Geophysical Research Abstracts
Vol. 19, EGU2017-11277-1, 2017
EGU General Assembly 2017

Thermotectonic evolution of the North Pyrenean Agly Massif from hyperextension through inversion using multi-mineral thermochronometry

Margo Odlum and Daniel F. Stockli
The University of Texas at Austin, Austin, Texas, United States (modlum@utexas.edu)

Lower to upper crustal rocks exposed in the North Pyrenean Zone preserve the geological and tectonic record of Cretaceous rifting, Santonian inversion and Tertiary shortening associated with the Pyrenean orogeny. The Agly Massif is the easternmost basement massif with the North Pyrenean Zone and represents a tilted ∼10 km thick crustal section exposing upper to middle crustal metamorphic and magmatic rocks. The highest-grade gneisses and charnockites are found at the southern part of the massif with decreasing grade toward the north. Zircon, rutile and apatite U-Pb and zircon (U-Th)/He thermochronometry from samples collected along a crustal transect across the western Agly massif constrain the thermo-tectonic history of the eastern Iberian-European margin from extension through inversion and shortening. Zircon U-Pb ages record the crystallization ages of the granites and gneisses during the Late Paleozoic Variscan orogeny. Similarly apatite U-Pb ages from St. Arnac pluton in the northern part, emplaced at shallow crustal levels, show Late Carboniferous crystallization ages. In contrast, rutile and apatite U-Pb ages from granulites and charnockites in the southern part of the massif exhibit Aptian-Albian ages, suggesting that these lower structural levels of the massif were rapidly exhumed from mid to lower crustal levels during large-magnitude extension and continental break-up. These data are interpreted to document the rapid synrift exhumation along a major south-dipping extensional fault along the southern contact of the massif. While U-Pb data document the late Variscan and early Cretaceous extension tectonic phases, zircon (U-Th)/He ages from across the Agly massif are Late Cretaceous (Coniacian-Maastrichtian). These ages are interpreted to record cooling associated with subduction/underthrusting of Iberia beneath Europe and relaxation of the geothermal gradients and/or exhumation related to earliest Pyrenean orogenic inversion/shortening. Zircon (U-Th)/He ages in this range are not found in the central or western NPZ, either supporting models invoking earliest inversion and orogenic exhumation in the easternmost Pyrenees or suggesting that subsequent Tertiary shortening is of limited magnitude in the area. These new high- and low-temperature thermochronometric data support rapid syn-rift exhumation of crustal section exposed in the Agly Massif likely related to extreme crustal attenuation and possibly hyperextension. Structurally deeper parts of the massif resided at the middle to lower crustal levels from the Late Paleozoic until the Aptian-Albian when they was exhumed and cooled below 400°C during extreme crustal thinning associated with the rifting between Iberia and Europe. The St. Arnac pluton, in the upper portion of the massif, crystallized and remained in the upper crust, cooling below ∼180°C in the Campanian. The whole massif experienced cooling below ∼180°C in the Late Cretaceous associated with onset of convergence between Iberia and Europe. These new thermochronometric ages from the Agly Massif reveal the tectonic evolution of Early Cretaceous extension followed by Late Cretaceous inversion and Cenozoic shortening in the Pyrenees.