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The Rangitikei River is actively downcutting in an uplifting Plio-Pleistocene sedimentary basement. Entrenchment is punctuated by formation of climatic terraces. The more recent one formed from 30 to 15 ka, spanning the Last Glacial Maximum. Since the LGM, the Rangitikei River incised 75-meter deep gorges into the LGM terrace deposits (max 15 meters) and the underlying bedrock. We investigate here this post-LGM entrenchment dynamics using optical dating of 17 post-LGM autocyclic strath terraces cut into the bedrock. We acquired two sets of IRSL data (IRSL on feldspars ; Multiple Aliquots or Single Aliquot Regenerative protocols): a first set of 19 samples where luminescence signal was measured on the fine grain fraction (4-11 um) of large aliquots (thousands of grains) and a second set of 7 samples (taken among the first dataset samples) where we considered a coarser grain fraction (125-200 um) of smaller aliquots (of ∼30 grains).

All the IRSL calculated ages on the first dataset samples are older than the LGM, implying a systematic overestimation of these ages. Overestimation is confirmed by measurements of the luminescence signal of present-day river sediments and of 2004' flood deposits, whose calculated IRSL ages are of 37.4 +/- 3.1 and 55.1 +/- 3.5 ka ! The same pattern of overestimation is observed on the second dataset when one considers Central Age Models, however to a lower degree. On this dataset, estimated ages according to the Minimum Age Model show limited overestimation problem; ages are similar for all the terraces between 75 and 20 m above the current river elevation (in the range 9-11 ka); only the two lowest samples show evidences for more recent deposition. These data indicate that terraces down to a relative elevation of 20 m formed during a period of rapid incision phase after abandonment of the LGM terrace and that incision rate slow down recently, documenting a non-linear incision rate since the LGM.

Age overestimation is very common when dating fluvial deposits using luminescence methods because of insufficient exposure of grains to daylight before deposition. In fluvial settings, the solar resetting of the luminescence signal of particles ("bleaching") is limited by turbidity because of attenuation of light through the water column and by the mode and distance of particle transportation. The consecutive age overestimation also likely depends on the magnitude and frequency of input of non-bleached particles from hillsides and river banks. Here, overestimation of IRSL ages for fine-grain samples, as well as for coarse-grain samples when considering Central Age Model, likely results from a mixing between grains that have been bleached during their fluvial transportation and unbleached ones, coming directly from the eroded bedrock or from older deposits. Our results indicate that this proportion is intimately linked to variations in the rate of bedrock erosion and supply of unbleached grains to the river, which control the related particle concentration and turbidity of the flow. Our study consequently suggests that the shape and width of IRSL age distributions could illuminate the past dynamics of rivers (paleo-erosion rates, paleo-turbidity, . . .).