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Micro- and nanoplastics occurrence and associated metals in soil landfill indigenous arctic communities

MARGAUX LAVILLE[1,2,3], MELANIE DAVRANCHE[4], MÉLIANE RENAUD[1,2,3,5], NATALIIA RYHENKO[4], DELPHINE VANTELON[6], JULIEN GIGAULT[1,2,3] AND DOMINIC LARIVIÈRE[1]

[1]Département de Chimie, Université Laval
[2]IRL Takuvik - CNRS - Université Laval - Sorbonne Université
[3]Centre d'Études Nordiques (CEN)
[4]Université de Rennes, Géosciences Rennes, UMR-CNRS 6118
[5]Interuniversity Research Group in Limnology (GRIL)
[6]Synchrotron SOLEIL, L'orme des merisiers, Saint Aubin BP48, 91192 Gif sur Yvette Cedex, France

Arctic autochthonous communities face major challenges in solid waste management due to their geographical isolation, limited infrastructure, and rapidly changing climate. Open dumping and open-air incineration remain widespread practices for waste disposal, particularly for plastics. While the plastics pollution in various environments is relatively well documented, the environmental fate of micro- and nanoplastics (MNPs), as well as that of their metal-based additives, in Arctic landfill soils remains poorly understood. This study investigates the occurrence, vertical distribution, and potential metal release associated with MNPs in soils contaminated by domestic and bulky waste landfills. In September 2025, five triplicated soil cores and plastic samples were collected in Kuujjuaraapik–Whapmagoostui landfills (Nunavik, Canada). Plastic degradation states and MNP presence in sample were characterized using ATR-FTIR and Pyro-GC-MS. ICP-MS analyses were subsequently used to quantify the vertical distribution of metal additives within soil profiles. Common MNPs, as polystyrene, polyethylene, and polypropylene were identified in varying quantities depending on their size. In addition, the presence of several metals (Ti, Cr, Zn, Sr, Sb, and Pb) has been identified in the form of additives from microplastics present in the soil. In the next phase of this work, the A4F-ICPMS method will be employed to achieve simultaneous characterisation of nanoplastics and their associated metals. This will enable an assessment of metal enrichment relative to natural soil background levels and determine the extent of metal release during plastic degradation.