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Suitability of phytoliths as a quantitative process tracer for soil erosion studies

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Phytoliths are a plant microfossil commonly used as qualitative archive markers in archaeological and paleoecological studies. Their potential uniqueness to the vegetation cover, robustness to weathering, and lack of chemical alteration along the paths make them a potentially suitable tracer for quantitative erosion studies.
In this pilot study, we explore the potential of phytoliths in a sediment fingerprinting study in the Ceguera catchment (28 km2) in NE Spain. The phytolith concentrations and morphologies of four land cover classes (agricultural land, badland, forest, and shrubland) were analyzed, and their contributions to four sediment mixture samples along the river course were modelled. Phytoliths concentrations allowed us to discriminate sources sufficiently, albeit with limited sample size. The performance of the phytoliths as the tracer was tested by reproducing the sources of artificial sediment mixture samples with satisfactory recall ratio. Results identified badlands to be the main contributor, with 84–96% of the sediment load to the sinks, followed by shrublands (median 5%) and agricultural lands (median 2%). Additionally, an intensively used agricultural area in the SW of the catchment was well indicated. These major findings can be reproduced by other conventional erosion studies from this area, indicating that phytoliths are suited to quantifying erosion patterns in mesoscale catchments.