



Combined quantification of post-glacial bedrock erosion and surface exposure duration by coupling in-situ OSL and ^{10}Be dating

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Assessing the impact of Quaternary glaciation at the Earth's surface involves a deeper understanding of the long-term evolution of alpine landscapes and their response to climate variability. In particular, there is a need to simultaneously quantify the climate forcing both on past glacier fluctuations and on bedrock erosion. Here we present a new approach to evaluate post-glacial bedrock surface erosion in mountainous environments by combining in-situ cosmogenic ^{10}Be (TCN) and optically stimulated luminescence (OSL) surface exposure dating. A coupling numerical scheme is introduced, which enables us to invert bedrock OSL signals and ^{10}Be concentrations into quantitative estimates of both post-glacial exposure time and bedrock surface erosion. OSL and TCN data are integrated over different timescales, which enables us to estimate how bedrock erosion rates may vary in both space and time since glacier retreat in an alpine environment. The results reveal erosion rates from 3.5×10^{-3} to 4.3 mm a^{-1} over 451 m of height difference. The most striking feature of our results is a strong anti-correlation between erosion rate and altitude. These results imply that the bedrock surface erosion can be altered at surprisingly high rates. This new approach provides better constraints on both surface exposure dating and bedrock surface erosion over timescale from 10 to 10^5 years, and might be used to quantify small-scale bedrock surface erosion and its contribution in sediment production within paraglacial environments.