



## **Constraining the pre-Mesozoic crustal structure in the North Pyrenean realm (Aulus Basin, France): implications for the mode and style of Cretaceous rifting**

Riccardo Asti (1), Federico Rossetti (2), Federico Lucci (2), Marc Poujol (1), and Yves Lagabrielle (1)

(1) Univ Rennes, CNRS, Géosciences Rennes - UMR 6118, Rennes, France (riccardo.asti@univ-rennes1.fr), (2) Department of Sciences, Università degli Studi Roma Tre, Rome, Italy

The North Pyrenean Zone recorded lithospheric mantle exhumation and its local exposure to the seafloor during mid-Cretaceous rifting in response to the eastward drift of the Iberian plate. However, the pre-Cretaceous crustal configuration and the role of pre-Mesozoic (Variscan) thinning events remain unconstrained. With the aim to constrain the pre-Mesozoic crustal structure in the region, we carried out a comprehensive petrochronological study on the granitoid intrusions emplaced in the Hercynian granulitic envelope of the Lherz peridotite (Aulus Basin, France). Field work, meso- and micro-scale investigation, multiequilibrium thermobarometry and zircon and titanite U-(Th)-Pb geochronology were combined to define the P-T-t-deformation history of the granitoids, in the transition from magma emplacement to solid-state deformation. Magmatic mineralogy consists of Kfs + Pl1 + Qz + Amp1 + Bt and Ttn1 + Zrc as accessory minerals. The application of Al-in-Hbl barometry and Zr-in-Ttn1 thermometry models constrains magma emplacement at  $\sim 0.5$  GPa and  $\sim 780^\circ\text{C}$ . The tectonic fabric is attested by distributed and narrow (up to 25 cm wide), sub-vertical bands of S-(L) tectonites, developed during the sub-solidus mylonitisation of the granitoid. Ductile shearing was accompanied by Amp-Ttn-Pl recrystallization, which occurred at shallower crustal levels and temperatures compatible with the greenschist- facies metamorphic conditions ( $\sim 450\text{--}500^\circ\text{C}$  and  $P \leq 0.2$  GPa). The U-(Th)-Pb dating of the magmatic zircon clusters around  $\sim 280$  Ma, indicating that the Pyrenean continental crust was already significantly thinned during the Permian (Variscan) post-orogenic collapse. The U-(Th)-Pb dating of the REE-poor metamorphic (syn-shearing) titanite (Ttn2) grains constrains the activation of ductile shearing on the envelope of the Lherz peridotites around the Albian-Cenomanian boundary ( $\sim 100$  Ma). The major implication of this study is that the Pyrenean continental crust was already attenuated and the Hercynian metamorphic envelope of the Lherz peridotites resided at upper crustal levels in pre-Mesozoic times. We infer that the pre-Cretaceous crustal configuration was likely the result of a polyphase thinning, resulted from the cumulated effects of the Permian post-orogenic collapse and of the Triassic and Liassic aborted rifting events. The polyphase evolution unraveled by this study has major implications for the amount of stretching required during the Cretaceous Pyrenean rifting to exhume the lithospheric mantle and, more in general, for the long-term post-orogenic evolution of the Variscan domain around the Iberian plate.