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Evolution of terrestrial climate and vegetation through the Mid Pleistocene Transition: A ~1.5 Ma record from Stoneman Lake, Arizona, USA

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Long continuous cores of lake sediments provide enormous potential for interpreting paleoenvironmental history in the North American Southwest, where few such records have been analyzed. Our research group has performed preliminary analyses from two long sediment cores, drilled in 2014, from Stoneman Lake, Arizona, USA, totaling ~73m of record. The centerpiece of our project is its innovative and collaborative approach, blending expertise in sedimentology, paleoclimatology, paleoecology, geochronology, magnetostratigraphy, stable isotopic geochemistry, organic geochemistry, scanning XRF geochemistry, sediment biochemistry, hyperspectral analysis and climate modeling. Initial Core Description (ICD) data were collected at NSFs LacCore facility. Initial sedimentary, pollen and chronologic data suggest that this record may be unique in North America. Stoneman Lake sediments record continuous paleoenvironmental change in the Southwest for the last ~1.5 Ma, covering at least 20 glacial/interglacial cycles, spanning beyond the Mid Pleistocene Transition (MPT). The MPT occurs roughly in the 27 m – 43 m section of the Stoneman Lake core, bounded by the Lava Creek B ash (~0.631 Ma) and an Upper Glass Mountain ash (~0.9-1.0 Ma). Magnetostratigraphy documents a normal to reverse polarity event that likely reflects the Brunhes - Matuyama polarity chron (781 ± 3 ka) along with several short reversals and several failed reversals. Seven basic facies are recognized, palustrine, shallow lacustrine, deep lacustrine, debris flow, fan delta, volcaniclastic and desiccation facies. Repeated alternations occur between glacial laminated facies and interglacial massive/bioturbated sections, particularly in the most recent ~1 Ma, suggesting cooler, stronger glacial intervals during and since the MPT. Initial pollen data support the stratigraphic interpretations, with greater concentrations of boreal pollen types within MPT and younger age glacial sediments than prior to the MPT. Sections interpreted as “glacial” generally include higher Picea (spruce), Abies (fir), Pseudotsuga (Douglas-fir) and Pinus flexilis (SW white pine), often with pelagic algae such as Pediastrum. Combinations of lower elevation pollen types, including Juniperus (juniper), Pinus edulis (pinyon pine), Atriplex (saltbush) etc., are concentrated during periods we interpret as interglacials. Many of these units also contain Pinus ponderosa (ponderosa pine) pollen, which dominates forests near the lake today. However, the Stoneman Lake pollen data strongly suggest that vegetation response to individual glacial/interglacial cycles has varied, perhaps due to the strength of climatic conditions through time. Collectively, the diverse data sets from the Stoneman Lake core provide a well-constrained chronology and paleoterrestrial climate record for the Southwest since the early Pleistocene.