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Development and application of OSL bedrock surface exposure dating to the Gorner glacier, Swiss Alps.

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Glaciers are sensitive to climate variations and so provide a potential source for localised information on past climate. The aim of this study is to contribute towards a more detailed understanding of the glacial history and post-glacial erosion across the Central and Western Alps, by better constraining the history of the Gorner glacier in Zermatt, Switzerland. This will be achieved by using Optically Stimulated Luminescence (OSL) bedrock surface exposure dating. This technique measures a distinctly shaped luminescence profile with rock depth that is usually formed within the first 1-5 mm of the surface (Sohbati et al., 2011) and provides an alternative exposure dating method to cosmogenic nuclide dating. Precisely constraining the glacial history in the Alps would provide valuable information on local, as well as possibly global, climate in the past.

For OSL bedrock surface exposure dating, one needs a mathematical model that describes how a luminescence signal changes with depth (Sohbati et al., 2011). This model includes 3 unknown parameters- the lithology dependent light attenuation factor, the mineral dependent photoionisation cross section and the location dependent photon flux. The interpretation relies heavily on accurately constraining these parameters, which have been shown to vary greatly across different lithologies, minerals and locations (e.g. Sohbati et al., 2012a; Lehmann et al., 2018; Ou et al., 2018). There are currently several methods to determine the values of these parameters: (i) Derivation from first principles based on experimental results (Sohbati et al., 2011; 2012; Ou et al., 2018) and (ii) Calibration from the luminescence profiles of independently known exposure age samples- including historical records (Lehmann et al., 2018), road cut outcrops (Sohbati et al., 2012) or the creation of a freshly exposed surface that can be resampled at a later date (Gliganic et al., 2018). Here, we investigate the feasibility of calibrating these unknown parameters using calibration samples from the freshly exposed surfaces created during sampling the previous year. This approach has the advantage of including the natural variability included in constraining the model parameters. Results from the preliminary analysis of samples collected down a vertical transect from the area will be presented and details will be provided on the method's accuracy, limitations and potential.

References:

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