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Centennial-scale monsoon variability on the western Chinese Loess Plateau since the last deglaciation

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Abstract: Centennial-scale monsoon variability and its links to external forcing and internal feedbacks since the last deglaciation remain poorly constrained due to discrepancies among different proxy records and varied correlations to high-to-low climate changes. Here we present high-resolution elemental results together with twelve 14C dates of a 13.5-m terrace sediment on the western Chinese Loess Plateau to infer the monsoon variability since the last deglaciation. Our results indicate that the ratios of Rb/Sr and Zr/Rb are sensitive indicators of chemical weathering and winter wind intensity, respectively, exhibiting significant fluctuations since the last 16 kyr BP. During the last deglaciation, two cold intervals of the Heinrich event 1 and Younger Dryas were characterized by intensified winter monsoon and weakened weathering intensity. In the early Holocene, weakening of the winter monsoon was gradually weakened around 10.7 kyr BP, leading to the abrupt increasing of the chemical weathering around 9.7 kyr BP. The winter monsoon intensity was relatively strong during the early Holocene and decreased gradually afterwards, whereas the summer monsoon intensity reached a maximum during 8-4.5 kyr BP. Such a discrepancy is likely attributable to different impacts of solar insolation and sea level on the wind and moisture changes. During the Holocene, 15 abrupt monsoon events can be easily identified in the Zr/Rb variation, with a dominant periodicity of ~600 yr. In contrast, centennial variability of the Rb/Sr ratio is more evident in the early Holocene than in late Holocene. Comparison of these centennial-scale climate changes with proxies from high- and low-latitude regions indicate that both north Atlantic and intertropical convergence zone (ITCZ) processes played important roles in driving abrupt climate changes.
Key words: Chinese Loess Plateau, terrace deposit, elemental ratios, centennial timescales. monsoon variability