

THE POTENTIAL OF OSL FOR ROCK GLACIER DATING IN THE SWISS ALPS

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To investigate the efficacy of optically stimulated luminescence methods, this study focuses on the luminescence properties of quartz expressed in the luminescence signal intensity and the correlation between signal and applied dose.

Key words: OSL (optically stimulated luminescence), dating, properties, quartz.

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ЗАСТОСУВАННЯ ОВЛ-МЕТОДУ (ОПТИЧНОЇ ВИМУШЕНОЇ ЛЮМІНЕСЦЕНЦІЇ) ДЛЯ ДАТУВАННЯ ЛЬДОВИКОВИХ ПОРІД У ШВЕЙЦАРСЬКИХ АЛЬПАХ

Для дослідження ефективності оптично підсилених люмінесцентних методів вивчалися люмінесцентні властивості кварцу, а точніше інтенсивність люмінесцентного випромінювання та залежність ступеня випромінювання від ступеня оптичного підсилення.

Ключові слова: метод ОВЛ (оптичної вимушеної люмінесценції), датування, характеристики, кварц.

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ПРИМЕНЕНИЕ ОВЛ-МЕТОДА (ОПТИЧЕСКОЙ ВЫНУЖДЕННОЙ ЛЮМИНЕСЦЕНЦИИ) ДЛЯ ДАТИРОВАНИЯ ЛЕДНИКОВЫХ ПОРОД В ШВЕЙЦАРСКИХ АЛЬПАХ

Для исследования эффективности оптически усиленных люминесцентных методов изучались люминесцентные свойства кварца, а точнее интенсивность люминесцентного излучения и зависимость степени излучения от степени оптического усиления.

Ключевые слова: метод ОВЛ (оптической вынужденной люминесценции), датирование, характеристики, кварц.

In high mountain environments the tongue position of active rock glaciers indicates the lower boundary of discontinuous permafrost where flow is not restricted by topography. Changes in the position, extent and dynamics (flow velocity, climatic inactivation) of rock glaciers might be used as (paleo-) climate indicators. However, their ages remain debatable. Difficulties in numerical dating of rock glaciers result from the unsure relationship between dateable physical effects and rock glacier formation. Assuming that the material was exposed to light as it was initially deposited and that burial processes incorporated it into the rock glacier talus, luminescence techniques may be appropriate dating methods. Especially when applied in combination with other relative and numerical dating techniques reliable ages could be achievable.

To investigate the efficacy of optically stimulated luminescence methods, this study focuses on the luminescence properties of quartz expressed in the luminescence signal intensity and the correlation between signal and applied dose. Bleaching status is assumed

by comparing the signal variation within one sample to the variability in dose recovery tests. Seven samples from three rock glaciers (Salteras, Suvretta und Gianda Grisha, Swiss Alps) were taken from the front of the talus. Measurement procedures included single aliquot (two samples from two rock glaciers) and single grain techniques (seven samples from three rock glaciers) and an adapted single aliquot regeneration protocol was applied (after Murray and Wintle 2000).

Single aliquot measurements result in relatively high errors of equivalent doses due to their low OSL signals, poor recycling ratios and high rates in sensitivity change and curve fitting errors. The relative standard deviation exceeds 50%. The dose recovery tests with a variation coefficient greater than 34 % might result from inappropriate measurement conditions or an inappropriate dosimeter. Whereas the arithmetic mean of equivalent doses differs between the rock glaciers from 25 to 45 Gy, the median is equivalent at 25 Gy.

Single grain measurement results clearly differ between rock glaciers. In the case of Salteras, the luminescence signals of nearly all grains were adequate for calculating equivalent doses in terms of shine down and growth curves. Dose recovery tests determine the variation coefficient to be at 32 % and identify a trend towards underestimation of the applied recovery dose. The large spread in the equivalent dose distribution results in a relative standard deviation of nearly 120 %. However, the median of equivalent doses, which is less influenced by distribution asymmetries, is consistent with results of single aliquot measurements at 30 Gy. For the other two rock glaciers the OSL signals of very few grains were detectable and correlated to increasing regenerative doses. Dosimeter problems are probable causes.

The applicability of OSL measurement procedures and/ or quartz as a dosimeter are debatable in both single aliquots and single grain analyses regarding shine down and growth curves. Although the material from the Salteras rock glacier yielded more reliable luminescence results, the dose recovery tests indicate high dosimeter-specific variability. These issues are addressed in a further study which concentrates on IRSL single grain properties of feldspar.

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