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Constant Chinese Loess Plateau dust source since the Late Miocene

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The dramatic deepening of northern hemisphere glaciation at the Pliocene-Pleistocene boundary is accompanied by major changes in global climate. The role of the global atmospheric dust cycle in this event is not clear; in particular, whether, changes in the dust cycle influenced climates change, or resulted from it. Miocene and Quaternary wind-blown Chinese loess records past dust-cycle history, influences of aridification and monsoon circulation. Previous work on the vast Chinese Loess Plateau is in conflict over whether changes in dust source occur at the Pliocene-Pleistocene boundary (2.59 Ma), or at 1.2 Ma, despite these intervals marking major shifts in monsoon dynamics (Sun 2005; Nie et al. 2014a). Here we present Sr, Nd and Hf isotopic data from multiple sites and show that the dust source remains the same across these boundaries. The use of isotope tracers from multiple sites allows us to demonstrate that shifts in sediment geochemistry can be explained by grain-size and weathering changes. Nd and Hf isotopes show that the dust was dominantly sourced from the Tibetan Plateau, with some input from bedrock underlying the Badain Jaran/Tengger deserts. This shows that a major established and constant dust source on the northern Tibetan Plateau has been active and unchanged since the late Miocene, despite dramatically changing climate conditions. Changes in loess accumulation are therefore a function of climate change in the Tibetan Plateau source regions rather than due to expanding source areas controlled by aridification over a widening area over the Pliocene and Quaternary.