New geo-thermochronometric constraints on the evolution of the Pyrenean-Provencal orogen

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The detrital content of a foreland basin can be seen as a material archive of the adjacent orogen. By compiling the thermochronological ages of this detrital content, one can theoretically estimate the long-term histories of cooling and exhumation of the mountain range.

In practice however, a lot of complications related to exhumation (variation in space and time), erosion (multiples sources of sediment), and deposition patterns (sediment recycling) will likely modulate significantly the thermochronological signal recorded by the foreland. In this work, we tried (1) to understand the circumstances in which the foreland basin's detrital thermochronological signal can be regarded as a trustful tool to estimate the cooling and exhumation histories of the orogen ; (2) to increase the quantity of information classically obtained from conventional thermochronological methods.

The first part of this work was to use forward numerical modelling to simulate bedrock and detrital cooling-ages in a geographic domain undergoing orogenic processes. The numerical model is based on Pecube code (Fortran solver for three-dimensional heat transport equation, Braun 2003) and Cascade code (Fortran routine to model landscape evolution, Braun and Sambridge, 1997).

The second part of our work was to conduct a geo-thermochronological study of the synorogenic deposits of the Pyreneo-Provencal foreland. We focused our study on two key areas : the Corbières region (East of the Aude Valley, North of the Mouthoumet Massif) in the Pyrenean domain ; the Eastern Provence (East of the Aix Fault, corresponding mainly to the Arc syncline). Samples include syn-orogenic deposits with deposition ages ranging from Late Cretaceous to Eocene. Zircons were chosen as the only thermochronometer, as we expected partial or total thermal resetting with lower temperature thermochronometers such as apatite. Detrital zircons were double dated using single-grain in-situ U/Pb & (U+Th+Sm)/He geo-thermochronometry based on laser ablation. This approach allows robust estimation of the detrital cooling-ages spectrum of a sample, and offers more information concerning the thermal history of dated minerals, since the coupled U/Pb & (U+Th+Sm)/He ages can be employed for provenance analysis. These newly acquired ages are integrated in a unified orogenic scenario related to the evolution of the linking zone between Pyrenean and Provencal domains.

Mots-Clés : Pyrenees ; Provence ; thermochronology

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