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Crustal melting triggering strain partitioning and crustal flow during continent collision. Clues from the tectono-thermal evolution of the Belledonne - Pelvoux Variscan massifs.

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Partial melting of continental crust is a strong weakening process controlling its rheological behavior and ductile flow of orogens.
The Variscan belt has been intensely studied as a key target to decipher the role of the partial melting on crustal flow phenomenon. In comparison, the Belledonne - Pelvoux massifs (French Western Alps) is as yet little documented while it exposes a beautiful section of the Variscan orogenic crust from low metamorphic upper crust to partially molten middle crust. This contribution summarizes the main results obtained from field based structural analyses, thermobarometrical estimations and geochronological works.
The Belledonne – Pelvoux area records five tectono-thermal events responsible for the building of this studied portion of the Variscan orogen. The first event (Dx) coeval with a MP-BT metamorphism occur at ca. 380 Ma that correspond to an earlier collisional event responsible of the eastward stacking of the Chamrousse ophiolitic unit. The D1 event corresponds to an eastward nappe stacking event occurring at ca. 350-330 Ma responsible of a MP-HT metamorphism up to partial melting at the base of the nappe pile. This early partial melting of the crust led to the emplacement of crustal-derived plutonic bodies. At ca. 320-300 Ma the D1 event moved progressively to a NW-SE directed shortening, in a sinistral transpressive regime recognized as the D2 event. It is characterized by folding and development of a subvertical S2 foliation. In the deep crust, where the partial melting is incipient, the steeply dipping S2 is reworked by vertical shear zones, defining a S-C-C' like finite strain pattern. This event is accompanied by the emplacement of numerous S-type granitoids. Contemporaneously with D2, a D3 event is responsible for the development of a S3 flat laying foliation that defines high-strain transition zone between the molten and the unmolten domain. Depending on structural level, the metamorphic conditions associated with D3 deformation range from partial melting conditions in the lower domain to subsolidus conditions above the D3 transition zone. We suggest that D2 and D3 deformation events were active at the same time, at ca. 305-300 Ma and resulted from strain partitioning on both sides of the anatectic front that may correspond to a major rheological boundary within the crust.
These last events, late-D2 - D3 are interpreted to be related to the lateral flow of the partially-molten crust during the late-variscan evolution. The proposed tectono-metamorphic evolution and crustal flow mechanism in the Belledonne-Pelvoux massifs is replaced at larger scale in the variscan orogeny with a comparison with the French Massif Central, Iberia and Bohemian Massif.