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Successes and Pitfalls of Applying Luminescence Dating to Alpine Deposits

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Optically stimulated luminescence (OSL) dating combines the measurement of the OSL signal from certain minerals (e.g. quartz, feldspar) with an assessment of the environmental dose-rate to determine the time since the last exposure of a sediment to sunlight. This allows the burial age of a deposit to be found, and thus the timing and rates of geomorphological processes can be known. Because this technique is used to date the sediment itself, it is a valuable geochronological tool in many situations, particularly those where radiocarbon dating is not feasible due to either an absence of suitable material or the deposit being too old. OSL dating can typically be used to determine ages that are between decades and hundreds of thousands of years, so is ideal for late Quaternary landscapes. Since the development of the Single Aliquot Regeneration (SAR) dose protocol (MURRAY & WINTLE, 2000, 2003) the application of OSL dating to quartz has been proven to be successful for samples from a wide range of depositional environments (MURRAY & OLLEY, 2002). Aeolian deposits are most suited to OSL dating because the long exposure time of the grains to sunlight during transport normally ensures that complete bleaching (removal) of the previously accumulated signal occurs. Samples deriving from depositional environments such as fluvial or glacial, however, can also be successfully dated if appropriate measures are taken to detect and overcome the possible problem of partial bleaching (where the previously accumulated signal is not completely removed from every grain).

In Alpine regions, OSL dating offers a lot of potential as a geochronological tool and in the last few years has been applied successfully in various studies (e.g. PREUSSER, 2004; PREUSSER et al., 2001, 2003, 2005, 2007; KLASEN et al., 2007). The majority of the previous work has focussed on the infrared (IR) signal deriving from feldspars, but KLASEN et al. (2007) also published results from OSL analyses of quartz. Where possible, quartz is the preferred dosimeter because the physical basis of OSL production is better understood and additionally, feldspar may be subject to a phenomenon termed "anomalous fading" which can lead to an underestimation in the results if not accounted for (e.g. BØTTER-JENSEN et al., 2003). Current research in the Luminescence Laboratory in the Institute of Geology and Palaeontology, University of Innsbruck, is focussing on the application of OSL dating to sediments from the surrounding region (Tirol). Investigations into quartz from the samples collected, however, demonstrate the presence of a number of undesirable luminescence characteristics such as: an "ultra-fast" component; a "fast" component with poor thermal stability; a high level of charge retrapping; and a strong IR stimulated signal. These problems may arise in part as a result of their "young" age (in terms of erosion, transport and re-deposition cycles) (PIETSCH et al., in press). At present research is focussing on developing measurement and/or analytical procedures that can be used to obtain a useable luminescence signal from quartz grains in this area. The development of a suitable protocol will allow OSL dating of various deposits in the region to be performed. This new chronological information will improve our understanding of geomorphological processes in the region and hence further our knowledge of glacial history in the Alps.

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