Organic matter compositions and loadings in soils and sediments along the Fly River, Papua New Guinea

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The compositions and loadings of organic matter in soils and sediments from a diverse range of environments along the Fly River system were determined to investigate carbon transport and sequestration potential in this region. Bulk and biomarker organic analyses were performed to determine specific mineral surface area, organic carbon, nitrogen and inorganic carbon contents, stable and radiocarbon isotopic compositions and yields of vascular plant-derived products (lignin phenols and cutin acids) in these samples. Our results show that organic matter in surface soils from active floodplains reflects local vegetation inputs mixed with allocthonous organic matter derived from eroded bedrock. Low overall organic matter contents in deeper mineral soils point to oxidative losses of organic carbon during storage.

Most soils from highland sites and active floodplain sites display intermediate organic carbon loadings (0.25-0.5 mg C/m^2) whereas soils from floodplain sites with low or negligible accumulation rates display much lower loadings (<0.1-0.25 mg C/m^2). Parts of the floodplain with little sediment accumulation appear to be regions of very efficient organic matter mineralization and low net storage capacity. Regions of the floodplain with active sedimentation appear to stabilize organic matter from local vegetation and allochthonous, pre-aged sources. Comparisons with previous studies indicate surface soils from most floodplain regions have lower preservation efficiencies than surface marine sediments from offshore depocenters located along the Fly delta-clinoform system. Combined with measurements of accumulation rates, we use these data to evaluate the overall sequestration potential of carbon along this globally significant sediment dispersal system.