

Past landscape dynamics of a valley in the Tatra Mountains

The Tatra Mountains are part of the Carpathian mountain chain and lies on the border of Slovakia and Poland. Here, evidence is found of glaciers during the Pleistocene, although no glaciers are present nowadays. Many valley sides of the Tatras are sequences of sediments that are reworked by glaciers or transported by glacial meltwater in the past. This project is executed in the Velická valley in the High Tatras in Slovakia (Fig. 1). An in-depth analysis of the sediments here can give a well-funded explanation of how these sediments were transported. When the same sediments are dated, a timeframe is available in which the processes of transport can infer what the landscape dynamics were in this valley in the past.



Fig. 1. The Velická valley with the Tatras in the background

The analysis of the sediments was done by in-depth descriptions and drawings of the sediments found on several locations in the Velická valley. Stones from these sediments were collected and the shapes and sizes were noted down and analysed. For the dating, luminescence was used. This is a method that can determine the last time a mineral grain (in this case K-feldspar) has seen light or has been heated. When the grains are buried by other sediment and the direct light or heating of the sun stops, the minerals built up charge which can be measured. From this, the age after transportation and before it is buried by other sediments, can be derived.

The results showed that most of the sediments were from the Middle Pleistocene, this was older than expected. However, the analyses of the dating measurements do indicate some limitations of the accuracy of the ages. From measurements, it turned out that the sediments had not seen enough light to be completely at zero charge before they were covered. This remaining charge would add up to the charge that was built up after the covering of the sediment and makes the total measured age older. Moreover, K-feldspar has a limit to the charge it can contain, if the sediments are old this limit is easier reached, which was observed in some of the measurements. This would mean that some of the ages appear younger than they are. In most of the analysed sediments, evidence was found of transportation by water. From the evidence of the glacier's presence in the valley, those are assumed to have been transported by meltwater from a glacier that was close by in the north.

What are the landscape dynamics?

After choosing the best estimated ages, the landscapes dynamics of the Velická valley are inferred from the ages and the results of the sediment analysis (Fig. 2). The three oldest sediment sites are dumped by glacial meltwater on a large plain close to the glacier. The valley is incised in this plain by the increase of meltwater and sediment from the glacier during a transition of a cold to a warmer period. At last the terraces are deposited on the valley sides in a warm period with less meltwater.

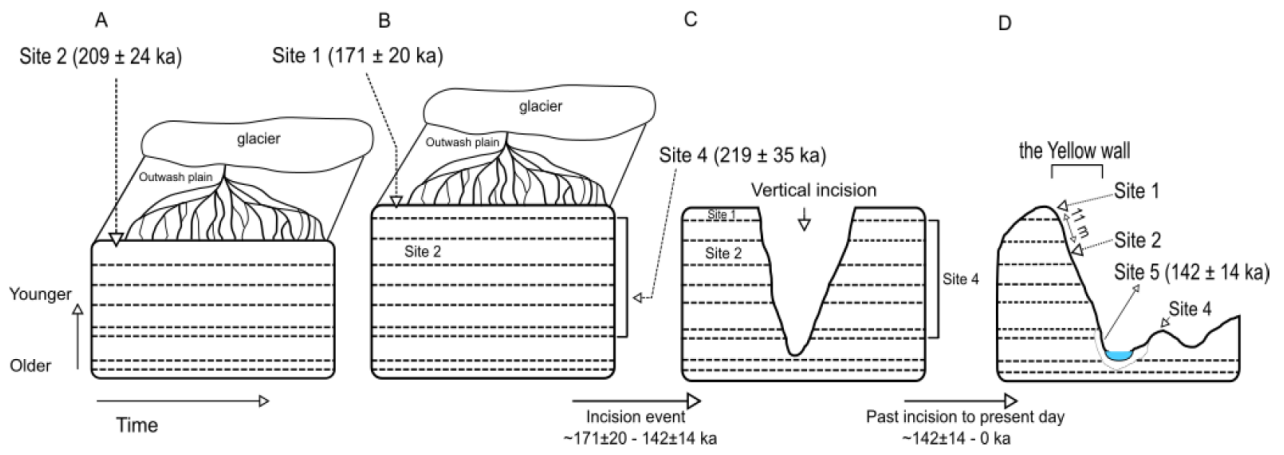


Fig. 2. A schematic model of the landscape dynamics in the Velická valley