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ABSTRACT BOOK

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Microplastic and microfibre pollution in unexplored caves

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Background & Objectives: Microplastic and microfibre contamination has emerged as a pressing global issue, however, karst systems remain largely overlooked. Due to their properties, these microparticles of anthropogenic origin are highly mobile and environmentally persistent, allowing them to reach even the most remote ecosystems. Subterranean environments - the so-called “dark continent” - represent one of the least explored frontiers of terrestrial science, with vast areas still inaccessible. In such hypogean systems, the distribution of pollutants is tightly regulated by the interplay between surface–subsurface connectivity, aquifer hydrodynamics, geological context, and local environmental factors. In this study, the first evidence of microplastic and microfibre pollution in unexplored caves was presented, revealing how human activity could indirectly impact even the uncontaminated environments of the dark continent.

Methods: Working together with speleologists, sediment samples from unexplored caves of the Abruzzo Region, Italy, were collected and investigated. Examined microparticles were counted and characterized by composition, size, shape, fluorescence, and color, via microscopy and spectroscopy.

Conclusions: Our findings show that microplastic concentrations were generally low or absent, whereas natural and regenerated microfibres were more frequent, with fibres representing the dominant morphological category. Most particles were transparent and exhibited fluorescence under UV light. Likely sources of contamination in the study area include atmospheric deposition, local anthropogenic activities, road networks, and waste dispersal. These results provide clear evidence that anthropogenic microparticles are present even in remote karstic caves, posing potential risks to subterranean biota and groundwater resources. Given the intrinsic connectivity of karst systems, there is an urgent need for systematic monitoring and protection. We also emphasize the key role of speleologists in contributing to data collection during explorations, as such rarely studied habitats can provide critical insights into pollutant pathways, ecosystem vulnerability, and conservation priorities. Future long-term research will be essential to elucidate sources, transport mechanisms, and ecological impacts of these contaminants.

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Microplastics, Microfibres, Pollution, Caves, Karst

Microplastic Contamination in Organic-Rich Agricultural Soils: Sources, Impacts, and Mitigation Approaches

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Background & Objectives: The ubiquitous presence of microplastics (MPs) in organic-rich agricultural soil matrices constitutes a growing global concern, fundamentally impacting soil fertility, microbial community dynamics, and potential food chain transfer. Agri-systems heavily reliant on high-organic amendments (compost, manure, biosolids) are uniquely vulnerable due to the strong affinity between polymer residues and organic matter components. This research aims to systematically identify the major sources and environmental transport pathways responsible for MP influx into these systems and to quantify their immediate impacts on soil physical structure and overall ecosystem health.

Methods: A hybrid methodological approach was employed, combining a comprehensive systematic literature review with a field-based analytical campaign focusing on compost-treated farmlands. Soil samples were subjected to rigorous density separation protocols, followed by confirmation and polymer characterisation using Fourier-Transform Infrared (FTIR) spectroscopy. Analytical results detailing MP abundance and polymer types were subsequently benchmarked against global contamination datasets to assess input-specific and regional variability in MP loading.

Results: Preliminary findings confirm that MPs, predominantly polyethylene (PE) and polypropylene (PP) fragments, enter agricultural soils via three primary vectors: organic fertilizers (compost/manure), irrigation water supplies, and the in-situ fragmentation of plastic mulch. Crucially, the presence of these polymers was correlated with measurable disruptions in soil aggregate stability, a significant reduction in microbial biomass, and observable hindrances in the bioavailability of essential macro- and micronutrients.

Conclusions: The pervasive introduction of MPs into organic-rich matrices fundamentally threatens the long-term resilience and sustainability of global agricultural systems. Effective mitigation requires a multi-pronged strategy, including the immediate adoption of stricter regulatory standards for organic amendment quality, the accelerated deployment of certified biodegradable mulching alternatives, and integrated waste-stream management. This study strongly advocates for the harmonization of international protocols for MP detection and validated risk assessment frameworks within agricultural environments

Microplastics, Agricultural Soils, Organic Matter, Soil Health, Mitigation Strategies