Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37466

Evaluating changes in erosion rate from pre- to post- Paleocene-Eocene Thermal Maximum in the Pyrenean Foreland Basin to test shifts in carbon flux

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Silicate weathering and associated erosion of orogenic systems are key mechanisms for long-term drawdown of atmospheric CO_2. These surface processes are intensified by increases in precipitation and seasonality during periods of global warming. However, the degree to which climatically-driven erosion is recorded and quantifiable in the sedimentary archive over geologic timescales remains poorly constrained.

The Paleocene-Eocene Thermal Maximum (PETM) is a relatively short-lived (< 200 ka from onset to rebound) and extreme Cenozoic carbon isotope excursion (CIE), analogous in magnitude to modern anthropogenic signals. Here, we use detrital apatite fission-track (AFT) and lag-time (cooling age - depositional age) analysis to calculate erosion rates in sandstone samples from the Tremp-Graus Basin in the Spanish (Ebro) foreland of the Pyrenees mountains. Applications of AFT are used conventionally to resolve exhumation on the scale of 10^6 – 10^7 years. Here we explore the use of AFT on much shorter timescales (10^5 years), to investigate climatic perturbations. We obtained 12 sandstone samples from the Esplugafreda section, which provides a continuous vertical profile through sediments from pre-, syn-, and post-CIE, and previously published high-fidelity $\delta^{13}C$, $\delta^{18}O$, and $\delta^{7}Li$ isotopic records. This section provides the ideal test for AFT as an erosion proxy during periods of global warming.

The working hypothesis is that a statistically significant shift towards shorter lag times occurs in syn- and post-CIE strata, which corresponds to an increase in erosion rates. The timing and magnitude of erosion rate increase will be compared with onset of silicate weathering derived from published physical and chemical weathering proxies to investigate whether these processes are decoupled. The development of quantitative erosion estimates from detrital AFT will help refine our understanding of atmospheric CO2 drawdown during major (paleo)climate events and provide insights for forward modelling parameterization.