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Inland dune field and deposits at Dviete: evidences of the late Pleistocene aeolian morphogenesis and landscape evolution during transition from glacial to post-glacial conditions in South-eastern Latvia

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In the south-western part of Jersika Plain (SE Latvia), the late Pleistocene aeolian sediments form the inland dune field located at Dviete village. This dune field with surface $>112 \text{ km}^2$ represents the evidence of aeolian activity and landscape evolution during the transition from glacial to post-glacial conditions in this region. The dunes have developed on the surface of glaciolacustrine plain, where subaqueous sedimentation in the Nīcgaļe ice-dammed lake took place during the retreat of glacier, the Pomeranian phase of the last glaciation.

Here, we focus on reconstructing paleoenvironmental conditions in this region, as inferred from landforms morphology, aeolian sand granulometry and geochemistry, and efficient wind directions derived from DEM. It will contribute to better understanding the processes of landscape evolution conditioned by last deglaciation in SE Latvia.

Results indicate that single parabolic dunes typically have U-shaped configuration in planar view. Aeolian landforms also link and override each other, presenting clustered groups. GIS analysis reveals that the dominating wind directions during the development of dunes would have been westerly to easterly. Previously published dates on OSL chronology for this dune field indicate the initial phase of aeolian activity at around 15.5 Ka and 14.5 Ka. Hence, when the studied landforms formed in presumably paraglacial landscape, the Scandinavian Ice Sheet (SIS) was still present, and most likely atmospheric circulation in this region was affected by anticyclone over the SIS.

The mean grain size M_z of the aeolian deposits forming inland dune field ranges between $143 \mu\text{m}$ and $256 \mu\text{m}$. Hence aeolian landforms are composed mainly of fine-grained sands. It indicates the dominance of saltation and a balance between sand particles and comparatively low energy of local wind power during the aeolian processes. The sediments demonstrate well and moderately well sorting with σ values between 0.473 and 0.707 phi. Granulometry elucidates symmetrical distribution of particles of different fraction with small both negative and positive skewness Sk values ranging from -0.048 to 0.112 phi. For the values of kurtosis K_G , results showed that sand is mainly mesokurtic.

Geochemical analysis points out that elemental composition is rather typical for aeolian

sediments, determined by the dominance of quartz and K-silicates. Among REE elements, only Y and Nb were identified in detectable concentrations. Similar geochemical signatures across the dune field suggest the provenance of sediments from one main source, possibly associated with glaciofluvial sediment transportation by extra-glacial waters draining from the already ice-free parts of adjoining uplands to the glacial lake.

As apparent from the limited number of paleosoils, aeolian deposition seems to nearly instantly follow the drainage of the Nīcgale ice-dammed lake. It is most likely that cold and dry climate in conjunction with low groundwater tables during the late Pleistocene – beginning of Holocene were among the main controlling factors which prevented development of vegetation cover in this region and delayed stabilisation of the dunes. In turn, it facilitates the action of wind over glaciolacustrine plain as the main driving process of aeolian morphogenesis during the initial evolution of metastable post-glacial landscape.