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Coupled U-Pb Dating and Hf Isotopic Analysis of Detrital Zircon of Modern River Sand From the Yalu River (YarlungTsangpo) Drainage System in Southern Tibet: Constraints on the Transport Processes and Evolution of Himalayan Rivers

ZHANG Jinyu[1], YIN An[1,2,*], LIU Wencan[1], WU Fuyuan[3], DING Lin[4] and GROVE Marty[5]

1 Structural Geology Group, China University of Geosciences (Beijing), Beijing 100083, China
2 Department of Earth and Space Sciences, University of California, Los Angeles, California 90095-1567, USA
3 State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, P.O. Box 9825, Beijing 100029, China
4 Institute of Tibetan Plateau Research, Chinese Academy of Sciences, P.O. Box 9825, Beijing 100085, China
5 Department of Geological & Environmental Sciences, Stanford University, Stanford, California 94305, USA

Recently U-Pb dating for detrital zircon has been widely used for reconstructing Himalayan deformation and exhumation history and drainage evolution, however, previous work has not systematically explored the linkage between zircon populations in the source regions and those in the sinks for the active Himalayan orogen. Therefore, we collected a series of river-sand samples from the modern Yalu River and its tributaries in southern Tibet, and conducted coupled U-Pb dating and Hf isotope analysis for detrital zircon to characterize the distribution of zircon populations along different segments of the Yalu River drainage system. Comparisons of zircon populations in the Yalu River drainage system and those of bedrock exposed within its watershed indicate: (1) the presence or absence of distinctive zircon populations in the Yalu main stream depends critically on the geometric configuration of the tributary rivers as well as the burial and exhumation history of the source rocks; and (2) the proportion of upstream zircon populations in the Yalu River sand decreases systematically in the downstream direction, which is caused mainly by zircon addition from new source areas in the downstream region. In some extreme cases, the upstream zircon signals can completely be lost in the downstream region due to this kind of dilution effect. Analysis of sand modal composition reveals a downstream increase in the proportion of lithic fragments along the Yalu River, from ~40% to ~60% over a distance of ~600 km. This may be attributed to the combined effect of an eastward increase in the topographic relief and an eastward increase in annual precipitation across the Yalu River drainage basin. Quantitative comparison of zircon populations along different segments of the Yalu River against those of Neogene sediments from the eastern Himalayan foreland supports a previous proposal that the Yalu River once flowed directly over the eastern Himalaya via the Subansiri River without going through its eastern syntaxis. The shortcut event appears to have been transient, as it is only recorded in specific stratigraphic horizons of foreland sediments. Initial fieldwork along the Siqunama-Subansiri river valley revealed a sequence of fluvial/glacio-fluvial valley-fill sediments and three levels of terraces preserved along the river valley, especially the Qiongduojiang basin. Geomorphic and sedimentological results support combined tectonic damming and climatic changes caused temporary diversion of the Yalu River via the Siqunama-Subansiri Rivers during the Last Glacial Maximum.

Key words: U-Pb dating & Hf, Yalu River, Himalayan drainage reconstruction, shortcut events

* Corresponding author. E-mail: jinyuzhang86@gmail.com