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Zn Isotopic Compositions of the Asian Mineral Dust

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Zinc isotopic systematics have been increasingly applied to trace the sources and potential impacts of the atmospherically derived Zn with both anthropogenic and natural origins. However, better understandings for the Zn isotopic variations of natural dust are still required. We have performed Zn isotopic studies in a loess-paleosol profile (S0-L3) from Yimaguan section in central Chinese Loess Plateau (CLP). The loess-paleosol sequences record the dust-climate interaction histories in (semi-) arid region, which can help interrogate Zn isotopic variations in Asian mineral dust and the response to glacial-interglacial climate changes.

The paleosol with X_{fd} (magnetic susceptibility) higher than $10\times10^{-8}m^3kg^{-1}$ have slightly lower $\delta^{66}Zn$ ($0.19 \pm 0.01‰$, $2SD/\sqrt{n}$, $n = 11$) than loess (unpaired Student's t test, $p < 0.005$). The lack of correlations between $\delta^{66}Zn$ and GT32 (the percentage of particles over 32 μm in size) suggests that the glacial-interglacial source fluctuations and particle size-sorting effects (due to wind system changes) are not important for $\delta^{66}Zn$ variations in loess and paleosol. The leaching residuals by ammonium acetate buffering solusion (pH = 5) display slightly lower $\delta^{66}Zn$ than bulk samples ($\Delta^{66}Zn_{bulk\text{-}residual}$ from -0.02 to +0.08), indicating a preferential release of isotopically heavy Zn during chemical weathering. Leachable Zn fractions (0.5 – 3.1%) show good correlations with leachable Mn and Co ($r > 0.8$), and moderate correlations with leachable Ca, Mg and Sr ($0.8 > r > 0.5$), implying the contributions from carbonates and/or Mn-oxides (desert varnish). Although the leachable Zn fractions decrease with increasing X_{fd}, a preferential retention of Zn is observed for loess with low X_{fd} ($< 6\times10^{-8}m^3kg^{-1}$) and homogenous bulk $\delta^{66}Zn$ ($0.24 \pm 0.01‰$, $2SD/\sqrt{n}$, $n = 13$) which is similar to the value of average upper continental crust (UCC). Our results suggest that the $\delta^{66}Zn$ variations within loess-paleosol sequences can record pedogenic information in response to climate change. Moreover, the loess from the CLP can represent the average UCC and the dust imported from central Asia in terms of Zn isotope compositions.