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The base of the Campanian: a magnetostratigraphic definition, integrated biostratigraphy and isotope stratigraphy

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The base of the Campanian, the longest stage of the Late Cretaceous, is still not defined by a GSSP (Global Boundary Stratotype Section and Point). Furthermore, no consensus exists about the boundary criterion: macrofossils like ammonites and inoceramids suffer from bioprovincialism. The LAD of the crinoid Marsupites testudinarius was proposed as the primary fossil marker. But this marker is mainly a chalk facies fossil, which is rare to absent in pelagic low-latitudes, absent in oceanic sections, and the LAD may be influenced by palaeoenvironmental and palaecological settings. More recently, a boundary defined by magnetostratigraphy, i.e. the base of Chron C33r after the Long Cretaceous Normal Chron C34n, has been discussed.

Western Tethyan pelagic sections from Austria and Turkey provide means for integrating various stratigraphic methods. A robust magnetostratigraphic signal was found at the Postalm section (Gosau Group, Northern Calcareous Alps, Austria) which may serve as a reference section for the northwestern Tethys. Including nearby complementary sections, palaeomagnetic data can be integrated with strontium isotope stratigraphy and stable isotope data, planktonic foraminifera and calcareous nannoplankton biostratigraphy, , and ammonite, crinoid and inoceramid data. The Postalm section shows a deepening trend from upper Santonian conglomerates and grey shelf marls to pelagic bathyal red marly limestones of Campanian age. Palaeomagnetic data allow identifying the top of Chron C34n and the following reversal in the lower part of the red marly limestones. A 1 m-thick interval of high magnetic susceptibility is present at the end of C34n. Two of the main suggested biomarkers to pinpoint the Santonian-Campanian boundary, i.e. the last occurrence of the planktonic foraminifer Dicarinella asymetrica and the first occurrence of the nannofossil Broinsonia parca parca, occur in close proximity to the reversal, which is suggested herein as the primary marker event for the base of the Campanian. Strontium isotope stratigraphy indicates a value of 0.707534. Both carbon and oxygen isotope values show a negative excursion just below the boundary. The positive Santonian-Campanian boundary carbon isotope event (SCBE) starts probably just at the boundary level. This interval is considered to correspond to a short sea-level high in the late Santonian followed by a lowstand at the Santonian-Campanian boundary. Macrofossil data from the nearby Schattau section indicate the late Santonian Paraplanum ammonite Subzone, the presence of the crinoid Marsupites laevigatus and inoceramids, e.g. Cordiceramus muelleri muelleri, below the boundary as defined by magnetostratigraphy.

Sections from the western Tethyan Mudurnu-Göynük basin (NW Turkey) provide similar evidence for the Santonian-Campanian boundary interval. Near Göynük town, a reversal of the magnetic polarity was identified to represent the base of C33r within a pelagic section. Biostratigraphic data suggest an age from the late Santonian Dicarinella asymetrica to the early Campanian Globotruncanita elevata planktonic foraminifera zone, and nannofossil zones UC13-CC14. Results from the assessment of field magnetic susceptibility give evidence for Milankovitch cycles, presumably the 405 ka eccentricity cycle.