



Alpine collisional wedge sequence of shortening from thermal, thermochronological and geochronological data.

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Thermicity and kinematics of collisional wedges are key to understand crustal rheology during collision, especially in thick-skinned mountain belts, where deep crustal levels are exhumed. In the Western Alps, the large body of available data now allows a detailed study of both structural and thermal evolution.

In this contribution, from new (U-Th-Sm)/He data on zircon and new Raman Spectroscopy on Carbonaceous Material (RSCM) data on samples from the Aiguilles Rouges and Mont Blanc massifs (External Crystalline Massifs, Western Alps) and their cover, coupled to HeFTy thermal modeling, we constrain the thermal evolution and exhumation of the massifs.

In the Aiguilles Rouges massif, the peak temperature was about 315°C, which is significantly higher than previously estimated, and thus close to the peak temperature reached by the Mont Blanc massif (400°C). Moreover, (U-Th-Sm)/He data (and literature data) point toward a coeval cooling and exhumation of both massifs.

These results allow refining both the thermal structure evolution and the structural evolution of the external Western Alps. In this scenario, which highlights a forward propagation of shortening, the Mont Blanc massif was shortened at thermal peak during Oligocene times (30-23 Ma). It is noteworthy that this thermal peak lasted 10-15 Ma in the Mont Blanc massif, and probably 5-10 Ma in the Aiguilles Rouges massif. At 23 Ma, the Mont Blanc Shear Zone was activated and the massif started to exhume slowly. At 16 Ma, the exhumation rate increased, coevally with the activation of a crustal ramp below the Aiguilles Rouges massif, the Mont Blanc Back Thrust, and the activity of the Mont Blanc Shear Zone: the zone of underplating below the wedge thus widened at this time. Finally, at 11 Ma, the Jura fold-and-thrust-belt formed at the wedge front.

One of the major results of this contribution is the significant shortening that the External Crystalline Massifs experienced during their thermal peak (lasting around 10 Ma at 300-400°C), before the onset of their exhumation.