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Fluvial system response to abrupt climate change: sedimentary record example of the Paleocene-Eocene Thermal Maximum (PETM) in the South-Pyrenean foreland basin, Spain

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The "Paleocene-Eocene Thermal Maximum" (PETM), is understood to be an extreme and short-lived (ca.150-220kya) global warming event that occurred 55.8 million years ago and during which global annual temperatures are estimated to have increased by ca. 5-8°C, with respect to sea surface temperatures and ca. 4-5°C, with respect to the deep sea. A remaining outstanding question is: in addition to the global increase in temperature, how was precipitation perturbed during the event, and how did fluvial surface processes respond to the perturbation?

In the southern Spanish Pyrenees, the Paleocene succession of the Tremp-Graus Basin is made up of the Talarn (Danian) and Esplugafreda (Thanetian) red bed formations. The Esplugafreda section is composed of approximately 250m of reddish paleosols and contains numerous lenticular bodies of calcareous conglomerates, which are interpreted as braided channels. The Esplugafreda Formation is overlain by the Claret Conglomerate—an extensive sheet-like unit which ranges in thickness between 1m and 4m of clast-supported calcareous conglomerate and pebbly calcarenites and is interpreted as marking the fluvial response to a dramatic climate change, in the form of the transformation of a braided river and floodplain system into an enormous conglomeratic braided plain (formed over at least 2000km2 conservatively) due to dramatic change in the hydrologic cycle. The conglomerate unit ends abruptly and is overlaid by fine-grained yellowish soils which are mainly made up of silty mudstones with abundant small size carbonate nodules suggesting another shift in the hydrological cycle after the PETM.

Here we present paleo-channel geometry and grain size data collected in the southern Pyrenees (Tremp, Aren, and Serraduy sections) that we invert to reconstruct paleoflow conditions during the Paleocene and during the Paleocene-Eocene Thermal Event. We confront paleohydraulic results with sea level, isotope and lithological records in order to understand river response to the PETM climate change and try to assess the possible precipitation perturbations at the PETM in the study area and how these are transferred into the sedimentary record.