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Cyclostratigraphy of a type-Maastrichtian chalk record, based on high-resolution geochemical analysis of the Gulpen Formation, NE Belgium

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Cyclostratigraphic studies on carbonate successions have proved invaluable for understanding palaeoclimate and for constructing improved, high-resolution age models of the Late Cretaceous. Whereas carbonate strata from the type-Maastrichtian from the Netherlands and Belgium have provided a wealth of palaeontological data, so far, dating of these deposits has relied mainly on biostratigraphy and preliminary attempts at cyclostratigraphy. The existing basic cyclostratigraphic framework is based principally on apparent cyclic variations in bioclast composition and suggested Milankovitch-paced flint cycles. Until now, these strata have not yet been examined using a cyclostratigraphic approach based on high-resolution multi-proxy geochemical data sets. Within the scope of the Maastrichtian Geoheritage Project, we attempt to construct an improved astrochronological age model for Maastrichtian chalk deposits of the Gulpen Formation.

We have carried out a high-resolution elemental composition analysis of the Lower to Middle Maastrichtian chalk succession exposed at the Hallembaye (Kreco) quarry, NE Belgium. Approximately 460 chalk samples were collected every 5 cm over a 23-metre-thick stratigraphic interval and analysed as homogenised powders using micro X-ray fluorescence. This extensive elemental data set is used to evaluate (regular) changes in palaeoenvironmental conditions over time. Additionally, stratigraphic comparison of variations in elemental concentrations in the chalk with the occurrence of flint layers provides insights into potential diagenetic alterations.

Preliminary results display promising trends with potential for the development of a cyclostratigraphic age model for the Gulpen Formation. Significant correlation between the main matrix elements calcium and silica might suggest a relationship between silica-depleted chalk and occurring flint layers throughout the chalk succession. Additionally, observed rhythmic variations in elements including - but not limited to - titanium, aluminium and potassium might exemplify changing palaeoenvironmental conditions. This improved astrochronological age model can be

compared with age-equivalent astrochronologies and will, in combination with ongoing carbon isotope stratigraphy work, enable a better dating of the geological and biological records from the type-Maastrichtian.