Terra Nova Bay (Ross Sea, Antarctica). *Environ. Int.* 137: 105587.