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Terrestrial astronomical age model for Eocene Thermal Maximum 2 and H2 hyperthermal events

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Knowledge of the duration and the rates of onset and recovery of early Paleogene hyperthermal events is crucial for understanding Earth's system response to massive input of greenhouse gases into the exogenic carbon pool. The second largest hyperthermal, Eocene Thermal Maximum 2 (ETM2), and its immediate successor H2 occur around 54 million years ago. Relative chronologies have been constructed for ETM2 and H2 in deep-sea records at Walvis Ridge in the southern Atlantic Ocean (Stap et al. 2009). Here, we construct an independent astronomical age model for these hyperthermals in terrestrial successions in the Bighorn Basin, Wyoming (Abels et al. 2012).

We first generated parallel carbon isotope records of the ETM2-H2 interval in the Creek Star Hill, West Branch, and Purple Butte sections located between 1 and 3 km of the previously analyzed Upper Deer Creek (UDC) section. The carbon isotope patterns in the three new sections mimic both in time and magnitude the ETM2-H2 carbon isotope patterns from the UDC section. This confirms the reproducibility of the carbon isotope time series in these floodplain successions. The four sections were subsequently correlated by lateral tracing of distinctive paleosol horizons representing time lines at the sub-precession time scale. The correlation was confirmed by overbank-avulsion sedimentation cycles coevally occurring in the four sections. The constructed stratigraphic fence panel allows disentangling local fluvial variability in sedimentation from the regional signal. Coeval overbank-avulsion cyclicity at the precession time scale (Abels et al. 2013) are then used to construct an astronomical age model for the ETM2-H2 hyperthermal events.

References

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