



Magmatism and high temperature metamorphism of the pre-Pyrenean passive margins: datations and peak-temperatures from the North Pyrenean Zone

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Distal domains of present-day passive margins are inaccessible environments and little is known about the thermal regime undergone by passive margins during extreme continent thinning. Unlike the Alpine analog, the north Pyrenean domain did not undergo subduction, and the thermal pattern recorded in the pre- and syn-rift material has not been overprinted by major crustal overthrusts or subductions. Recent studies have shown that the northern flank of the Pyrenean belt, especially the Northern Pyrenean Zone, is an example of an inverted hot passive margin. Units in the North Pyrenean Zone resulting from the tectonic inversion of the pre-Pyrenean passive margins exhibit HT-LP metamorphic assemblages and coeval syn-extensional, ductile deformation.

In this study, we provide new Ar-Ar ages on amphibole and micas from metamorphic and magmatic rocks of the North Pyrenean Zone. We compare these ages with the dataset obtained so far for the Cretaceous metamorphism and magmatism in the North Pyrenean Zone and discuss their implications on the geological evolution of the Cretaceous Pyrenean paleomargins. Ages are ranging mainly from 110 to 90 Ma and westward or eastward propagation of the metamorphism and magmatism cannot be clearly identified. In contrast, it seems possible to emphasize a progressive propagation of the thermal anomaly from the base to the surface of the continental crust.

We also provide a map of HT-LP metamorphism based on a dataset of more than one hundred peak temperature estimates. We used the thermometric approach of Raman spectroscopy of the carbonaceous material (RSCM) on samples collected during the past five years. This dataset is completed by previous PT estimates based on mineralogical assemblages. Our results indicate a strong increase in peak-temperatures from West (<350°C) to East (>600°C).

Focusing on the key-localities of the Mauléon basin, Arguenos-Moncaup, Lherz, Boucheville and the Bas-Agly, we analyse, using the new thermometric data and datation, the thermal conditions prevailing during the Cretaceous crustal thinning. The results are synthetized into a series of regional thematic maps, and into two detailed maps of the Arguenos-Moncaup and Lherz areas. The results indicate a first order control of the thermal gradient by the intensity of crustal thinning. The highest grades of metamorphism are intimately associated with the regions where subcontinental mantle rocks have been unroofed or exhumed.