Organic matter erosion after large earthquakes: isotope constraints on provenance and processes

JIN WANG[1,2], ROBERT G. HILTON[1], ERIN L. MCCLYMONT[1], JAMIE D. HOWARTH[3], DARREN R. GRÖCKE[4], SEAN J. FITZSIMONS[5], ERIN L. HARVEY[1], ALEXANDER L. DENSMORE[1,2]

[1]Dept. of Geography, Durham University, Durham, UK
[2]Institute of Hazard, Risk & Resilience, Durham University, UK
[3]University of Victoria, Wellington, New Zealand
[4]Dept. of Earth Sciences, Durham University, Durham, UK
[5]University of Otago, Dunedin, New Zealand

Erosion in tectonically-active mountain belts is dominated by landslides that can mobilize biospheric carbon from soils and vegetation, and export organic carbon from rocks. In particular, earthquakes can trigger widespread landsliding in mountains and introduce large pulses of organic carbon (OC) to rivers[1]. To understand their impact on the carbon cycle, it is important to constrain the source of OC and its pathway following these major geomorphic disturbances. It is also necessary to understand the imprint of these events left in sedimentary archives, such as lakes, deltas and marine sediments.

We use lake sediment cores from the western Southern Alps, New Zealand, which capture materials eroded from the steep, forested mountains close to the Alpine Fault. The lake sediments record at least four Alpine Fault earthquakes over the last millennia. We examine the sediments accumulated after each event, which reflect river inputs following widespread landsliding in the decades to centuries that follow. To constrain the source of organic matter and its evolution, we measure the abundance and isotope composition ($\delta^{13}C$ and δD) of specific compounds of OC, including *n*-alkanes, *n*-alcohols and *n*-alkanoic acids. Soil profiles from different elevations and river suspended sediments are measured to constrain the terrestrial sources of biospheric carbon and its processing during transport to the lake system. In combination with the analysis of bulk elemental concentration and isotopes ($\delta^{13}C$, $\Delta^{14}C$ and $\delta^{15}N$), the biomarker measurements show large shifts in organic matter provenance after large earthquakes. Our work reveals how large earthquakes impact erosion and processing of biospheric carbon over centuries to millennia, providing novel insight on the link between active tectonics and the carbon cycle.

[1] Wang, J. *et al.* (2016) *Geology* **44**, 471-474.