Southeastward impact of eolian dust on river chemistry in the northeastern Tibetan Plateau during the Late Cenozoic

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Here we present Ca-Mg-Sr concentrations and Sr isotopic compositions of bulk carbonates in a new fluvial sequence (12.7-4.8 Ma) in the Xining Basin on the northern Tibetan Plateau, and compare these proxies with a previously reported fluvial section (12.2-5.1 Ma) in the Linxia basin, ~200 km southeast of the Xining basin. The bulk carbonates in the Xining Basin show a uniform pattern in log–log plots of Mg/Ca versus Sr/Ca ratios with a generally lower slope ~0.8 of power fit line, which resembles bulk carbonate Mg-Sr systematics of the Linxia Basin since ~ 8 Ma but differs from those of the Linxia Basin prior to ~ 8 Ma. The $^{87}Sr/^{86}Sr$ ratios of bulk carbonate and water-soluble salts in the Linxia basin show general lower values than those in the Xining basin between 12.2-~8 Ma, start to approach the Xining Basin since 8-9 Ma and the two basins share the same range of $^{87}Sr/^{86}Sr$ ratios since ~7 Ma. The 7-4.8 Ma bulk carbonate and water-soluble salts $^{87}Sr/^{86}Sr$ ratios of the two basin fluvial sediments and the followed Pliocene eolian red clays and Quaternary loess in the Xining Basin resemble carbonate $^{87}Sr/^{86}Sr$ ratios of eolian dust accumulation on the Chinese Loess Plateau, suggesting a dominating eolian dust impact on fluvial systems in the Linxia Basin since ~8 Ma. By using the carbonate element and $^{87}Sr/^{86}Sr$ ratio discriminations, we confirm further that the initiation of eolian dust-dominated hydrochemistry type in the Xining Basin was at least as early as 12.7 Ma, and a strengthened dust input at ~8.6 Ma. The much earlier eolian dust impact on fluvial systems in the Xining basin than that in the Linxia basin suggests a southeastward eolian dust impact on fluvial chemistry in the northeastern Tibetan Plateau and a stepwise expansion of eolian dust delivery systems in Central Asia.