



Relating shortening, erosion, and exhumation to orogen width during Alpine collision

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The width of orogens may change through time depending on the amount of shortening, on the efficiency of erosion, on the strength and thickness of the plates, or on the occurrence of pre-existing and newly formed weaknesses within the plates. The effect of erosion rates on the width of the Alps was controversially discussed, based on estimates of paleo-erosion rates and paleo-widths of the orogen. However, both parameters are difficult to reconstruct. In this contribution we investigate the causes of present-day, along-strike changes of width of the Eastern and the Central Alps to understand its width changes through time.

Based on a series of 6 orogen-scale cross-sections and their retro-deformation we set the width of the thickened accreted lower plate in relation to the amount of collisional shortening and exhumation. We conclude that higher amounts of shortening systematically coincide with smaller widths of the thickened, accreted lower plate, i.e. the width of the mountain chain north of the South-Alpine indenters. Changes of width by a factor 2 along orogen segments of less than 200 km length cannot result from long-term climatic differences and sedimentary or paleontological evidences suggesting such differences are lacking. Therefore, erosional processes did not directly control the width of the orogen, which did not behave as a critical taper. Higher amounts of shortening coincide with larger amplitudes of orogen-scale, upright folds, with larger amounts of exhumation, and with higher exhumation rates. Hence, erosion did play a major role in reducing by up to 35 km the vertical crustal thickness in order to accommodate and allow shortening by folding, but along-strike changes of erosion rates were governed by different amounts of shortening, not by different climate.