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PTtD evolution of continental crust during subduction-collision processes : example of the Briançonnais domain (Western Alps, France).

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Understanding exhumation processes of high to ultra-high pressure (HP to UHP) terrains during plate convergence is a major challenge for the comprehension of plate convergence processes and mountain building. Contemporaneous contraction and extension coupled with erosion are frequently proposed to drive the exhumation process. In the internal alpine belt, HP and UHP metamorphism are recorded both in the Piemont oceanic unit and in the continental units such as the Internal Crystalline Massifs and the Briançonnais zone.

In the western Alps, the consensus is to relate the top to NW then W directed D1 thrusting phase to nappe stacking and exhumation of the HP to UHP units within a subduction channel. Although there is an agreement on the occurrence of a top to the east D2 tectonic phase, its significance in terms of shortening or extensional deformation is controversial. On one hand, top to the east D2 shear zones and associated folds are interpreted as backthrusts or backfolds active during the Oligocene syn-collisional shortening phase, post-dating the exhumation of the HP units. On the other hand, D2 structures are interpreted as top the east normal faults that are active during the exhumation of the HP unit within a subduction channel.

To decipher between these two different interpretations, we conducted a combined structural, petrological and geochronological study of the Modane-Aussois area in order to build a PTtD path of the Briançonnais zone. The current construction of a high velocity railway tunnel between the Maurienne and Susa valleys provides the opportunity to gather a large amount of geological data in the internal Western Alps and to extend surface observation at depth. We provide a structural analysis on ductile and brittle domains. New PT estimates are obtained using pseudosection and multiequilibra methods. Ar/Ar step heating on phengite provide time constraint on tectonic phases. Then, in light of our data and available literature, we focus on the significance of the D2 structures in the internal Western Alps.

Results indicate that polyphased tectonic occurs during exhumation. The first deformation phase (D1) is characterized by nappe stacking in a context of top to the NW shearing, between 37 and 35 Ma deformation occurs between 1.0 and 0.5 GPa and 360-350°C. Top to the East deformation phase (D2) is associated with decompression up to 0.1 GPa and cooling down to 280°C. D2 deformations end at 31Ma. Following these phases of ductile deformation, two successive brittle deformation phases are evidenced: the first one is characterized by a N-S direction of extension and produce the overall tilting toward the south of the studied zone. The second one is characterized by E-W direction of extension.

In the Internal Alps, the transition between Oceanic-continental subduction and continental collision occurred at 32Ma. In this context, D1 deformations that are dated between 37 and 35 Ma are clearly related to continental subduction. In the same way, brittle deformation phases are the expression of continental collision. The D2 tectonic phase took place at the transition between subduction and collision. Its attribution to one of these two processes remains ambiguous and will be discussed at the light of these new results.