



## **Tracing oxygen variations and its biogeochemical expression during the late hauterivian Faraoni Event: A multi tracers approach using paired carbon, nitrogen, sulfur isotopes and trace metallic elements**

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During the Cretaceous, several occurrences of Oceanic Anoxic Event (OAE) are described in the sedimentary record. Among them, the late Hauterivian Faraoni Event has been extensively studied in several locations including Italy, Switzerland, France and Spain and interpreted as a short-lived OAE from palaeontological, sedimentological and geochemical observations. However, the biogeochemical response to water column oxygen depletion is poorly documented and mostly stands on carbon carbonates isotopes during the Faraoni event.

In order to bring further insights into the biogeochemical cycles modifications during O<sub>2</sub> variations across the Faraoni Event, we performed an integrated geochemical study including C, N and S isotopes together with paleo-redox tracers (i.e. trace metallic elements and iron speciation) on about 25 samples from the Río Argos section (S.E. Spain).

$\delta^{13}\text{C}_{\text{carb}}$  increases from 1.23‰ to 1.61‰ at the base of the studied section before the Faraoni event. Maximum values, ranging between 1.21‰ and 1.73‰ are observed within this event and are followed by a rapid decrease in  $\delta^{13}\text{C}_{\text{carb}}$  values down to 0.50‰ toward the top of the section.  $\delta^{13}\text{C}_{\text{org}}$  and TOC values show a narrow range of variations around  $-26.3 \pm 0.3$ ‰ and  $0.15 \pm 0.3$  wt.%, respectively. Only one sample records a higher TOC content up to 1.53 wt.% at the very base of the Faraoni Event while no sensible variations can be deduced from organic carbon isotopes. Bulk sediments nitrogen isotopes have a mean value of  $2.3 \pm 0.2$ ‰ and nitrogen contents vary between 320 and 790 ppm. A noticeable  $\delta^{15}\text{N}$  excursion (i.e. 0.86‰) is observed at the very base of the Faraoni Event and is associated with the highest TOC value. Sulfur contents vary between 100 and 2480 ppm, the highest content being recorded just below the base of the Faraoni Event.  $\delta^{34}\text{S}$  show a wide range of variations from -44.8 to -10.1‰ on a short scale without easily recognizable stratigraphic trend. Finally, slight increases of redox tracers (U, V and iron speciation: Fe<sup>HR</sup>/Fe<sup>T</sup> of 0.55) are only observed at the base of the Faraoni suggesting a local oxygen depletion leading to a short-lived pulse of anoxic and may be ferruginous conditions in the water column. Transient anoxic conditions at the onset of the Faraoni Event can be thus deduced from increasing preservation of organic matter and trace metallic elements. The negative  $\delta^{15}\text{N}$  excursion at the base of the Faraoni Event is consistent with increasing primary productivity and reducing conditions during this dysoxic to anoxic event. However, local controls during early diagenetic remineralization, probably within sedimentary pore fluid might have hidden the biogeochemical sulfur isotopes response to oxygen depletion in this environment.