

U-series in Himalayan rivers : timescale of sedimentary transfer

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Recent studies on U-series disequilibria in river waters have highlighted the potential of U-series nuclides to constrain the timescale of weathering processes at the watershed scale [1] [2] [3]. Here we propose to analyse ²³⁸U-²³⁴U-²³⁰Th disequilibria in the bank river sediments of two main himalayan rivers : the Kali Gandaki-Gandak river system and the Bheri-Ghaghara river system.

In the plain, the sediments of the Gandak and Ghaghara rivers display regular variations of U-series disequilibria. They are interpreted in terms of increase in the weathering intensity of the sediments during their transfer from the Piedmont to the Ganges (transport and storage). The U-Th variations can be used to evaluate transfer times: about 80 ka and 100 ka for the Ghaghara and the Gandak respectively by applying a model classically used to explain the U-disequilibria in weathering profiles [4].

In the chain, the variations of major, trace elements, and Sr isotopic ratios observed for the dissolved and particular phases of the Kali Gandaki are explained by mixing between fluxes from two main sources which are more or less fractionated by weathering (TSS, LH-HHC). This process is also controlling the U-Th fractionation in the sediments. Modelling this double phenomenon of mixing and weathering allows us to propose a mean residence time of weathering products in the watershed which ranges from about 20 ka to 80 ka.

In the plain, the results highlight quite long transfer times which are higher than the Quaternary climate oscillations. It confirms that a short-term perturbation originating in the chain will be buffered by the floodplain. In addition, the high time constants found for weathering in the chain suggest a long duration of the bedrock weathering, before its erosion and transfer by the rivers.

References

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