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Hydroclimatic change regulated fluvial sediment supply in southern North China during the early Permian deglacial warming

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The early Permian deglacial warming is the critical period in the last icehouse to greenhouse transition in the Phanerozoic and provides an opportunity to investigate the interactions among terrestrial ecosystem evolution, regional tectonics, and climatic perturbations during climate warming. This climate change has been documented by climate modelling and geological proxies, however, its effect on fluvial sediment dispersal remains unknown. During this period, there were a southwardly diachronous aridification in North China. We here employ detrital provenance data to track the changes in continental-scale drainage system and fluvial sediment supply in southern North China. Combing detrital zircon U-Pb age and sandstone petrographic data from the early Permian sedimentary successions in southern North China defined three major sources in the Qinling orogenic belt (P1) to the south, the uplifted Paleoproterozoic-Archean basement in the northern North China margin (P2) and in the Inner Mongolia Orogen (P3) to the north. In the high-resolution chronostratigraphic framework established for North China, we use DZ mixing modeling method to quantitatively estimate the relative sediment contributions of source regions to the early Permian southern North China basin. Our modeling results suggest that the relative contribution of northly sourced detritus (from P2 and P3) increased from ~4 % in the late Gzhelian to early Asselian (ca 301−297 Ma) to ~95 % in the late Asselian to Sakmarian (ca 297−290 Ma), then declined to ~70 % in the early Artinskian (ca 290−286 Ma), finally returned to ~95% in late Artinskian (ca 286−284 Ma), whereas the estimated relative sediment contribution of the these northerly sources remained in high, stable level (~95 %) for the corresponding successions in northern North China .The increase in northerly derived sediment fraction in southern North China through the Asselian-Sakmarian can be interpreted in terms of the enhanced erosion associated with the tectonic evolution of Central Asian Orogenic Belt which caused uplifting in the northern margin of North China. In contrast, the subsequent reduction in the Artinskian is abnormal considering the persistent tectonic activities in the northern margin of North China. It can be linked instead to the climate aridification in the northern North China and resultant decrease in fluvial sediment supply from the northerly sources to the southern North China. This work highlighted the regulation of hydroclimatic change on low-latitude fluvial sediment supply during the early Permian deglacial warming.