

## **Thermal evolution of the north-Pyrenean granulitic crust: a combined petrological, geochronological and thermal study of the Saint-Barthelemy Massif**

Baptiste Lemirre (1), Stephanie Duchene (1), Muriel Gerbault (1), Michel de Saint Blanquat (1), and Marc Poujol (2)

(1) Geosciences Environnement Toulouse, OMP, Université Toulouse III, CNRS, IRD, Toulouse, France, (2) Geosciences Rennes, OSUR, Université de Rennes I, CNRS, Rennes, France

The Variscan orogeny is the result of an oceanic subduction followed by a continental collision that ended with a late-collisional high temperature – low pressure event at the scale of the whole orogen. The singularity of the Pyrenean segment is the predominance of this late high temperature event which is characterized by an intense deformation synchronous with the high temperature metamorphism and an abundant and varied magmatism.

The aim of this study is to determine pressure-temperature-time trajectories in the Saint Barthelemy Massif, and to discuss the origin of the geothermal gradients.

The Saint Barthelemy Massif is one of the granulitic north-Pyrenean massifs constituting the deepest relics of the Variscan crust. It is composed of two main units separated by a low angle detachment. The upper unit is composed of Paleozoic metasediments, micaschists, migmatites and small plutonic bodies and represents the Variscan upper crust. The basal unit, made of granulitic to amphibolitic gneisses, corresponds to the intermediate to lower crust. Pressure-temperature-time data indicate a homogeneous temperature of 800 °C at a depth between 10 and 20 km around 300 Ma (U-Pb dating on zircons and monazites from granulites and migmatites). This temperature of 800 °C corresponds to the dehydration melting of biotite as constrained by thermodynamic modelling. In the upper part of the crust, we observe a maximal gradient higher than 80 °C/km above 10 km depth. This high temperature metamorphic event, characteristic of the north-Pyrenean massifs, followed a magmatic episode at ca. 305 Ma in the whole Variscan Pyrenees. The magmatic-metamorphic succession, as well as the absence of significant crustal thickening in the Pyrenean segment of the Variscan belt, suggests a mantellic origin for the late-Variscan thermal anomaly. A one-dimensional thermal model of the crust is used to investigate the effect of buffering by latent heat of fusion and the effect of advection of melts in response to an abnormal basal heat source. The buffering of temperature at 800 °C in the lower to intermediate crust and a minimum advection rate of 2.5 km/Ma explain the shape of the geotherm with the extremally high gradient in the upper crust. We thus interpret the geotherm at 300 Ma as induced by crustal melting and melt migration from the lower to the upper crust.