



Active faulting unexpectedly slows erosion in the highest Swiss Central Alps

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It has been suggested that an orogen that is in topographic steady-state, rock uplift and denudation rates should be equal. This relationship has been recently measured in the Central Alps where high rock uplift rates from leveling do in fact correlate with denudation rates (Wittmann et al., 2007). Based on this relationship and nearby measurements, the denudation rates in the Upper Rhone Valley (Goms) are expected to be amongst the highest in the entire Alps, exceeding 1 mm/y. We tested whether this expectation holds for small, geomorphologically distinct parts of the valley flanks providing > 2000m of relief north and south of the Rhone valley. Deglaciation from the LGM left a series of small, < 10km², valley-perpendicular drainage basins that enter the Rhone River. Cosmogenic ¹⁰Be measured in stream sediment and soils in a series of these lateral valleys in the Goms yield basin-averaged denudation rates more than 5x slower than expected, 0.1 to 0.4 mm/y only.

Ustaszewski et al. (in prep.) have identified the presence of numerous faults, parallel to the main valley in this region. These faults are believed to be post-glacial in timing, and result from either differential loading and unloading by glaciers, gravitational collapse, neotectonic reactivation, or some combination of these. In all cases however, the downslope side of the fault is upthrown, causing 1-10 m scarps. These steps in the lateral valleys trap sediment by providing excess accommodation space. Therefore, denudation cannot proceed as it would in the absence of such natural traps. This hypothesis can be tested by measuring the denudation rates in adjacent basins that lack post-glacial faulting. Of the 15 valleys sampled, 3 have been extensively glaciated during the Holocene, resulting in the removal of the fault scarps. As would be expected, if

the faults are responsible for reduced process rates, the denudation rates in three valleys are much higher, up to 2.5 mm/y. The competition between faulting and erosion has created a setting in the Upper Rhone Valley in which denudation is locally much lower than rock uplift, and relief is locally developing. Yet the high denudation rates in fault-free tributaries to the Rhone trunk stream seem to ensure that on average the denudation rate of the entire Upper Rhone catchment is similar to the prevailing rock uplift rate.

Wittmann, H., von Blanckenburg, F., Kruesmann, T., Norton, K.P. and Kubik, P.W., 2007. *Journal of Geophysical Research*, Vol. 112: F04010, doi:10.1029/2006JF000729.