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Revisiting the Mono Lake Excursion Type Section with High-Resolution Paleomagnetic Records

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The Wilson Creek Formation, exposed around Mono Lake in east-central California, is comprised of interbedded lacustrine sediments and tephra that were deposited during higher stands of Mono Lake (Lake Russell) in the late Pleistocene. A prominent paleomagnetic excursion recorded in this formation led to the recognition and naming of the ~33 ka Mono Lake geomagnetic excursion (MLE). However, recent direct radiometric dating of key tephra layers bracketing this event have shown that this excursion is instead the Laschamps geomagnetic excursion (~41 ka). This has prompted a recommendation (e.g., Laj et al., 2014) that the MLE be renamed the "Auckland excursion," based on a reliably dated and well-documented paleomagnetic record for a ~33 ka excursion in New Zealand, casting doubt on the presence of the MLE at its namesake site.

Nevertheless, close inspection of paleomagnetic profiles from two pioneering studies suggest that there may be a second, less prominent, paleomagnetic anomaly above the Laschamps. The striking lateral continuity of the Wilson Creek Formation and its prominent tephra layers facilitates the identification and resampling of the intervals of interest. We carried out high-resolution paleomagnetic sampling of three trenches bracketed by key dated tephra, focussing on the interval between Ash 8 (~34 ka) and Ash 7 (~26 ka), the location of the potential second anomaly, with one trench extending below Ash 15 (~42 ka) to capture the Laschamps excursion. Thermal demagnetization revealed that the lacustrine sediments of Mono Lake are excellent paleomagnetic recorders, with well-behaved remanence directions. Below Ash 15, the sediments contain a sharp and well-defined excursion consistent with the Laschamps excursion. Most significantly, all the trenches reveal a coherent pattern of significantly reduced inclinations between Ashes 8 and 7, with values dipping below 20° without full polarity reversal. This pattern, present in all three trenches, is defined by a double-dip inclination structure and westward-shifting declinations. These findings show that while the original excursion identified at Mono Lake is instead the Laschamps excursion, the MLE is indeed recorded at Mono Lake with an age of ~33 ka consistent with current estimates. Moreover, the enhanced resolution afforded by high sedimentation rates may be capturing previously underappreciated complexity in the geomagnetic field behavior during this excursion.