

A Magnetostratigraphy for the Upper Tuchengzi and Lower Yixian Formations of North China

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The Tuchengzi formation in North China nominally spans nearly 20 million years of the Late Jurassic and Early Cretaceous, an interval during which age calibration of the Geomagnetic Polarity Time Scale (GPTS) based on seafloor magnetic anomalies is poorly known. The overlying Yixian formation is of special paleontological interest due to an abundance of spectacularly preserved macrofossils of feathered non-avian dinosaurs, birds, mammals, and insects. Scarce fossils in the Tuchengzi, sparse accurate radiometric dates on both the Tuchengzi and overlying Yixian formation, and scant previous paleomagnetic studies on these formations motivated our application of magnetostratigraphy as a geochronological tool. We constructed a geomagnetic reversal sequence from the upper 142m of a 200m core extracted in Liaoning Province at Huangbanjigou spanning the lower Yixian Formation and the unconformably underlying Tuchengzi Formation. Thermal demagnetization up to 680°C in steps of 25-50°C revealed predominantly normal overprints consistent with the modern day field with unblocking temperatures between 125°C and as high as 550°C, as well as normal and reverse characteristic components with unblocking temperatures between 500°C and 680°C. Going up from the base of the core, there is a reverse polarity magnetozone >6m thick, followed by a 5m normal magnetozone, a 10m reverse magnetozone, a 25m normal magnetozone, and a 6m reverse magnetozone truncated by the Yixian-Tuchengzi unconformity. Above the unconformity, all 81m of core were normal. These results indicate that a meaningful polarity stratigraphy can be recovered from the Tuchengzi and Yixian formations that will be invaluable for correlations across the Tuchengzi and potentially the Yixian formations, which span thousands of square kilometers and vary in thickness by many hundreds of meters. The results also demonstrate that, in combination with accurate and precise radiometric dates, the Tuchengzi Formation has the potential to provide tight constraints on presently poorly constrained Late Jurassic and Early Cretaceous parts of the GPTS and provide an independent reversal time scale by which seafloor-anomaly based time scales can be refined.