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Microplastic contamination in remote alpine lakes

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Since their first detection in the 1970s, microplastics have been a growing concern in public opinion. Although a large number of studies are interested in this contamination, the fate of microplastics in freshwater remains poorly understood. In particular, the identification of sources, the degradation processes of these compounds and their impacts on aquatic ecosystems constitute fields of research to be investigated. PLASTILAC is the first project focusing on the presence and fate of microplastics in 4 remote alpine lakes (Muzelle Lake, Vert Lake, Pormenaz Lake and Anterne Lake) that have been investigated during summer 2019. The aims of this study were to better understand the microplastic dynamics in small remote lake catchment and to quantify the impacts of various anthropic activities on the microplastic contamination.

The lakes were chosen to allow the comparison of the different transfer processes occurring at the catchment scale. Thus, the lakes of Muzelle and Anterne have similar sizes (about 10 000m²) and altitudes (about 2100 m a.s.l.). These two lakes are isolated and have no direct access apart from several hour hikes. They are however separated by a distance of about 120 km. A comparison of their contamination levels therefore makes it possible to assess the background contamination at the scale of the Northern Alps. On the contrary, the Anterne, Pormenaz and Vert Lakes are very close but cover a wide gradient of altitude (from 1260 to 2100 m a.s.l.) and of exposure to anthropogenic activities. Their comparison allows us to study the influence of distance from potential sources on the microplastic contamination.

To investigate the dynamics of microplastics at the lake basin scale, a multi-compartment approach was implemented. The water column was sampled using a specially designed boat that allowed the filtration of the large volumes (approximately 200 cubic meters) of water required in lightly contaminated environments. The boat was equipped with a 50 µm mesh. A similar system was used to sample the lake outlets and determine the outflows of microplastics. In order to quantify the incoming flows, an atmospheric fallout collector was also installed. Finally, lake sediments were collected to quantify the fraction of microplastics eliminated from the water column through sedimentation. All of these data made it possible to establish a mass balance of microplastics at the scale of the watershed of lakes and to determine the characteristic times of

contamination.

Although analyzes are still in progress, the first results show that even the most distant lakes from anthropogenic sources have significant microplastic contamination of the order of 1 particle per cubic meter. Due to the distance to the sources, the microplastic pollution was constituted fibers while fragments and micro-beads could not be observed.