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Mica hydraulic sorting in the Yangtze River: implications for detrital mica 40Ar/39Ar analysis

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Detrital muscovite and biotite 40Ar/39Ar analysis has been proven useful for studying regional tectonic history, sediment provenance and paleo-drainage reconstruction. A common but less appreciated process is the physical abrasion and chemical dissolution during transport of detrital micas and the associated effect on grain size and age populations. Here, we present detrital muscovite and biotite 40Ar/39Ar results of 15 modern sediments from the Yangtze River to approach this scientific question. Mass-spectroscopic signals of induced 39Ar, formed from 39K by neutron capture reaction during sample irradiation, have been used as an index for grain size. It is found that (1) relatively older detrital mica ages of the Yangtze River are often characterized by small induced 39Ar signals (i.e. grain sizes), and (2) older age components (>1000 Ma) given by zircon U-Pb detrital data cannot be detected by our mica 40Ar/39Ar results. The first observation is also revealed by reanalysis of previously reported detrital mica studies in other major rivers (Red and Brahmaputra rivers) and strata (Canada and Antarctic) and probably results from physical and chemical weathering during transport and recycling. The disappearance of Neoproterozoic and older micas (the second observation) is probably caused by prolonged transport and recycling. Our Yangtze results indicate that detrital muscovite and biotite ages of grains with a size of 100 - 1000 μm cover the age components given by all grains (with a size of 50 - 2000 μm), and thus indicate that detrital mica 40Ar/39Ar analyses should cover small grains up to 100 μm to reduce the effects of hydraulic sorting on detrital mica 40Ar/39Ar age population analyses.