



## **Late Variscan evolution of the hot middle crust of the Pyrenees: the Aston and Hospitalet gneiss domes (France)**

**Y. Denèle** (1), Ph. Olivier (1), G. Gleizes(1), P. Barbey (2)

(1) LMTG - UMR 5563, Université de Toulouse, CNRS, IRD, OMP, 14 avenue E. Belin, F-31400 Toulouse, (2) CRPG-CNRS, Nancy-Université, BP 20, F-54501 Vandœuvre-lès-Nancy

The Variscan formations of the Pyrenees are characterized by an important plutonism and by gneiss domes surrounded by HT-LP metasediments (with gradients ca. 60°C/km). A new geochronological and structural study was performed on the orthogneiss and granite cores and on the Cambrian-Ordovician metapelitic country-rocks of the Aston and Hospitalet gneiss domes (Ariège, Pyrenees). U-Pb dating on zircons demonstrates that the orthogneisses correspond to a former Ordovician (469 ± 3 Ma) granitic laccolith, deformed under solid-state conditions during the Variscan orogeny and intruded by numerous sills of peraluminous granite, late Carboniferous in age (321 ± 7 Ma).

The Aston gneiss dome shows four main events as follows: (i) D1 deformation appears only as relics in the orthogneisses and their country-rocks located above the sillimanite isograd; it is characterized by a NS to NE-SW non coaxial stretch associated to top-to-the-south motions, attributed to a NS convergence. (ii) D2-a deformation appears in the orthogneisses and their country-rocks located below the sillimanite isograd, where the D1 structures are transposed, and in the peraluminous granites whatever their structural level; this deformation is characterized by an EW to N120° stretch associated to a top-to-the-east flat shearing attributed to lateral flow in the hot middle crust in a transpressive regime; during this event HT-LP metamorphism developed and numerous sills of peraluminous granite were emplaced. (iii) D2-b deformation is

characterized by EW-trending megafolds with horizontal axes in the middle crust and by EW-trending tight folds with subvertical axial planes in the metapelitic upper crust; by the end of this event large calc-alkaline plutons emplaced in this upper crust, the zones of magma transfer corresponding to openings in the orthogneisses favoured by the transpression. (iv) Subvertical MT mylonitic bands developed by the end of the transpression.

The orthogneisses and the peraluminous granites of the Hospitalet gneiss dome, systematically located below the sillimanite isograd, are characterized by the same events, with the exception of the D1 structures which have been completely transposed.

We propose a model of geodynamic evolution of the middle and upper crust of the Variscan Pyrenees considering the domes as a succession of megafolds formed in transpression. Our data invalidate previous models based on early or late extension to explain the development of the HT-LP metamorphism. Our model specifies the chronology and the relationships between the domes formation, the magmatism and the HT-LP metamorphism. The D2-a event of the Variscan Pyrenees appears as a good example of uncoupling between the cold upper crust and the middle crust overheated by a thermal event originated in the upper mantle. This uncoupling allowed the lateral flow of the migmatitic middle crust along a direction forming an important angle with respect to the more-or-less NS-trending direction of convergence. This new interpretation of the dynamics of the Variscan crust of the Pyrenees is consistent with recent studies conducted in Archean and Paleoproterozoic hot continental crusts having undergone an oblique compression, and characterized by a competition between vertical thickening and lateral flow induced by the important rheological contrast of two thermally different levels.