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# On the quantification of soil bioturbation and soil relocation in a mountainous area in S Spain – testing the potential of single-grain OSL techniques

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Soil formation depends on bedrock, climate, relief, vegetation and time. Bioturbation and colluvial soil re-location are important and significant processes that affect the mechanisms and rate of bedrock weathering. The estimation of the relative fraction of bedrock grains which has been mixed in the soil and transported either vertically or laterally to different depths gives an indication of the degree to which bedrock weathering is controlled by the latter processes. However, despite the great effort dedicated to the analysis of these processes, little is known about the quantitative relationship between geomorphological changes and soil formation, especially for long timescales. This study presents reconstruction of soil processes by single grain optically stimulated luminescence techniques (OSL) in several profiles sampled along a hillslope. The OSL analyses provide a direct measurement of soil forming processes (e.g. bioturbation, colluviation) and with them a more precise formulation of soil formation models at longer timescales.

Single-grain OSL techniques have been applied to quartz and feldspar minerals which were extracted from different soil horizons from a hillslope catena located in Sierra Morena, Córdoba, in the south of Spain. Four profiles were explored extracting twelve samples in order to study vertical and lateral mixing (e.g. soil creep, colluvial processes) of soils.

The suitability of three different OSL single grain approaches, quartz OSL, IRSL (infrared stimulated luminescence) and pIRIR (post-IRSL) feldspar, was tested on four samples. From this analysis parameters from single-grain OSL age distributions (e.g. number of zeroed grains, scatter and shape of the distribution) were deduced to be used as indicators for bioturbation and/or soil-relocation. The most suitable approach was the applied to the several samples from hillslope catena. This study reveals the potential of OSL single-grain techniques in order to shed light on bioturbation and pedoturbation processes within soil formation and their interrelationship with geomorphological processes.