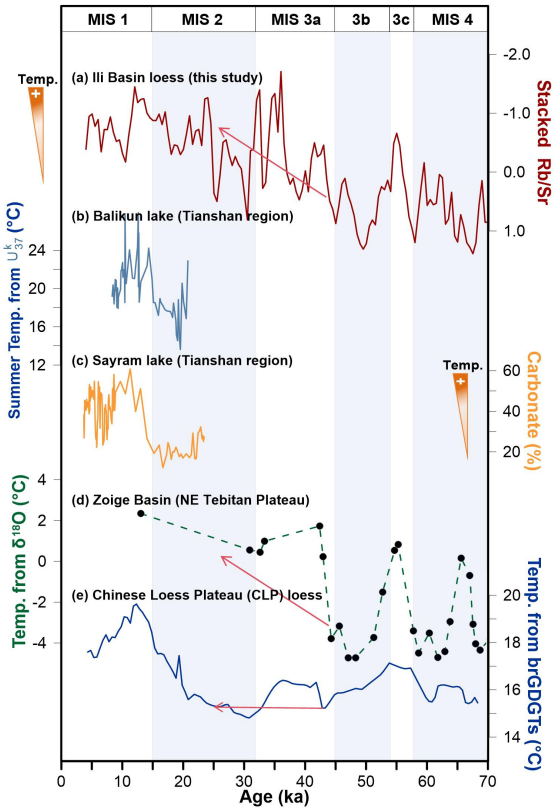
Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.25875

The Rb/Sr Ratio in Central Asian Loess: A Novel Paleotemperature Proxy for Reconstructing Paleoclimate Changes

YOUGUI SONG

Institute of Earth Environment, Chinese Academy of Sciences

The rubidium/strontium (Rb/Sr) ratio in loess deposits has been widely recognized as an indicator of pedogenesis and East Asian Summer Monsoon intensity on the Chinese Loess Plateau (CLP). However, its potential as a paleotemperature proxy in Central Asian loess remains underexplored. This study investigates the factors influencing the Rb/Sr ratio in the Ili Basin, northeastern Central Asia (NCA), using advanced machine learning techniques, including Random Forest and Partial Least Squares Regression. Our results reveal a strong correlation between the Rb/Sr ratio and spring to early summer temperature, particularly in March, May, and June. Unlike in the CLP, where leaching primarily drives Rb/Sr variations, vegetation dynamics, influenced by temperatures from March to June, are the dominant factor in the Ili Basin. Based on these findings, we reconstructed a stacked Rb/Sr record spanning from the Last Glacial Period to the mid-Holocene. This record closely mirrors NCA temperature variations and is related to glacial dynamics on both orbital and millennial scales. The stacked Rb/Sr sequence indicates that spring to early summer temperatures in NCA were lowest during Marine Isotope Stage (MIS) 4 and MIS 3b, then increased to a peak around 12.5 ka, and declined from the early to mid-Holocene (Fig. 1). A significant warming trend from MIS 3a to MIS 2 is linked to changes in sea surface temperature in the northern tropical Indian Ocean, which influenced the Hadley cell circulation (Fig.2). These findings position the Rb/Sr ratio as a novel and valuable paleotemperature proxy for loess in NCA, providing new insights into the regional paleoenvironmental dynamics and climate variability during the Last Glacial Period to the mid-Holocene. This study highlights the potential of the Rb/Sr ratio to enhance our understanding of past climate changes and their driving mechanisms in Central Asia, contributing to a more comprehensive reconstruction of global climate dynamics.



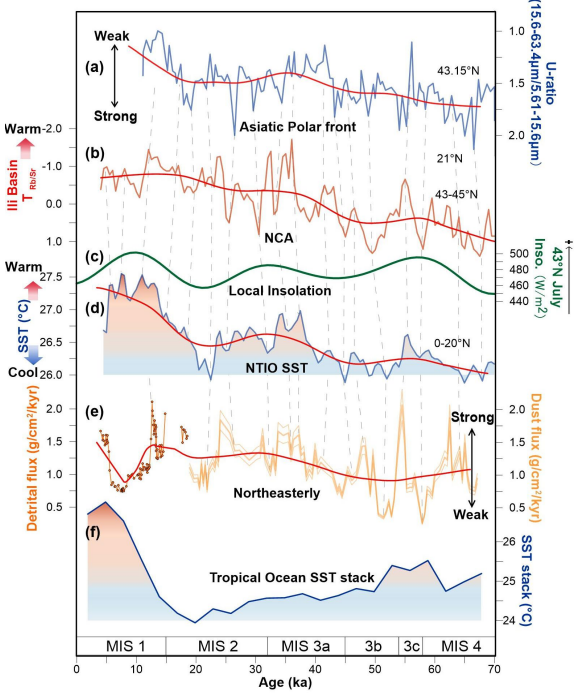


Fig. 1 Comparisons of Paleoclimatic Records Since 70 ka

Fig. 2 Paleoenvironmental Records