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^{238}U-^{234}U-^{230}Th disequilibria and the sediment transit time in himalayan rivers

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The timescale of weathering processes and the transfer time of sediments in the rivers are key parameters to correctly constrain the response of the erosion and sedimentation processes to tectonic and climatic forcing. We propose to address this question in the case of the Himalayan rivers by analysing ^{238}U-^{234}U-^{230}Th disequilibria in the bank-river sediments collected along two main Himalayan rivers : the Kali Gandaki – Gandak river system, and the Bheri – Ghaghara river system. Both systems were sampled from their source in the chain to their confluence with the Ganges in the Indian plain. The main result displayed by the U-Th data is a regular evolution of the ^{238}U-^{230}Th-^{232}Th systematics along the rivers with a decrease of (^{238}U/^{232}Th) and (^{230}Th/^{232}Th) ratios in river-bank sediments from upstream to downstream. This decrease is different in the Himalayan chain and in the Gangetic plain. The variations in the chain can be related to a mixing between erosion products of different sources and to their evolution by weathering (corresponding to a uranium leaching). The modelisation of this dual process leads to quite long weathering and sedimentary tranfer times for these himalayan rivers : 50 to 80 ka in the case of the Kali Gandaki river from the High Himalaya Crystalline (HHC) to the Siwaliks. This result could suggest that the duration of the bedrock weathering, before its erosion, is long. In the plain, the U-Th geochemical variations of the sediments are mainly controlled by their geochemical maturation during their transfer and storage in the alluvial plain. The data allow us to estimate tranfer times of sediments of about 80-100 ka to transit from the piedmont to the Ganges. These quite long sediment transit times in plain certainly account for the average constancy of sediment yield of the Ganges rivers during the Quaternary. Overall results highlight the potential of the ^{238}U-^{234}U-^{230}Th disequilibria to constrain the dynamic of the sedimentary transfers in the rivers.