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'American West Tephras – Geomagnetic Polarity Events Redefined through Calibration of Radio-Isotopic and Astronomical Time'

The foundation of the EARTHTIME/GTSnext initiative seeks to construct an internally consistent geologic timescale based on astronomical and radio-isotopic geochronology. American west tephras offer a prime opportunity to integrate these two independent timescales with the geomagnetic timescale. Using an astronomically calibrated age for the monitor mineral Fish Canyon sanidine (FCs; 28.201 ± 0.046 Ma, Kuiper, et al., 2008), ages of Pleistocene geomagnetic polarity events are re-examined.

Of particular interest, the Quaternary mineral dating standard Alder Creek sandine (ACs) is the type locality for the Cobb Mountain geomagnetic event. New single-crystal analyses, performed on a Noblesse multi-collector noble gas mass spectrometer, suggest a refined $^{40}Ar/^{39}Ar$ age for ACs, with precision nearing the ambitious 0.1% goal of the EARTHTIME project. Moreover, this new ACs age is consistent with the astronomical age of the Cobb Mountain event, independently determined through correlation of oxygen isotopes in a piston core (Horng, et al. 2002).

Two other ash flows in the American west were analyzed: the Bishop and the Huckleberry Ridge Tuffs. Multi-crystal sanidine experiments of the Bishop Tuff provide an astronomically relative $^{40}Ar/^{39}Ar$ age for the eruption and associated Matuyama/Brunhes magnetic polarity transition. Single-crystal astronomically relative $^{40}Ar/^{39}Ar$ ages for the Huckleberry Ridge Tuff are indistinguishable from previously determined ages, and provide a degree of confidence in the astronomical calibration. Although this geomagnetic event is not part of the most recent geologic timescale, refined ages on short-lived excursions could hold importance to understanding time scales for the wavering nature of Earth's magnetic field.

We propose a new $^{40}Ar/^{39}Ar$ age for the Quaternary mineral dating standard ACs that reflects the astronomical calibration of FCs and age of the Cobb Mountain polarity event. It is suggested that this $^{40}Ar/^{39}Ar$ age replace that of Renne, et al. (1998) when using ACs as the monitor in argon age determinations.

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