



## A new reverse subchron (C33n.1r) in the Campanian: astronomical duration estimate and geomagnetic/chronostratigraphic implications

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The Cretaceous Normal Polarity Superchron (CNPS, chron C34n, Aptian–Santonian, ~83–118 Ma in CK95 GPTS) is followed in the Campanian by two relatively long chrons (chron C33r, 3.925 My duration and then the normal chron C33n, 5.456 My duration) straddling most of the Campanian stage. The analysis of the geomagnetic reversal history has classically determined two nearly linear segments for the late Cretaceous–Cenozoic interval divided at chron C12r. The length of chrons in the younger interval has no systematic trend and henceforth is considered stationary for statistical analysis with a mean chron length of 0.248–0.219 My while the older segment has 0.749 My mean chron length. The stationarity for this latter interval is attained, however, when the two long polarity chrons C33r and C33n adjacent to the CNPS are omitted. Studies in the weakly magnetized southern England chalk succession and marine Bearpaw Shale in the Canadian Rockies from Alberta have argued about the presence of a number of reversals within C33r and C33n (and C34n). However, all these remain ambiguously established and not incorporated in the standard GPTS despite their significance for theories of geodynamo behavior and potentiality for high-resolution stratigraphic correlations that could notably impact, for instance, the chronostratigraphy of dinosaur-bearing terrestrial Upper Cretaceous of the Western Interior of North America. In any case, no polarity subchrons within C33r or C33n have been reported in any deep-sea record or in the landmark pelagic “scaglia” sections from the Gubbio area in the central Italian Apennines, for which a good integrated biostratigraphy and a thorough paleomagnetic record exists.

Here, we report on a new reverse subchron in the lower part of C33n, informally named the Postalm Fall Subchron (PFS), retrieved in the Postalm section (Gosau Group, Northern Calcareous Alps of Austria). The Postalm section shows a deepening trend from upper Santonian conglomerates and grey shelf marls to pelagic bathyal red marly limestones of Campanian age. The section has previously been studied in the frame of an integrated multi-proxy stratigraphic study that includes high-resolution calcareous plankton biostratigraphy, magnetostratigraphy, stable isotopes, strontium stratigraphy and Fe content. Robust paleomagnetic data has pinpointed the top of C34n that defines the Santonian–Campanian boundary together with key biostratigraphic markers in the lower part of the red unit. The integrated study extends upwards for about 170 m up to calcareous nannofossil zone UC16 in chron C32 in the late Campanian. The

cyclic nature of the pelagic sequence has been studied by means of spectral analysis on the limestone/marl couplet thickness data and geochemical proxies that allows identifying the short and long eccentricity cycles and to establish a cyclostratigraphic framework. From 33 new tightly collected samples in this study, 23 display unambiguous reverse polarity and conform the PFS subchron that straddles 3–4 precession cycles (~70 ky duration) within the UC15b calcareous nannofossil biozone. The average sediment accumulation rate at Postalm (~2 cm/ky compared to ~0.6–1 cm/ky at Gubbio) and the high-quality paleomagnetic signal have favored this discovery. The absolute age calibration and related geomagnetic and chronostratigraphic implications would be discussed.