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Variation and possible forcing mechanism of organic carbon isotopic compositions of loess in Northeastern China over the past 1.08 Ma

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As a valid indicator for reconstructing paleovegetation, the stable carbon isotopic composition of total organic matter (δ^{13}C) in aeolian deposits has been widely used, especially on the Chinese Loess Plateau (central China), the area of typical loess sediments. By comparison, little is known about the long-term variations and influencing factors of the loess δ^{13}C in Northeastern China, which is also an important part of the Eurasian loess belt. On the basis of previous study, here we present magnetic susceptibility, grain size and δ^{13}C data of a new high-resolution loess-paleosol profile, the Sanbahuo profile (SBH) in the Chifeng region in Northeastern China since the early Pleistocene ($\sim$ 1.08 Ma). The results demonstrate that the values of the three indicators show generally similar variations on glacial-interglacial cycles, with positive δ^{13}C values occurring in paleosol layers and negative values in loess layers. By estimating C_3/C_4 relative abundance, we get a rough threshold of δ^{13}C value as the discriminator of pure $C_3$and mixed C_3/C_4 plants. The forcing mechanisms of the two types of vegetation compositions are different. When the δ^{13}C values are more positive than the threshold, mainly during interglacial periods, temperature in the region was high enough for the growth of C_4plants. Both precipitation brought by enhanced Asian summer monsoon and temperature favored a higher relative abundance of C_4 plants. Although according to modern investigation, the δ^{13}C values of C_3 plants are more negative corresponding to greater precipitation and temperature, the effects were not enough to offset the positive variations on the δ^{13}C values by the increasing relative abundance of C_4 plants. On the other hand, during glacial periods due to low temperature, the contribution from C_4 plants to the loess could be neglected. Then the δ^{13}C values in this region recorded mainly the response of δ^{13}C of predominant C_3 plants to climatic factors, both temperature and precipitation. The forcing mechanism in this region is different from that on the Chinese Loess Plateau. The relationship between climatic factors and loess deposits in Northeastern China requires further study.

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