What Happened 5 Million Years Ago in the Alps?

Stüwe, K., Robl, J., Hergarten, S. & Legrain, N.

Institute of Earth Sciences, University Graz, Heinrichstr. 26, A- 8010 Graz, Austria
(kurt.stuewe@uni-graz.at)

There is rising evidence that some 5 million years ago a surface uplift event started in the Alps that caused a renewed and ongoing phase of tectonic activity. This uplift event appears to encompass not only the Alps, but also the surrounding regions including the foreland basins (in particular the northern Molasse basin), the Styrian and Vienna basins in the east and parts of the Bohemian Massif. The event is particularly visible in the eastern half of the orogen where topography is lower, convergence is more active and pervasive Miocene strike slip tectonics provides a backdrop against which the Post-Miocene events may be evaluated more clearly than in the west. The evidence includes (i) young karst-cave formation ages at elevations high above current ground water tables, (ii) the indirect evidence of ancient fissions track ages at surface elevations above 2000 m, (iii) bimodal landscapes with substantial planation surfaces about 500 meters above current valley floors (iv) coalification and compaction studies in the sedimentary basins surrounding the eastern Alps, (v) current geodetic surface uplift rates, as well as: (vi) numerical modeling evidence that appears to indicate that the Alps are geomorphologically premature. Overall, it appears that some 1000 m of surface uplift occurred within the last 5 million years. Along the eastern margin of the Alps, the event has been described as an inversion event in the sedimentary basin and has been brought in connection with the cessation of a subduction zone underneath the Carpathian arc. However, the event appears to be associated with little horizontal tectonics and it is regionally widespread, so that we suspect that more deep-seated drivers are responsible. The implications of the event for the discussion around tectonic versus climatic drivers as causes or consequences of young erosion and tectonics in the Alps are profound: Modern consensus holds that the global deterioration of climate some two million years ago is the principal driver for the youngest phase of uplift and erosion in the Alps. We argue here that the glaciation of the Alps was only possible because the 5 million year tectonic event uplifted the range enough so that an icecap could form. As such, we diplace the "chicken or egg debate" (currently in the vogue of climatic drivers) one step back: We argue for a deep seated uplift event as the cause for glaciation in the Alps.

Statistical analysis of a huge fault database around the bend of the Western/Eastern Alps

Sue, C.[1], Champagnac, J.D.[2], Bertrand, A.[3] & Rabin, M.[1]

[1] Chrono-environnement Laboratory, UMR 6249. University of Franche-Comté, 16 route de Gray 25000 Besançon. France
(christian.sue@univ-fcomte.fr)
[2] Geologisches Institut. ETH-Zürich Sonneggstrasse 5 8092 Zürich. Switzerland
[3] AlpS GmbH – Centre for Climate Change and Adaptation Technologies, Innsbruck, Austria

The internal arc of the Western and Central Alps underwent an important brittle deformation stage, expressed on the field by meso-scale to kilometric scale brittle structures. Regional paleostress studies achieved all around the arc highlights two distinct extensional phases.

The first is an orogen-parallel extension phase, dated of about 10 Ma using pseudotachylites in the Lepontine Dome (ALLANIC & GUMIAUX, 2013). The strike of the extensional axes turns with the alpine arc, from the Lepontine Dome to the back of the Argentera massif. This major signal increases to the NE of the belt, and could be compatible with the roughly E-W extension observed in the Eastern Alps, particularly within the Tauern