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Interpretation of sedimentary subpopulations extracted from grain size distributions of loess deposits in the Sea of Azov, Russia

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Loess-paleosol sequences in eastern Europe, especially those at the Azov region, are among the sensitive terrestrial archives for past aeolian dynamics identification and paleoclimatic reconstruction within the Quaternary. Grain size analyses of loess sediments are widely used to interpret these transporting mechanisms and paleoclimatic changes, based on granulometric parameters and statistical decomposition methods. It is therefore of growing interest in the Earth Sciences and has been a major focus of sedimentary studies. Here, we present the unmixing grain size distribution results of a loess-paleosol section by jointly applying the standard deviation method and the end-member modeling in the Sea of Azov, Russia. The results indicated that two methods can produce the similar result on grain size decomposition, while the end-member modeling has advantage on quantitative and objective character. In addition, three main loess subpopulations or end-members with mode sizes of 8 μm, 18 μm and 32 μm respectively which represent distinct aerodynamic environments are identified from the grain size distribution in the Azov region. Thereinto, EM1 with mode size of 8 μm is the integrative result of combining atmosphere circulation with other environmental processes. EM2 with mode size of 18 μm is inferred to represent continuous background dust under non-dust storm conditions. EM3 with mode size of 32 μm is fraction that being transported in short-term, low-altitude suspension clouds during dust storm outbreaks. Of the three EMs, EM1 and EM2 have multiple origins due to their complex formation, whereas EM3 are primarily derived from the alluvial plains of different rivers in the Sea of Azov.

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