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Spatial and temporal variations of erosion rates in Taiwan from detrital zircon-fission-track dating.

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The landscape of the Taiwan orogen has changed rapidly over the last few million years due to the young arc-continent collision, the climate change and the interaction between climate and tectonics. Several studies based on low-temperature thermochronology, cosmogenic nuclides, and modern river sediment loads characterized erosion rates and suggested spatial and temporal variations across a range of timescales. We use detrital zircon-fission-track dating to determine not only the spatial but also the temporal variations of erosion rates in Taiwan, and we compare the modern and past rates by sampling rivers and Plio-Pleistocene sediments and applying detrital methodologies. We studied three stratigraphic sections: the Tsaohuchi section in the north-west foreland, the Chengwenchi section in the south-west foreland and the Sanfuchi section in the Coast Range, which is in the eastern foreland of the modern collision belt. Modern sediments from four rivers in north-western and in eastern Taiwan have been dated.

In eastern Taiwan, modern rivers show a young zircon populations with mean ages of 0.8 Ma (Muguachi), 0.9 Ma (Luyehchi) and 1.1 Ma (Hopingchi). The northernmost, Hopingchi has a second population with a mean age of 2.3 Ma. The southernmost Luyehchi has a small population of 3.5 Ma. In north-west Taiwan, consistent with the drainage basin exposure of both high- and low-grade metamorphic rocks, we find two populations of zircons with ages of 2.0 Ma and 42.4 Ma, respectively. These populations indicate extremely high modern erosion rates, particularly in eastern Taiwan and they correlate well with a general southward trend of increasing erosion rates inferred

from river sediment loads.

The Sanfuchi section in eastern Taiwan records the deposition of zircons reset by the Taiwan orogen, first occurring at 1.9 Ma and a clear upsection trend of increasing proportion of young zircons.

Samples from the two western sections consist mostly of old zircons that were not reset by the Taiwan orogen and only a few to no young reset zircons. In the north-western Tsaohuchi section, the Pliocene samples show some relatively young (late Miocene) zircons that could be interpreted as totally or partially reset by the Taiwan orogen whereas the uppermost Pleistocene sample shows no young zircons. The Chengwenchi section in south-west Taiwan shows an upsection increase in totally or partially reset zircons. A possible explanation for the upsection disappearance of young zircons in the Tsaohuchi section could be the onset of surface uplift of the Hsuehshan range and establishment of a drainage barrier isolating the northern foreland from the deeply exhumed Central Range.

The comparison of modern and past detrital records and of erosion rates at different timescales suggests that, at least locally, the high erosion rates observed in the present day are also characteristic of the early phases of collision during the Plio-Pleistocene.