Extracting paleo-erosion records from sedimentary archives sunk in basin by using stable cosmogenic ^{21}Ne

YAN MA*, YING WU, JIANZHANG PANG, YIZHOU WANG

State Key Laboratory of Earthquake Dynamics, Institute of Geology, China Earthquake Administration, Beijing, China (*correspondence: mayan82634@hotmail.com)

The late Cenozoic transition to a colder climate is presumed to have modified erosion globally, which was interpreted in the majority of studies as exhibiting an increase in accumulation rates in sedimentary basins. However, this potential increase is seldom evidenced directly by the variation in erosion rates, which also left the issue that to what degree the eroding process is influenced by the changes on climatic conditions less certain. Moreover, recent study on fluvial sediment transport histories using cosmogenic nuclides has demonstrated that the upstream surface processes are decoupled from the downstream depositional records [1]. This finding further promotes the investigation on ancient erosion and its temporal variation.

Cosmogenic nuclides provide an available technique to study the paleo-erosional processes over a wide timescale of million-years. Thereinto, radionuclide ^{10}Be has been successfully applied to track the variation in erosion rate back to Plio-Pleistocene [2], or even to the Miocene [3, 4]. For the first time, we extracted the paleo-erosion rates from the stratigraphic record sunk in the Tarim Basin by using stable noble gas isotope ^{21}Ne. We quantify the paleo-erosion rates in the time range from around 10 to 2 Ma ago by measuring cosmogenic ^{21}Ne concentrations of a magnetostratigraphically dated section. Our results show a continuous upward trend in the erosion rate from 5.5 to 3.5 Ma, which is followed by a slight decline and then tended to be stable after 3.5 Ma. It provides direct evidence on the increase of erosion rate during the late Cenozoic, and furthermore, supports the previous conclusion that climate affects erosion mainly during the transition period rather than the colder but stable climate stage.

Reference:

[1] Sinclair, H.D., et al., Geology, 2018. 47(1): p. 3-6.

[2] Oskin, M.E., et al., Journal of Geophysical Research Earth Surface, 2017. 122(9): p. 1653-1677.

[3] Charreau, J., et al., Earth and Planetary Science Letters, 2011. 304(1): p. 85-92.

[4] Madella, A., et al., Scientific Reports, 2018. 8(1): p. 2299-2307.