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Late Pleistocene loess in Central Asia and its significances for millennial-scale rapid climatic oscillations

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The climate instability (millennial-scale rapid climatic oscillations) during the last glacial period has been a hot issue in Quaternary paleoclimate cycle, however, the driving mechanism and involved areas are still unclear. Previous reports mainly came from Green ice cores, North Atlantic deep-sea sediments and loess, stalagmites, lake records in the East Asian monsoon area, however, evidences from the Asian interior arid regions are scarce. Central Asia is distant from oceanic moisture sources and the climate is dominated by the Westerlies and the Subtropical High. Late Pleistocene loess sediments sporadically distributed at the pediments, terraces and basins provide us an opportunity to verify the existence of millennial-scale climatic fluctuations in Central Asia and understand the relations between high-low latitude climate. During the last decades, we have carried lots of loess investigations in Central Asian mainly around the Tienshan Mountains including Xinjiang in China, Kazakhstan, Kyrgyzstan and Tajikistan. In this paper, we report the preliminary results of loess investigations, and divide the loess distribution in Central Asia into three zones, which correspond to different hydrothermal combination conditions; and coupled with previous literatures, we review the progress of paleoclimate study of loess especially chronology in Central Asia, analyze problems of the last glacial climate events in Central Asia, and discusses its process and mechanism. Up to now, paleoclimatic proxies like grain size, mineralogy and geochemistry confirmed that that there are indeed millennial-scale rapid oscillations during the last glacial period in Central Asia, but they are inconsistent in age and variability. These rapid changes may be related to the following aspects: (a) contraction and expansion of the ice sheet in the high latitudes region of North Atlantic, (b) changes in the intensity and extent of the Siberian high pressure which further lead to the variance in wind dynamics, (c) and the north-south migration of the mid-latitude westerlies. The solar radiation is not the main driving factor for the rapid changes in Central Asia.