

New time constraints on Alpine brittle structures: coexistence of compressive and transtensive deformation since the Miocene.

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In the early 2000's, recording of extensional seismicity and faults in the internal domain of the western Alps have led to reconsider purely compressive models. Some authors have associated this "post-compressional" phase to the collapse of the alpine belt featured by the inversion of the Penninic Frontal Thrust (PFT). Now, major advances in direct U-Pb and (U-Th)/He dating methods, make it possible to date minerals like calcite or hematite allowing brittle deformation dating. In the Internal Alps, the initiation of transtensive deformation is expressed by the formation of the High-Durance Fault System (HDFS). In the Briançonnais zone close to the PFT, the HDFS activity has been constrained to 3.5-2.5 Ma by U-Pb calcite in fault cataclasite. Further ages have been obtained toward the East, ~5.5 Ma by U-Pb calcite (central briançonnais) and 12.7-8.4 Ma by (U-Th)/He on hematite (Clarée Fault activity). These new ages show that the extensional regime exists in the internal Alps since at least the middle Miocene.

To the West, the structuration of the Alpine foreland fold and thrust belt has been recently constrained in the subalpine massifs by U-Pb calcite on fault related structures. Several stages of deformation have been identified (from 15 Ma for the easternmost thrust to 8 Ma for the westernmost thrusts).

In sight of these new data, the activity of the extensive regime at the back of the PFT and the compressional propagation of the frontal part of the orogenic system are clearly contemporaneous. Moreover, both of these deformations are coherent with the thermochronological ages of the External Crystalline Massifs (ECMs). We propose that the ECMs exhumation, driven by crustal ramp structure, which propagates compressional deformation to the foreland sedimentary cover through a

decollement at the base of the sedimentary pile. In turn, the ECM uplift has led to the inversion of the PFT at its back. In other words, extension is not due to the collapse of the Alpine belt, but is a local accommodation of a still transpressional orogenic system.