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Organic carbon dynamics in a Mediterranean catchment as affected by soil erosion, sediment transport and deposition processes.

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Soil erosion, sediment transport and deposition processes result in a non-homogenous redistribution of organic carbon within catchments. Variations in organic carbon concentrations (OC) of sediments are reported in literature depending, among others, on the spatial scale of measurement, dominant soil erosion processes and on the local environmental conditions. This study characterized the OC concentrations in soils and in different sedimentary deposits within a medium sized subhumid Mediterranean catchment (111 km2) in SE Spain. The aim was to increase understanding of how the principal soil erosion and sediment transport processes determine catchment scale OC redistribution. Total Organic Carbon (TOC), Mineral-Associated Organic Carbon (MOC), Particulate Organic Carbon (POC), Nitrogen and particle size fractions were determined for soils (i), sediments transported in suspension (ii) and sediments stored in a variety of landscape sinks such as sediment wedges behind check-dams (iii), channel bars (iv), a small delta in the conjunction of the channel and a reservoir downstream (v) and the reservoir at the exit of the catchment (vi). Data show how the OC content of sediments is approximately half of that in soils (9.42$\pm$9.01 gkg-1 versus 20.45$\pm$7.71 gkg-1, respectively). Selectivity of mineral and organic material during transport and deposition increases in downstream direction. OC mineralization, burial or new OC formation occurs in sediments depending on their transport process and on the post-sedimentary conditions. In upstream areas (alluvial wedges) sediments showed low OC contents because they are partially mobilized by non-selective erosion processes affecting deeper soil layers. Based on our results we hypothesize that the relative short transport distances, the effective preservation of OC in microaggregates and the burial of sediments in the alluvial wedges lead to low mineralization of OC with C:N ratios similar to those in soils. In middle stream areas, selectivity of particles upon deposition is evident in the channel bars, which are enriched in sand associated to low OC contents. Downstream, in the delta area, sediment transported over longer distances is much more selected (dominant clay and silt fractions) and has lower OC contents and C:N ratios, suggesting OC mineralization. The reservoir deposits downstream showed similar MOC contents as soils and indications of in situ formation of OC. Overall, our results show that OC redistribution within a catchment is highly complex, and specific environmental conditions, transport and deposition processes strongly determine the ultimate redistribution and OC budget.