Use of faecal stanols to distinguish specific mammalian species in modern and past environments

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Tracking the origin of faecal material in modern and past environments is of primary importance as it permits the identification of pathogenic contamination hazardous for human health in water, sediment or shellfish, and helps archaeologists and paleoecologists identifying animal activity areas for example. For the past few decades, sterol-derived compounds have been used as faecal biomarkers to identify the main sources of faecal inputs in different environments, and especially to distinguish a human/omnivore origin from a herbivore one. Simple compound ratios of a limited number of these biomarkers have been used as source identification proxies, but these ratios have limited ability to distinguish the origin of faecal material at the species level, especially among herbivore species.

In combination with multivariate analysis, the analysis of faecal biomarkers from different mammal species faeces allowed to build faecal signature databases able to track species identity in water samples. Nevertheless, this method suffers limitations in soil and sediment samples as they both are naturally rich in steroid-derived compounds.

Therefore, we developed a new method based on 5β-stanols, direct faecal biomarkers, and analysed their composition from 90 faeces of ten mammal species to create a faecal fingerprint database. This new tool allows the distinction of faecal fingerprints at the species level even among herbivores. We tested its applicability to distinguish faecal signatures in soil and sediment samples from different modern and archaeological contexts involving various mammal species. Our faecal fingerprint database model successfully confirmed the main species origin of faecal material inputs in modern and archaeological sites and allowed to refine their archaeological interpretations.

This database and its ongoing development could have important applications not only in archaeology, but also in watershed management, paleoecology, geochemistry and forensic soil science.