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Controlling factors of spatial and temporal preservation of the geochronological signal in sediments during an orogenic cycle

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Detrital content of sediments preserved in basins provide constraints on the nature of source rocks, dynamics of sediment transport, and potentially on tectonics and climate changes. U-Pb dating method on detrital zircon is ideally suited for provenance studies due to the ability of U-Pb age data to resist several orogenic cycles. However, with the aim to track sediment source evolution over a single orogenic cycle and determine characteristic time and parameters controlling the geochronological signal preservation throughout the cycle from rifting, mountain building to post-collision evolution, low-temperature thermochronology combined with sediment petrography are more appropriate than the U-Pb dating approach taken alone.

To better understanding processes at play in the long-term geochronological signal preservation we focus on the sediment record associated with the Iberia plate tectonic evolution, which is part of the OROGEN research project, co-financed by BRGM, TOTAL & CNRS. The Iberian plate recorded a period of extension in the Late Jurassic, followed during the Early Cretaceous (Aptian-Albian) by a major thinning event documented by thick syn-rift sediments in intraplate basins and plate-scale heating/cooling of the Iberia crust, as argued by published fission track ages. Paleogeographic reconstructions that are based on stratigraphic and lithofacies analyses in northern Iberia (Iberian Range, Pyrenees and Basque-Cantabrians Range), describe a large domain of continental/fluvial and shallow-marine siliciclastic deposition. The related detrital content was then recycled during the subsequent Pyrenean orogenic phase in the Ebro foreland basin, and eventually transfer to the Mediterranean realm during post-orogenic re-excavation of the Ebro basin.

In this study, we complete the published time-temperature paths in the mesozoic syn-rift basins by providing new thermo-chronological analyses of well-dated syn-collision and post-collision stratigraphic sections of the Ebro basin to determine thermal control on preservation through burial and geothermal evolution. We combined this study with sediments petrography analyses to identify relative control of source petrography, hydraulic sorting, alteration and diagenesis processes on the signal preservation during sediment transfer. All these observations will ultimately be incorporated in a geodynamic reconstruction of Iberia, and compared with age predictions from a model coupling surface processes and thermal evolution.