Geophysical Research Abstracts, Vol. 8, 02967, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02967

Plio-Pleistocene erosion rates in Taiwan inferred from detrital zircon fission-track and (U-Th)/He thermochronometry

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Modern erosion rates in Taiwan are 3 to 5 km/Myr on average, and are among the highest rates on earth. However, it is still debated how erosion rates vary through time and space given the youth of the arc-continent collision, its progressive southward propagation and Pleistocene-Holocene climate change. Different methodologies, such as fission-track dating, cosmogenic surface dating, and suspended sediment loads in rivers, yield different erosion rates suggesting that erosion rates sampling more recent timescales may be enhanced by recent climate changes. This hypothesis can be tested by estimating paleo-erosion rates using detrital thermochronometry. We have applied a method of combined detrital zircon fission-track analysis and (U-Th)/He dating on the same grains to take advantage of the efficiency of fission-track dating and the precision of (U-Th)/He dating. This “double-dating method” with well-resolved stratigraphic ages is capable of resolving the temporal variability of erosion rates in environments such as Taiwan where rates are high and lag times are short.We have obtained the first results from a Pliocene-to-Pleistocene, deep-marine mudstone and sandstone section in the Sanfu-Chi area of the Coastal Range of eastern Taiwan. Zircon fission-track dating of 4 samples with depositional ages from 1.95 Ma to 1.8 Ma captured the first stratigraphic appearance of young, “reset” zircons that we interpret as coming from the Central Range of Taiwan. The oldest reset zircons appear at 1.90 (+/- 0.05) Ma. (U-Th)/He dating of three grains exhibiting reset fission-track ages give ages of 3.25 to 2.26 Ma, indicating lag times of 1.3 to 0.4 Ma. This result implies erosion rates, at least locally, of 6 to 8 km/Myr, suggesting that the high erosion rates observed

in the present day are also characteristic of the early phases of collision during the Plio-Pleistocene.