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Do apatite fission-track peaks witness local or orogen-wide processes?

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Detrital thermochronology is generally used to reconstruct tectonic and erosional processes at the scale of the entire orogen (Garver et al., 1999). Comparison of apatite-fertility maps and thermochronological data from the European Alps (Malusà et al., 2016) and Taiwan orogens indicate instead that the detrital signal in these settings only reflects processes limited to surprisingly small areas.
Detrital signals, in fact, are determined by various controlling factors, including short-term erosion rate and fertility of the target mineral in eroded bedrock. Moreover, different grains of the same mineral may have different chemical composition, hence different durability to diagenesis and metamorphism, and - last but not least - propensity to be dated by radiometric methods (Malusà and Fitzgerald, 2019).
In the Po Plain sedimentary sink south of the Alps, the combined effect of apatite fertility and erosion rates determines a virtually-exclusive contribution of apatites with young cooling ages from the high-fertility Lepontine dome (Malusà et al., 2017).
In Taiwan, the same approach indicates that apatite contribution to river sediments is dominated by only a small area along the backbone of the orogen. Fast exhumation and low U concentration result in a great abundance of zero-track grains that, if ignored, lead to a misinterpretation of the location of erosional foci and to an underestimation of long-term erosion rates.

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