

Rollback orogeny model for the evolution of the Central Alps

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The construction of the European Alps and the Himalayas has been related to the convergence and subsequent collision of two continental plates. Nearly all models of orogeny build on this concept, and all of them relate the stacking of nappes and the build up of topography to compressional forces at work in response to the collision between two continental plates. For the Central European Alps, however, these models fail to explain the first order observations of a mountain belt, which particularly includes the striking isostatic imbalance between the low surface topography and the thick crust beneath the Alps. Here, we review and synthesize data on the geologic architecture of the Central Alps and its foreland basin, the chronology and pattern of crustal deformation, and information about the deep crustal structure derived from seismic tomography. Furthermore, we discuss the intrinsic and explicit assumptions in the kinematic models of Alpine evolution in the context of plate tectonic considerations. We combine these views with progress in understanding that has been gained through subduction and collision isostatic mass and force balancing, and with information that has been collected on the current seismic regime. We conclude that a rollback orogeny model for the European plate offers the most suitable concept to explain the ensemble of surface and deep lithosphere observations. In this model, the evolution of the orogen is driven by gravity forces and the construction of surface topography is accomplished without the requirement of a hard collision between two continents.