

NEOGENE EVOLUTION OF THE SOUTH-WESTERN ALPS (FRENCH-ITALIAN  
BORDER): AN INTEGRATED SISMOTECTONIC AND THERMOCHRONOLOGICAL  
APPROACH

**Abstract**

This thesis focuses on the Neogene evolution of the south-Western Alps. An integrated approach coupling in-field analysis, seismotectonics and low-temperature thermochronology was adopted and highlights a complex tectonic pattern as an original tecto-morphic evolution within the Alpine belt.

The faulting analysis shows a strong original pattern of NW-SE dextral fault drawing orogen-parallel valleys and accompanying the Alpine curvature. These faults coexist with a second order network of steep normal faults accommodating orogen-parallel extension. Paleostress inversions reveal a complex history of stress/strain in the South-Western Alps, involving an extensional and a transcurrent regime. Chronological discrepancies suggest that these regimes have coexisted. I propose that they are end members of a fluctuating stress state that results from interference between a regional extensional field and a more general transpressional field. In our view, the more local field would be induced by gravity while the general field is likely induced by indentation of Apulia.

The seismotectonic analysis shows that the south-Western Alps are undergoing extensional to transcurrent deformation in the Briançonnais zone and almost pure extension in the more internal Piemonte zone. Extension is oriented E-W, as it is farther north in the arc, in apparent independence with the surface structural curvature. Discussing extension in terms of orogen-perpendicular vs. orogen-parallel is consequently no longer pertinent in the western Alpine arc. The area undergoing extension overspreads onto the inner fringe of the external zone, and is no longer strictly confined to the internal zones as it is further north in the rest of the arc. I propose that the area affected by extension correlates with high crustal thickness. This would promote buoyancy forces as the main factor governing extension. The arc of the Western Alps mainly reflects the upper-crustal structure and contrasts with more linear structures at depth. This implies a vertical uncoupling probably acquired during the Oligocene climax of the indentation-collision that could explain why the major thrust at the front of the internal arc was not reactivated as an extensional detachment like further to the north.

The synthesis of new and previously published Apatite Fission Tracks data confirms that the south-Western Alps have undergone an original tectono-morphic evolution during Neogene times. Thermochronology reveals a rapid exhumation in the Internal zones just after the Oligocene collision climax and confirms a strong jump in age (around 20 Ma) with respect to the External Zone. The latter testifies for reactivation of the front of the internal arc as an extensional detachment soon after the collision climax. I relate the rapid exhumation of the south-Western Alps to the strong erosion of an elevated cordillera taking place in the internal zones.

Quantification of relief evolution is tested by using the Apatite Fission track thermochronological system along two transects sampled in the Pelvoux and Dora-Maira massifs. Age-elevation relationships at several topographic wavelengths allow estimating a mean exhumation rate of 0.4km/Myr for the last 7Myr in the Pelvoux massif and of 0.1Km/Myr for the last 20Myr in the Dora-Maira massif. No clear evolution of relief through time is evidenced. We underline a general lack of resolution of the AFT system to quantify relief evolution.

Synthesis of results allow proposing that the Neogene deformation results from a weak equilibrium between inner-to-the belt processes, related to a gravitational spreading of an overthickened alpine crust, and outer processes related to the complex indentation/rotation of Apulia.

**Keywords** : Alps, Tectonics, Seismotectonics, Thermochronology, Fission tracks, orocline, Exhumation, Extensional post-orogenic collapse, paleostresses, Alpine geodynamics.