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Lateral flow of the middle crust in a transpressive regime: the Hospitalet Variscan thermal gneiss dome (Pyrenees, France)

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Gneiss domes are common in all exhumed orogens and their formation is considered to result from the combination of thermal and tectonic processes. These domes may occur in extensional, compressive or transcurrent regime. A transpressive regime may also favour dome formation especially in the case of a hot continental lithosphere.

The Variscan Pyrenees show several examples of highly metamorphic gneiss domes around which developed high temperature - low pressure (HT-LP) metamorphism. Between the domes, numerous calc-alkaline plutons were emplaced in polyphased low-grade country-rocks, in a transpressive regime at 305-312 Ma. There is a strong structural contrast between the gneissic core of the domes, showing subhorizontal foliations (= infrastructure corresponding to the middle crust), and the micaschist cover characterized by steep EW-trending foliations (= superstructure corresponding to the upper crust). The Hospitalet dome, one of the most studied of this range, corresponds to the eastern half of an EW-trending antiformal structure. It consists of an orthogneissic core intruded by peraluminous granitoids, and a Cambrian-Ordovician metapelitic cover. Calc-alkaline granitoids crop out on its southernmost part. Very different models (diapirism, late extension) were proposed to explain its formation.

A new structural and microstructural study of both the orthogneisses and the granitoids, with special care for kinematics, leads to the following succession of tectonic and magmatic events in a dextral transpression: (i) strong HT pervasive deformation corresponding to initially subhorizontal foliations and lineations, and associated with

a non-coaxial top-to-the-east kinematics; the peraluminous granitoids also suffered this deformation with HT solid-state microstructures; (ii) formation of a southward verging recumbent mega-fold; (iii) emplacement of calc-alkaline granitoids, on the southern border of this fold, showing a magmatic fabric oblique to the fabric of the orthogneisses; (iv) formation of middle temperature mylonitic bands, with a reverse dextral kinematics, located on the southern border of the dome, both in orthogneisses and granitoids.

We interpret the first deformation as a plurikilometre-thick, EW-trending, lateral flow of the middle crust due to the transpression, with an important uncoupling between the micaschist cover and the gneissic core. The subsequent stages were related to a continuum of deformation in the same dextral transpressive regime.

This allows a consistent model for the late Variscan deformation of both the upper and middle crust of the Pyrenees, in a unique stress regime, to be proposed. This new interpretation of the Variscan dynamics of the Pyrenees is comparable to the recent interpretation of Precambrian hot continental lithospheres submitted to oblique compression in which flat foliations and lateral flow developed. Hence, such structures do not appear to be specific to Precambrian lithospheres but may occur in more recent ones characterized by a high geotherm as observed in the late Variscan Pyrenees.