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Aeolian transport pathways along the transition from Tibetan highlands towards northwestern Chinese deserts

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The identification and semi-quantification of aeolian transport pathways enhances the understanding of aeolian sediment archive formation and thus supports reliability and explanatory power concerning palaeoenvironmental reconstructions.

Grain size analysis of 279 surface sediment samples from the transition of Tibetan highlands (Qilian Shan) towards northwestern Chinese deserts allows the differentiation of contributing pathways among three types of aeolian sediments: *silty* loess, *sandy* loess, and aeolian sands. The study area exhibits a high diversity of geomorphological surfaces due to varieties in relief, elevation and climatic conditions. Therefore, it provides the opportunity to investigate the characteristics of sediments in different geomorphological settings. Using the peaks of grain size frequency's standard deviation of primary loess allows identification of the most sensitive fractions to varying accumulation conditions. mU/fS-ratio (7 – 13 μm / 58 – 84 μm) of primary silty loess relates the far-travelled dust proportion to the locally transported fine sand component. In vicinity to fluvial channels in the foreland mU/fS-values are significantly decreased, whereas mU/fS-values increase with altitude (r^2 = 0.74). This indicates higher contribution of long distance transport compared to lower regions. A prominent increase of mU/fS-values above 3000 m asl likely indicates an increasing contribution of fine and medium silt particles transported by Westerlies in higher altitudes. In contrast, lower areas seem to be more strongly influenced by low altitude monsoon currents (NW-Winter- / SE-summer monsoon). The difference in grain size properties is additionally enhanced by the contrasting geomorphologic settings along the mountain declivity: Plain foreland alluvial fans support fine sand supply and availability whereas steep high mountain topography provides only limited potential for fine sand deflation. Similarly, the relatively low relief in intramontane basins leads to fluvial sediment aggradation and allows comparably high fine sand deflation. This supports the formation of sandy loess in these regions and on foreland alluvial fans, whereas in contrast, sandy loess is absent in the high mountain geomorphologic setting.

Aeolian sand distribution in the study area indicates a high dependence on sand supply. In eastern forelands perennial Hei River and northerly bordering Badain Jaran desert are important sand sources and hence support dune field formation in the northern Qilian Shan foreland (Hexi Corridor). In contrast, western forelands, dominated by gravel gobi surfaces, exhibit very few aeolian sand accumulations on the surface. The latter area shows only ephemeral discharge and is lacking large sand source areas. Therefore, although sufficient wind speeds occur, aeolian sand transport is limited due to restricted sand supply.

Concluding, the medium scale geomorphological setting (10^3 m) exerts a rather underestimated influence when reconstructing aeolian transport processes. However, considering the spatial distribution of aeolian sediments in combination with their grain size distribution allows the reconstruction of dominant transport pathways.