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Origin of particulate organic matter exported during storm events in a forested headwater catchment.

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Particulate organic matter (POM) plays an important biogeochemical role towards ecology, ecotoxicology and carbon cycle. Moreover POM within the fluvial suspended sediment load during infrequent high flows can comprise a larger portion of long-term flux than dissolved species. It is well documented that storm events that constituted only 10-20% of the year contributed to >80% of POC exports. But the origin and composition of POM transferred during those hot moments remained unclear. In order to improve our knowledge on this topic we explore the variability in storm event-transported sediments' POM content and source down a continuum of catchment drainage locations.

Wetland, upland and forest O horizons, litter, river banks and bed sediments were analyzed for their content in organic C, isotopic (13C) and molecular (thermochemiolysis-gas chromatography-mass spectrometry) fingerprints. The isotopic and molecular fingerprints recorded in suspended and deposited (differentiated into fine, medium and coarse particles) sediments sampled during different storm events down a continuum of catchment drainage locations (12 and 79 ha).

This study highlights compositional differences between the catchment size (12 versus 79 ha), the particle size of deposited sediment (fine versus medium versus coarse) and the sampling time during a storm event (rising limb versus peak flow versus falling limb). Two sampling strategies were used. Suspended sediments sampled at a specific time during flood events allow evaluating changes along the hydrograph, while deposited sediments that integrate the entire event allow making comparisons with drainage scale. For deposited sediments, the proportion of OM coming from the endmembers wetland, litter and Forest O horizon decreases from the 12ha to the 79ha catchment, which exhibited a higher proportion of OM coming from stream bed sediment and river banks. For both catchments, from fine to coarse particles, the influence of stream bed sediments and river banks decreases while the influence of Forest O horizon increases. For suspended sediments, the evolution during storm events were opposite in the 12ha and the 79ha catchments. In the 12ha catchment, during the rising limb of the hydrograph, POM seems to be inherited from stream bed sediments and river banks, while from the rising limb to the peak flow, the influence of litter and/or wetland increases. This influence decreases during the falling limb. The opposite trend was observed in the 79ha catchment, with an increasing contribution of stream bed sediments to the OM exported during a storm event.

What is the information to take away? First POM transferred in headwater catchments has multiple sources. Secondly, the combination of those sources is different along the size continuum of particles. Then, down a continuum of catchment drainage locations, the combination of sources changes both along the size continuum and during storm events. This information is critical for identifying the various drivers and mechanisms behind POM transport and for understanding the impacts of POM on aquatic metabolism and downstream water quality.