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Palaeoenvironmental reconstruction in loess based on stable isotope analyses of pedogenic carbonates from Charyn Canyon, Central Asia

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Charyn Canyon is located in the Ili Basin of southeast Kazakhstan, in the Central Asian transition zone between the major northern hemispheric climate systems: the polar front to the north, the Asian monsoon systems to the south and the mid-latitude westerlies. This area is presently characterized by a cold semi-arid climate (mean annual temperature 7-8°C) with dry summers (maximum of 20°C in July) and cold winters (minimum of -11°C in January); these parameters are likely to have varied through time in response to variable influence and intensity of the major climate systems over the region over long time scales.

The Charyn Canyon sedimentary succession is an 80-m thick exposure of alternating fluvial and loess deposits. Loess thickness increases upwards, suggesting a long-term trend of aridification in the Ili Basin. We investigated the more accessible 38-m thick central part of the whole succession to reconstruct palaeoenvironmental change over the late Cenozoic. The chronostratigraphic framework is provided by magnetic susceptibility data and palaeomagnetic dating, all at 10 and 50 cm resolution respectively. Stable oxygen and carbon isotope analyses of pedogenic carbonate nodules were undertaken at 50 cm resolution to reconstruct quantitative palaeoclimatic parameters and variability through the sequence. Our combined proxy data approach to the Charyn Canyon sequence enables us to better understand climate system dynamics in arid Central Asia during the late Cenozoic.