

Orogenic processes in Taiwan and the role of changes in motion of the Philippine Sea Plate

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The Taiwan orogenic belt is often treated as a steady, southward propagating orogenic system with a steady erosion rate of 4-6 mm/yr since the collision began, 6-5 Ma. A few recent studies of the exhumation history, however, suggest that the collision was initially simultaneous and that the tectonic setting may have been more complicated. To better understand orogenic processes in Taiwan and their relation to past plate motions we evaluate the exhumation history in more detail and compare this history to different interpretations of orogenic evolution and to possible changes in motion of the Philippine Sea Plate 15 Ma to present. A more detailed view of the exhumation history comes from four new age-elevation transects from, north to south, the Central Cross-Island Hwy, the South Cross-Island Hwy, Mt Yu and an area around Small Ghost Lake in southern Taiwan. Mt Yu, is from the western Central Range whereas the remaining three are from the eastern part of the range. The age-elevation transects are based on 106 new and previously published (U-Th)/He and fission track ages of detrital zircon and apatite grains. The results show that all four sites record similar exhumation histories from about 5 Ma to the present, with slow apparent exhumation cooling (~ 0.1 mm/yr) from 5 Ma to about 1.5 to 2 Ma, moderate apparent exhumation cooling (3-5 mm/yr) from about 2 to 0.5 Ma and relatively fast exhumation cooling (5-8 mm/yr) from 0.5 Ma to present. Although several interpretations of the progressively increasing rate of exhumation cooling since 5 Ma are possible, we focus on two end-member hypotheses: 1) progressively thicker crust, possibly continental in composition, is subducted and possibly underplated and 2) the rate of convergence between the PSP and Eurasia plates increases at ~2 Ma and again at 0.5 Ma, which leads to greater shortening and higher rates of exhumation in the Central Range. To evaluate these hypotheses we examine the crustal structure in Taiwan using Vp and Vs tomography (Huang et al., 2015) and re-examine geologic and geophysical evidence for changes in motion of the PSP 15 Ma to present.

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