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New geo-thermochronometric constraints on the initiation and early phase of Pyrenean convergence from syn-orogenic sediments in the Corbières region, France

Julien Léger (1), Raphaël Pik (1), Mary Ford (1), Sébastien Ternois (1), Gianluca Frasca (1,2), Bouchaïb Tibari (1), Julien Mercadier (3), and Florimonde Lebel (4)

(1) CRPG, UMR 7358 - CNRS et Université de Lorraine, 54500 Vandoeuvre-lès-Nancy, France, (2) EOST - IPGS, UMR 7516 - CNRS et Université de Strasbourg, 67000 Strasbourg, France, (3) GeoRessources, UMR 7359 - CNRS et Université de Lorraine, 54500 Vandoeuvre-lès-Nancy, France, (4) Institut Jean Lamour, UMR 7198 - CNRS et Université de Lorraine, 54000 Nancy, France

Understanding the early exhumation history of a collisional orogen is an essential yet difficult goal. In the Pyrenees, early orogenesis (Late Cretaceous) is still poorly documented compared to the main, late collision (Eocene). Here we present in situ U-Pb and (U-Th)/He double dating data obtained for detrital zircons sampled from the Campano-Maastrichtian deposits of the Sub-Pyrenean Zone in the Corbières region, France. Our work aims (1) to unravel the early exhumation history of the Pyrenean orogen, and (2) to characterize the source area(s) which supplied syn-orogenic sediments to the eastern foreland basin.

We collected two sandstone samples, one from the Monplaisir locality (upper Campanian-lower Maastrichtian) and the other from the Boutenac locality (middle Campanian). For both samples, we successfully double-dated around 110 zircons. Meanwhile we compiled published single-grain U-Pb age data for igneous and detrital zircons from the Eastern Pyrenees (EP), the Southern French Massif Central (SFMC) and the Corsica-Sardinia block (CSB) in order to estimate the representative U-Pb age distributions of these potential source regions and to compare them to our individual samples' U-Pb signature. Both published and new U-Pb data were processed using Kernel Density Estimation (KDE) for the estimation of probability density functions (PDF). Our (U-Th)/He data were treated similarly.

Our results show multi-modal U-Pb and (U-Th)/He age distributions for both samples. The U-Pb age distribution of both samples is dominated by Ordovician ages centered around 470 Ma. Cambrian, Ediacaran and Cryogenian populations are also found. The younger sample yielded few Carboniferous zircons. Both sample (U-Th)/He age distributions are dominated by Permo-Triassic ages, with a small proportion of Carboniferous ages. Very few Early Cretaceous (U-Th)/He ages are found and constitute our youngest record of cooling, most likely related to the late Aptian-Albian rifting that occurred in the Pyrenees. Based on our current U-Pb compilation and provenance analysis, the samples' U-Pb signatures are not representative of any unique source. This suggests a sediment supply from several Paleozoic units (Carboniferous, Cambro-Ordovician). Our provenance analysis also reveals that both U-Pb age distributions have more affinity with a SFMC source than with a CSB source. Nevertheless, Early Cretaceous (U-Th)/He ages are not compatible with a SFMC source and, given available paleocurrent data, indicate the existence of an eastern source where thermally reset rifted crust was progressively unroofed. We note that our results, such as the absence of Late Cretaceous (U-Th)/He ages and the samples' U-Pb signatures, are similar to results for syn-orogenic sediments of about the same depositional age in the Rennes-les-Bains region, further southwest in the Sub-Pyrenean Zone (Ternois et al., this session). In this region, the authors show that Late Cretaceous (U-Th)/He ages are not recorded before the middle Maastrichtian. More (U-Th)/He data are needed to determine whether this early convergence signal is also recorded in the Corbières region, and will provide precious insights regarding the early exhumation history of the Eastern Pyrenees as well as the Western Mediterranean paleogeography.