Geophysical Research Abstracts
Vol. 18, EGU2016-4917, 2016
EGU General Assembly 2016

Reworked loess and Yellow River sediment as the main sources of the Chinese Loess Plateau

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The Quaternary aeolian dust deposits of the Chinese Loess Plateau have been attributed to spring and winter monsoonal storms sweeping clastic material from the deserts of the Asian interior into central China. Recent U-Pb geochronological studies of aeolian zircons have emphasized the existence of two major wind pathways: from the north, throughout the Tengger, and Mu Us deserts during interglacials, and from the west, through the Qaidam Basin during glacials. Others have emphasized the importance of Yellow River supply in the Loess Plateau sediment budget. However, tracking dust source regions through U-Pb dating is particularly complex, given the paucity of data in many potential sources regions and the similar ages peak in the age probability distributions of western and Northern deserts in central China.

Here, we present an extended dataset of U-Pb ages covering all the potential provenance areas for the aeolian dust in central Asia and including 2400 new ages from loess, paleosols, modern sand dunes and fluvial deposits. We then propose a new mixture modeling technique to statistically address the contribution of these different sources to the Loess Plateau sedimentary budget. Our contribution estimates indicate that aeolian supply is dominated (60–70 %) by reworking of Yellow River sediment. Moreover, evidence of Qaidam Basin sourced zircons (15–20 %) in both loess (glacial) and paleosols (interglacial) layers corroborates the existence of an erosive wind pathway from the west during glacials and implies that a substantial portion of the interglacial dust is recycled from older glacial loess. We propose that sediment reworking of Yellow River sediment and older loesses by wind homogenizes aeolian zircon populations on the Chinese Loess Plateau toward a glacial provenance due to higher dust accumulation rates during glacials. These findings indicate that the Loess Plateau has evolved as a more dynamic landform than previous thought where wind deflation, fluvial input, and lateral transport of sediment are equally important, and suggest that previous paleoclimatic interpretations based on aeolian dust properties might be biased toward glacial conditions.