EGU25-11153, updated on 25 Sep 2025
https://doi.org/10.5194/egusphere-egu25-11153
EGU General Assembly 2025

Microplastic particles in groundwater systems worldwide

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Microplastic particles (MPs) have been identified as potentially harmful to groundwater ecosystems. They can potentially enter aquifers through recharge water passing the vadose zone, through groundwater-surface water interactions, through wells and boreholes at water supply and managed aquifer recharge sites or at sites were river water or wastewater is extensively filtered through subsurface sediments. While first studies have identified MP contamination in groundwater, a clear picture of global MP concentrations in aquifers is still missing. However, such baseline information is required to understand the potential threat MPs pose the World's groundwater resources.

Here we show results of global groundwater sampling undertaken by the scientific community. Samples were collected from aquifers around the world via accessible boreholes, monitoring wells, surface springs and caves. A low cost and easy-to-follow sampling protocol was developed to maximise participation during sampling and to ensure comparability among different field sites. At each sampling site, about 300 L of groundwater were collected and filtered on-site through a series of metal sieves (123 and 25 µm mesh size). Filtrates and meshes were then collected in glass vials and stored for further analysis. Additionally, passive air samples were collected at each site for quality control.

Sample processing in the lab included organic matter removal via digestion with hydrogen peroxide or Fenton reagent, density separation in glass separation units using zinc chloride, and staining with Nile Red dye. MP characterisation and polymer identification were carried out using fluorescence-guided Raman spectroscopy and an in-house spectral library. First results indicate a higher presence of fragments than fibres and of MPs between 25-123 µm than those larger than 123 µm. Identified concentrations range from 0.1 to almost 8 particles per litre.