Geophysical Research Abstracts
Vol. 21, EGU2019-13329, 2019
EGU General Assembly 2019


# Yellow River integration linked to Pleistocene increased climate instability

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The establishment of major rivers in Asia is often attributed to tectonic-driven topography changes associated with Tibetan Plateau growth. However, it is unclear whether the globally accelerated erosion related to climatic instability since the Pliocene is an important mechanism for river evolution. Here we present detrital-zircon age data from three well-dated boreholes in the lower floodplain of the Yellow River (YR) to constrain the timing of the integration of the YR, one of the longest and the most sediment-laden rivers in the world. Our results show significant provenance change at  1.5 Ma corresponding to the final integration of the Upper and Middle Reaches to the Lower Reaches of YR, through the incision of the Sanmen Gorge. This late integration of the YR notably lags significant uplift of the northeastern Tibetan Plateau, precluding a tectonic driver. Our results rather suggest that Plio-Pleistocene increasing climate instability and sea level fall significantly enhanced headward incision finally cutting through the Sanmen Gorge to integrate the whole drainage system at  1.5 Ma.