

Did the PETM occur before or after the Claret Conglomerate (CC) at Campo (Spain)? New perspectives from high-resolution chemostratigraphy ($\delta^{13}\text{C}_{\text{org}}$, $\delta^{13}\text{C}_{\text{carb}}$ and $\delta^{18}\text{O}_{\text{carb}}$)

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Keywords: Campo, PETM, Spain, Isotopes, Nannofossils

Abstract

The Tremp-Graus and Basque-Cantabrian basins in northern Spain, expose several sections from continental to marine setting, encompassing the PETM (Paleocene-Eocene Thermal Maximum). The Campo section has remained a reference section because of 1) its transitional position, marine during the late Paleocene and early Eocene and continental across the Paleocene-Eocene boundary (PEB) and 2) the presence of two late Paleocene mammal levels, cropping out below the Claret Conglomerate (CC), at Tendrui and Claret respectively. The position of the PETM is still a matter of debate: previous studies on both organic material and bulk carbonate suggest that this event is located prior to the CC. We here present a high-resolution $\delta^{13}\text{C}_{\text{org}}$ study for the Campo section, spanning 14m of continental/proximal marine deposits, across the PEB. Through comparison of the carbon isotope profiles of organic matter ($\delta^{13}\text{C}_{\text{org}}$), bulk carbonate carbon and oxygen ($\delta^{13}\text{C}_{\text{carb}}$ and $\delta^{18}\text{O}_{\text{carb}}$), we were able to identify a typical CIE (Carbon Isotope Excursion) triangular profile: (1) the onset starts at ~1m (unit c; -24.4‰) or at 3.05m (unit c; -25.8‰), above the last limestone bed (unit a); (2) rapid CIE decrease to minimum value at 4.15m (unit c; -29.5‰); (3) continuation of the minimum values up to 5.60m, representing the core of the CIE (unit d; -29.3‰) and finally 4) the recovery phase up to 8.70m (unit e; -24.8‰). The magnitude of the CIE recorded for $\delta^{13}\text{C}_{\text{org}}$ is about 3.5 to 4.9‰, which is similar to previous studies at Campo (2.1-4.8‰). The CIE onset starts below the lateral equivalent of the Claret Conglomerate (between 5.90m and 8.80m). The upper section shows perturbations in the $\delta^{13}\text{C}_{\text{org}}$ that could be explained by incorporation of marine organic matter. The lower part of the section (below 3.05m) shows two successive negative shifts of the $\delta^{13}\text{C}_{\text{org}}$ record, respectively at 0.45m (unit b; -27.8‰) and 2.30m (unit c; -28.7‰). At least one of these small excursions, below the core of the CIE, is observed in numerous other PETM sections and is here highlighted for the first time in the Campo section. Carbonate and oxygen isotope values seem to be perturbed by carbonate diagenetic overprint resulting in anomalous $\delta^{13}\text{C}$ shifts. A high-resolution calcareous nannofossil investigation has been carried out, but the preliminary results are rather discouraging, because of the nearly complete absence of *in situ* specimens. Additionally, palynofacies and Rock-Eval data have also been performed to quantify the marine organic matter input in the sequence.