A climatic change at the Danian/Selandian boundary: increasing weathering fluxes

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Abstract

The abandoned Loubieng quarry located close to Pau (France) encompasses the Danian/Selandian boundary (DSb). The Danian consists of an alternation of almost horizontally-bedded limestone layers and tiny marl intercalations. Marls with few thin limestone beds are observed in the Selandian. A very short-term hyperthermal event at the very base of the Selandian is marked by a short-term $\delta^{13}C_{org}$ negative excursion. This event is followed by a long-term cooling interval highlighted by a decoupled carbon isotope event (Storme et al., 2014). These events have been observed in three sections, which belong to the Atlantic (Zumaia and Loubieng) and the Tethys (Sidi Nasseur, Tunisia) realms. A detailed multi-proxy approach is under study on the Loubieng section aiming at unravelling how this cooling event does affect other proxies across the DSb. Clay mineral analyses by XRD reveal an assemblage dominated by smectite, illite, kaolinite and traces of mixed layers (illite-smectite). The amount of kaolinite increases during the Danian, reaching 15-20% at the end of the Danian, and decreases progressively during the basal Selandian. The smectite percentage increases inversely during the Selandian reaching 94 % ten meters above the DSb. The smectite/kaolinite ratio could highlight a change from warm climate with alternating wet and dry seasons in the Danian towards a warmer humid climate with heavy precipitations (rainfalls) before and across the DSb followed by a progressive return to dryer conditions upwards in the Selandian. The gamma-ray spectrometry highlights a progressive increase in K and Th contents from the Danian to the Selandian. The positive and good correlation between K and Th values suggests a primary detrital influx of fine-grained minerals. The input of detrital minerals seems to follow a rhythmic evolution during the Danian with a clear enhancement starting a few meters before the DSb towards the highest values in the Selandian. This enhanced detrital influx is also highlighted by the magnetic susceptibility data and represents an increased weathering input during the basal Selandian. The calculated proportions of U_{authig} and U_{det} reveal four intervals during the Danian where the proportions of U_{authig} are higher. The U/Th ratios indicate dysoxic to anoxic conditions during the three first intervals. The last interval and most of the section correspond to oxic conditions. These data reveal that the paleoredox conditions were only restricted at the base of the section.