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How and when were sediments deposited in the southern foothills of the Tatra Mountains?

The Tatras are located in the western Carpathians and during their history they were covered by ice eight times during the last 2.6 million years. The sediments from the foothills are described as being transported and laid down fluviially, by meltwater from the glaciers (glacifluvial). This classification was done based on geological maps without evidence from studies of the sediments or their age. This project aims to verify this classification by doing a detailed analysis of the sediments and determining their age.

The identification of the process of deposition, “the how”, involved a detailed description of the sediments and collecting samples. The “when” was determined with luminescence dating, a method based on the last time the sediments were exposed to daylight before being buried. During the fieldwork, the sediment data was documented, along with sketches from the area and the collection of samples for the dating analysis. The sand samples were prepared in the laboratory to isolate quartz and feldspar grains (Fig 1). These were measured in a machine that measures the light and this data is then translated to age.



Figure 1. Feldspar grains measured in the machine on a steel disc.

The analysis and description of the sediments led to identifying different layers with distinct characteristics, from which samples were collected for dating. Moreover, the measured signal from the grains represents the amount of energy that was accumulated inside them after being buried. Before the burial, it is important that the grains' previous accumulation of energy to be erased with enough light exposure (bleaching). In the case of quartz grains, the results were not good because the signal was weak, making the data unreliable. Feldspar grains yielded better results, with a stronger signal, and were used for dating instead. This mineral has the risk of losing the accumulated signal with time and it needs longer exposure to be bleached. Consequently, corrective procedures were taken during the measurements of feldspar grains to obtain reliable results.

How do the results relate to the glacial history of the Tatra Mountains?

The results of the sediment analysis indicate that for the process of deposition high energy was needed to transport the rocks and big grain sizes that compose the layers. For this to occur, an abundant availability of sediments is needed so when the meltwater of the glacier has a big discharge it produces a highly concentrated flow of sediments.

From dating analysis, the ages with the best assessment were chosen and these were compared to the known glacial history of the Tatra Mountains. The determined ages range between 200,000 to 260,000 years (Fig. 2), which matches the time when the Riss glaciation occurred. Both, ages and sediment characteristics, coincide with those of other deposits from the northern and southern Tatra foothills that also have been related to the Riss glaciation. Taken together these results suggest that during the Riss glaciation an extensive deposition of sediments happened in the foothills of the High Tatras; providing evidence to support the classification of the sediment as glacifluvial and that the deposition occurred outside the glacier ice margin.

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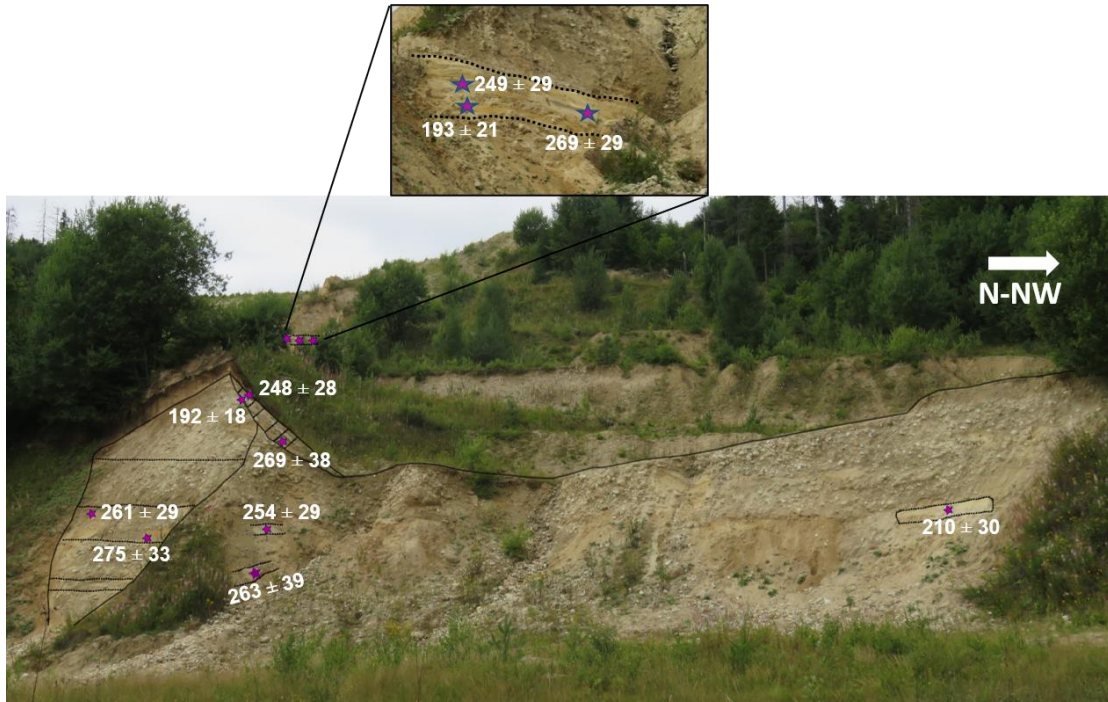


Figure 2. Study area with the different identified layers and the corresponding ages for each collected sample. The ages are given in ka (thousand years) with their corresponding error.