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An orbital time scale of environmental perturbations across the Cretaceous – Paleogene boundary section of Nye Kløv (N. Denmark)

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The Cretaceous-Paleogene boundary (K-PgB) section of Nye Kløv, (N. Denmark) has been the subject of important past contributions for understanding of this mass extinction. Although it is less emblematic than the Stevns Klint section, due to its poor exposure in a farm field, this section presents many advantages. For instance, calcareous microfossils are well preserved, and none of the hardgrounds documented at Stevns Klint are observed there, thus arguing for better continuity. Here, we focus on environmental changes occurring across the K-PgB as documented from various, high-resolution geochemical analysis coupled with paleontological data. Bulk carbonate carbon and oxygen isotopes, elemental data from XRF, XRD mineralogical data, mercury content and rock-EVAL analysis provide a robust environmental framework. The late Maastrichtian Kjølby Gaard marl is an event of particular importance, characterized by the most negative values in oxygen isotopes and a transient mercury anomaly, suggesting a strong imprint of a latest Maastrichtian volcanic event and associated greenhouse warming. Oxygen isotopes delineate the end-Maastrichtian warming, followed by an end-Maastrichtian cooling and by a last pulse of warming immediately below the K-PgB. Moreover, oxygen isotopes show a well-pronounced orbital cyclicity throughout the section with strong influence of both precession and short-eccentricity that permit a detailed astronomical calibration of the K-Pg transition. Two early Danian mercury anomalies are found, one of which may be related to the Dan-C2 event. Altogether, our new data draw a precise timing of K-Pg environmental perturbations (volcanism and impact) and their effects in the Boreal Chalk Sea.