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Aeolian dust flux variability in China during the last glacial-interglacial cycle: inferences from unmixing of loess grain-size records

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The grain-size distributions (GSDs) of loess-paleosol sequences may provide valuable information on provenance, transport and paleoclimate variability, and consequently, a wide range of methods to extract genetic information from loess GSDs has been proposed. Here it is shown that a genetically meaningful decomposition of two series of Late Quaternary loess grain-size records from the NE Tibetan Plateau and the Chinese Loess Plateau can be accomplished with the end-member modelling algorithm EMMA (Vriend and Prins, 2005).

The end-member modelling results indicate that the 'western' and 'eastern' loess deposits are described by very similar mixing models, each consisting of three loess components (end-members) representing very fine sandy, coarse silty and medium silty loess. The unmixing results in conjunction with loess accumulation rate estimates reveal that two contrasting dust supply patterns were active over the NE Tibetan and Loess Plateaus during the last glacial-interglacial cycle: (i) a background sedimentation pattern that was dominant during interglacial periods is reflected by the constant flux of the fine-grained loess component, (ii) an episodic, highly variable dust input pattern, that was dominant during glacial periods is reflected in the admixture of two coarse-grained loess components.

A genetic interpretation and the paleoclimatic significance of the mixing model are provided by comparison of the modelled end members with modern dust samples in terms of their grain-size distribution and flux rates. The comparison indicates that the

fine-grained loess (clayey silt) component represents the fine dust component supplied over the entire loess region, partly during major dust outbreaks in spring and early summer, but mainly as part of a background supply system active throughout the year. The coarse-grained loess components represent the coarse dust fraction supplied over the proximal parts of the Loess Plateau during major dust outbreaks in spring and early summer. The low-level winter monsoon (north-westerly wind system) is the likely transporting agent for all three dust components, although it can not be ruled out that the high-level subtropical jet stream (westerly winds) might, at least partly, be responsible for the input of the fine-grained loess component.

Vriend, M., Prins, M.A., 2005, Calibration of modelled mixing patterns in loess grain-size distributions: an example from the north-eastern margin of the Tibetan Plateau, China. Sedimentology 52: 1361-1374.