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# Late exhumation of the Alpine foreland (Digne nappe, France) constrained by low temperature thermochronology

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The frontal part of the southwestern Alpine belt is characterized by important compressional deformation marked by the emplacement of the Digne nappe and the formation of the Valavoire thrust-sheet. The final displacement of this nappe is dated Late Miocene thanks to continental molasses of the foreland basin, which are folded in its footwall and form the famous Vélodrôme recumbent syncline. The stratigraphic series of the Digne nappe is made of more than 5000 m thick Liassic to Eocene deposits a part of which overthrust the vélodrôme syncline. In order to quantify this overburden and the timing of the subsequent exhumation and erosion of the Valavoire thrust-sheet we performed a low temperature apatite fission tracks (AFT) and (U-Th)/He (AHe) study on the Tertiary molasses sampled at Faucon du Caire and Esclangon area in order to (i) characterize the thermal conditions during burial and exhumation (ii) and to propose a coherent evolution of the European foreland in the front of the Digne nappe. AHe and AFT data obtained on detrital grains present for Faucon du Caire and Esclangon molasses minimum ages ranging of 3-5 Ma. From these data we determine than the Faucon du Caire molasses have been totally reset for He system and whereas the Esclangon molasses have been only partially reset. Using QTQt inverse modeling and He damage codes (Gallagher et al., 2012), the thermal history results implied a burial at 90-100°C for the Esclangon molasses and >120°C for the Faucon du Caire molasses and a similar exhumation starting at 5.5±0.5 Ma. From these results, we conclude that the thermal conditions during burial associated with the Digne nappe thrusting were enough sufficient to reset the detrital apatites in Miocene sediments. This implies several kilometers of tectonic overload. Maximum burial occurred at ∼6 Ma ago, which precludes the occurrence of any Messinian incision overlain by the nappe in the Barles half-window as recently proposed (Hippolyte et al., 2011). This localized exhumation and erosion is related to large-wavelength anticlinal bending of the Barles area, which is coeval with the ultimate SSW-directed motion of the main part of the nappe. This thickening, which is compatible with outward propagation of deformation in the frontal part of the Alpine orogenic wedge, could be a consequence either of sedimentary cover stacking, and / or of deep-seated basement shortening.

References

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