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Reconciling late fracturing over the entire Alpine belt: from structural analysis to geochronological constrains

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Brittle deformations allow assessing the late stage of deformation of an orogenic chain. We reappraised the meaning of the late fracturing over the entire Alps in a global geodynamic context. The closure temperature of ZFT corresponds to the brittle-ductile transition in quartz. Therefore, ZFT ages are a proxy for the maximal age of brittle deformation. Combined analyses of ZFT ages with paleostresses data allow the comparison of the brittle deformations over the belt. In the Western Alps, paleostress indicate a major occurrence of orogen-paralell extension and associated strike-slip regimes (Champagnac et al. 2006; Sue et al. 2007 ; Sue and Tricart, 2003). Indeed, paleostress data show a rotation of the main $\sigma 3$ stress axes along the arc. Those structures are of Miocene age and are related to the propagation of the Alpine front toward the external zone. In the Central Alps, Paleostress fields are dominated by orogen-parrallel extensional regimes both in the Bergell area (Ciancaleoni and Marquer 2008) and the Lepontie dome (Allanic, 2012). In the Eastern Alps, the only area where ZFT ages are of Tertiary ages is the Tauern Window. The brittle deformation is here dominated by orogen-parallel extension at the eastern and western borders of the dome and by strike-slip faulting in the central parts (Bertrand et al., 2015), and inferred to be driven by the combined collapse and lateral escape of the orogenic wedge, due to indentation on the Adriatic indenter (Ratschbacher et al., 1991).
Major orogen-parallel extensional signal is closely linked with transcurrent deformation's component. It appears extremely stable all over the Alps and coeval with the propagation of the alpine front top the W-NW. Looking deeper, SKS splitting over the Alps [Qorbani et al., 2015] roughly indicates an orogen-parallel anisotropy pattern in the upper mantle. Indeed, the scheme of the SKS is very comparable with faulting data along-strike of the Alps. In this frame, we can compare both kinds of data, a priori disconnected, but which exhibit similar patterns. How about connecting deep processes in the upper alpine mantel, and its ductile flow, and upper crustal Miocene dynamics, as seen by brittle deformation? There is a very good correlation between the two pattern of deformation, related to two structural levels, the upper crust and the upper mantle, suggesting that the orogen-parallel extension could be an answer to lithospheric-scale processes. In this geodynamic model we may propose that the overall orogen-parallel Miocene extension observed in the upper crust of the internal Alps may be driven by mantel flow and slab retreat processes implying the Panonian slab to the East and the Apennine slab to the SW.

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