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High-precision geochronology of lower Paleocene fluvial sediments in eastern Montana (USA): implications for geologic time scale calibration and orbital climate forcing control on fluvial sedimentation

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High-precision geochronology in terrestrial fluvial sections is pivotal to understand timing and mechanisms of geological processes that act on both regional and global scale. Moreover, the development of a detailed geochronological time frame is crucial for a robust calibration of the Geomagnetic Polarity Time Scale (GPTS), which allows accurate correlations between the marine and terrestrial realm. The well-exposed outcrops of fluvial sediments of the Tullock and Lebo Members of the Fort Union Formation outcropping in the Western Interior Williston Basin of eastern Montana (USA) represent an ideal setting to establish a robust chronostratigraphic framework for the early Paleocene. This succession, preserving a reliable paleomagnetic signal [e.g. 1], consists mainly of sandstones and siltstones interbedded with lignite seams. The coal beds are traceable over distances of kilometers and contain multiple volcanic ash layers (tephras) suitable for radio-isotopic dating.
Here, we present new high-precision 40Ar/39Ar radio-isotopic ages of single and multiple sanidine grains separated from tephra samples, collected at several locations in eastern Montana. Integration of the radio-isotopic ages with existing litho- and magnetostratigraphic record provides a high-resolution time frame for the early Paleocene. Magnetostratigraphic records reveal the presence of polarity reversals comprised between Chron C29r and C28n, consistent among different sections. In this study, 40Ar/39Ar geochronology provides new absolute age constraints for these polarity reversals and the associated Chron durations, allowing the re-calibration of the GPTS. Moreover, the high-precision geochronology provides additional age control for testing the role of orbital forcing in controlling the fluvial sedimentation, as suggested by Noorbergen et al. [2].

References:

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