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Fracture density as a controlling factor of postglacial fluvial incision rate, Granite Range, Alaska.

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The relations between lithosphere and atmosphere to shape the landscape are disputed since the last two decades. The classical "chicken or egg" problem raised the idea that erosion can promote creation of topography thanks to isostatic compensation of eroded material and subsequent positive feedback. Quaternary glaciations and high erosion rates are supposed to be the main agent of such process. More recently, "tectonic activity" has been considered not only as a rock uplift agent, but also as a rock crusher, that in turn promote erosion, thanks to the reduction of size of individual rock elements, more easily transported.
The Granite Range in Alaska presents a contrasted morphology: its western part shows preserved glacial landscape, whereas its eastern part presents a strong fluvial / hillslope imprint, and only a few relicts of glacial surfaces. We quantify these differences by 1) qualitative appreciation of the landscape, 2) quantification of post-glacial erosion, and 3) hypsometric quantification of the landscape.
On the field, the eastern part appears to be highly fractured, with many, large, penetrative faults, associated with km-thick fault gouges and cataclasites. The westernmost part shows massive bedrock, with minor, localised faults. Remote-sensed fracture mapping confirms this: fracture density is much higher to the east, where hypsometric parameters (HI and HIP) display anomalies, and where high post-glacial incision (up to 600m) is observed.
We provide here an impressive case study for tectonic-erosion interactions through rock crushing effect, and document that half of the sediments coming out of the range come from the $\sim$10% of the most fractured area, all other being equal. This challenges the usual view of tectonic "driving" rock uplift, while erosion removes material: In our case, tectonics is the main erosional agent, rivers and glaciers being (efficient) transport agents.