Transport of soil organic carbon in the upper catchment of the Amazon River traced by branched GDGTs

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Transfer of soil organic carbon from land to sea by rivers plays a key role in the global carbon cycle by enabling long-term storage upon deposition in the marine environment, and generates archives of paleoinformation. Specific soil bacterial membrane lipids (branched glycerol dialkyl glycerol tetraethers, brGDGTs) can trace soil inputs to a river. BrGDGT distributions relate to soil pH and mean annual air temperature and can be inferred by a novel calibration [1]. In the Amazon Fan, down-core changes in brGDGTs have been used for paleoclimate reconstructions [2]. However, the effects of fluvial sourcing and transport on brGDGT signals in sedimentary deposits are largely unknown.

In this study, we investigated the implications of upstream dynamics and hydrological variability (wet/dry season) on brGDGT distributions carried by the Madre de Dios River (Peru), a tributary of the upper Amazon River. The Madre de Dios basin covers a 4.5 km elevation gradient draining the eastern flank of the Andes to the Amazonian floodplains [3], along which we examined organic and mineral soils, and river suspended particulate matter (SPM). BrGDGT signals of SPM indicate sourcing of soils within the catchment, with concentrations increasing downstream indicating accumulation of this biomarker. River depth profiles demonstrated uniform brGDGT distributions and concentrations, suggesting no preferential transport and that brGDGTs are well-mixed in the river.

These findings add to prior studies on brGDGTs in the downstream Amazon River [4, 5]. Our study highlights the importance of the upstream drainage basin to constrain the source of brGDGTs in rivers, to better interpret climate reconstructions with this proxy.

[1] De Jonge et al. (2014) Geochim Cosmochim Act **141**, 97-112 [2] Bendle et al. (2010) Geochem Geoph Geosy **11** [3] Ponton et al. (2014) Geophys. Res. Lett **41**, 6420-6427. [4] Kim et al. (2012) Geochim Cosmochim Act **90**, 163-180. [5] Zell et al. (2013) Front Microbio **4**, 228.