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Neon isotopic signature applied to detrital provenance assignment in foreland basins

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Cosmogenic noble gas isotope ^{21}Ne in terrestrial rocks has been used primarily to determine timing and rates of the Earth's surface evolution. Here we explore the ability of detrital ^{21}Ne as a provenance tracer, considering that Ne isotopes produced in source rocks could be preserved in minerals over geological time and might be predominant in total Ne inventory of sediments sunk in basins. This ability is predicated on potential source terranes of a given stratigraphic section with distinct neon isotopic signatures. Here we analyze neon isotopes of a well-dated Miocene–Pleistocene sedimentary archives in Kuqa foreland basin of southern Tianshan. The data suggest that the neon isotopic signature, which is expressed as ε_{Ne} and defined in this work as the excess ^{21}Ne/^{20}Ne-ratio relative to atmospheric ratio, is stratigraphically sensitive to changes in local source terranes. This result is compatible with U/Pb provenance analysis and also supported by evidences from sandstone petrography and heavy mineral analysis. Influence of other non-source related ^{21}Ne components in sedimentary archives on sensitivity of ε_{Ne} has proven to be negligible. Furthermore, the integrated stratigraphic signatures of neon isotope and U/Pb age permit the detection of differential erosion in drainage basin, by which the tectonic or climatic effects on geomorphic evolution could be deciphered.