Eolian dust forcing of river chemistry on the northeastern Tibetan Plateau since 8 Ma

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We present the bulk carbonate Ca-Mg-Sr concentrations and Sr isotopic compositions in water soluble salts, carbonate and silicate fractions, as well as the Nd isotopic compositions in the silicate fraction of a Late Miocene (12.2-5.1 Ma) fluvial sequence in the Linxia Basin on the northeastern Tibetan Plateau. Bulk carbonate Mg-Sr systematics show a distinct pattern in log-log plots of Mg/Ca versus Sr/Ca ratios, and clearly higher $^{87}Sr/^{86}Sr$ ratios since ~8 Ma.

The dramatic changes in carbonate Sr contents, Sr isotopes, and Sr/Mg ratios since ~8 Ma may be inferred to have been triggered by significant inputs of eolian dust via the dissolution of dust carbonates and evaporites in the paleowaters where fluvial and paleosol carbonates precipitated. This process of eolian dust input can be reliably illustrated using a binary mixing model corresponding to a series of varying prior calcite precipitation fluxes combined with a constant eolian influx calculated from the co-variations between Mg/Ca, Sr/Ca and Sr isotopic ratios. Eolian dust also leaves a fingerprint in the carbonate and silicate minerals of bulk sediments, as revealed respectively by their Sr and Nd isotopic compositions. Eolian dust compositions for the ~8–5 Ma on the northeastern Tibetan Plateau can thus be taken to be characterized by a ε_{Nd} value $\leqslant -10.5$ for the silicate fraction, and by a $^{87}Sr/^{86}Sr$ value $\geqslant 0.7115$ for the labile faction (carbonates and evaporites). Eolian dust is now recognized to have made a significant impact on the hydrological evolution of arid and semi-arid northern China as far back as ~8Ma, suggesting an enhanced regime of dust activity and regional aridification in central Asia at that time.