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Rate of dune formation and sediment transfer in the past few hundred years on the Danube-Tisza Interfluve, Hungary

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Environmental change let it be induced either by climatic or anthropogenic factors has had a key role in determining the rate of aeolian sediment transfer, on the highly sensitive landscape of the Danube-Tisza Interfluve, Hungary. The study area is located on a former alluvial fan of the Danube, abandoned by the river in the Late Pleistocene, and then reshaped by aeolian activity. The resultant dune fields were time to time reactivated during the Holocene and historical times. As this part of the Carpathian Basin is often stricken by droughts, anthropogenic factors, such as forest clearances and/or overgrazing could easily lead to the disturbance of morphological stability. These effects acted on a local level, however in certain historical periods they supposedly were more extended and general. An era of this type was the time of Turkish occupation (16th-17th c.) and the following two centuries. During the Turkish rule the territory was cleared of forests and became deserted. Following the slow recolonisation by people and vegetation the land was mainly used for grazing. There are numerous historical reports on repeated sand storms and wind erosional events. However, we have no concept on the true amount of sediment reworked these times and the rate of geomorphic change.

The major aim of the present study is therefore to quantify the possible amount of sediment transfer in a wind blown depression–hummock system on the central part of the Danube-Tisza Interfluve during the past 500 years. The determination of dune formation and migration rate provides further insight into the active morphological processes of the region, and also highlights the possible geomorphic responses to environmental changes (mostly climatic) currently affecting the central part of the Carpathian Basin.

Seven drillings were made on the chosen hummock and the adjacent blow out to set up the chronological framework of dune formation by the means of luminescence dating (OSL). The relatively high resolution of dates in this “young” environment was achieved by IRSL feldspar dating. The verification of luminescence ages and the reconstruction of past environment and environmental change was made on the basis of historical reports, military survey maps and municipal maps from the 17th, 18th and 19th centuries. The assessment of transferred sediment volumes and visualisation of dune evolution was carried out by digital terrain modelling based on high resolution on site measurements.

According to our preliminary results the 8-9 m high hummock was primarily formed around 400 years ago, due to the clearance and abandonment of the area. Subsequent events were less intensive, resulting only approx 1-2 m vertical accumulation. Horizontal development (migration) seems to be much less intensive. In all 75 000 m3 of material was moved and reworked in the past few centuries in the investigated morphological system.