

Comminution ages constrain sediment residence time in the large Changjiang (Yangtze) river catchment

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Physical erosion intensity in large river basins may greatly regulate chemical weathering process and shape the catchment landscape. Comminution age derived from ($^{234}\text{U}/^{238}\text{U}$) of silicate fraction in sediment provides an innovative approach to constraining the time elapsed since physical erosion of bedrock into a detrital particle, which is also considered as sediment residence time from the source-to-sink point of view in the study of earth surface processes.

In this study, we calculate the residence time of suspended and bank sediment samples from the mainstream and major tributaries of Changjiang, the largest river originated in the Tibet. The mean residence time of bank sediment is 299 ± 141 kyrs for mainstream samples and 215 ± 178 kyrs for tributary samples, showing great spatial heterogeneity even between samples from the same location. In comparison, the mean residence time of suspended particle is less variable, about 226 ± 61 kyrs and 152 ± 156 kyrs for the mainstream and tributary samples respectively. For the suspended particle, residence time has a significant positive correlation with sediment yield (Fig. 1), which probably indicates that a great portion of suspended sediment is eroded from reworked sediment in alluvial plain rather than in mountainous region.

Previous studies suggest that the sediment residence time in small mountainous river basins may be mainly determined by the depth of hillslope erosion, and deep erosion would produce more newly-formed materials with short residence time^[1]. Our study indicates that the sediment residence time for large rivers depends more on the complex sedimentary recycling, with more reworked sediments from alluvial plain in lowland region. This work provides insights into erosion patterns and sedimentary recycling of large rivers.

References:

[1] Dosseto, A., Buss, H.L., Chabaux, F., 2014. Age and weathering rate of sediments in small catchments: The role of hillslope erosion. *Geochimica Et Cosmochimica Acta*, 132(3): 238-258.

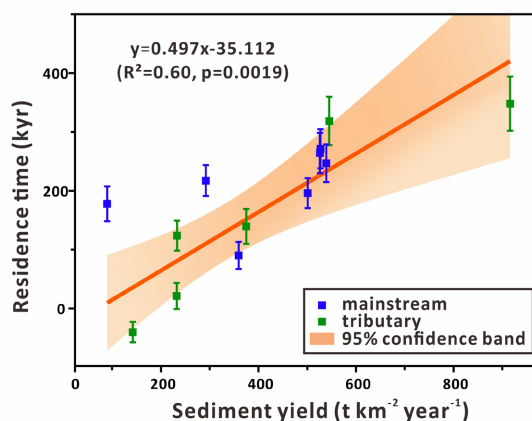


Fig.1 Linear correlation between sediment yield and residence time of suspended particles