Testing a luminescence surface-exposure dating technique

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Recent work has shown that the relationship between the luminescence signal (optically stimulated [OSL] and infra-red stimulated [IRSL]) and depth into a rock surface can be used to estimate the length of time since that rock surface has been exposed to sunlight (Sohbati et al., 2012), thus serving as a means for surface-exposure dating. Despite the potential of this new dating tool, few published studies have tested or used this technique. Here, we present the results of two tests of the method. First, we perform laboratory bleaching experiments using two unexposed bedrock samples of different lithologies (granite and quartzite). Sub-samples were bleached for various durations (0 to 100,000 s) in a solar simulator, and IRSL/OSL-depth profiles were measured and fitted using the model of Sohbati et al. (2012). Results of fitting for each sub-sample were then compared. Second, we used a granite boulder from a known age moraine (1850 CE) to test the reproducibility of bleaching depth curves. Multiple cores were collected from the same ∼5 cm2 surface area of the boulder, and IRSL-depth profiles were measured and modelled. While our systematic tests confirm the general physical basis of luminescence surface-exposure dating method, we found unexpected scatter in both adjacent bleaching depth curves and the fitting parameters of isochronous rock surfaces for some of our samples. Potential sources of error, including small-scale lithological variabilities and implications for accuracy and precision of the method are discussed.

Sohbati, R., Murray, A.S., Chapot, M.S., Jain, M., Pederson, J. (2012) Optically stimulated luminescence (OSL) as a chronometer for surface exposure dating. Journal of Geophysical Research 117 (B9), B09202. doi.org/10.1029/2012JB009383.