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A Lacustrine Record of Postglacial Dust Deposition from the Uinta Mountains, Utah, USA

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Samplers deployed in 2011 reveal a modern dust flux to the alpine zone (>3000 m asl) of the Uinta Mountains (Utah, USA) of ∼4 gm/m^2/yr. A notably uniform layer of silt, ∼20 cm thick, in soil profiles from throughout the alpine zone, along with the presence in soils and modern dust of minerals not found in the bedrock, indicates that dust deposition has been an important long-term process in this environment. To evaluate how dust flux and properties have changed over the postglacial period a 190 cm-long lacustrine sediment core was analyzed. The core was collected with a percussion corer from a small lake (8 ha) at an elevation of 3043 m asl in 10.6 m of water. Six AMS ^{14}C analyses on conifer needles, wood fragments, and bulk sediment support a depth-age model extending back to 12.7 ka BP. Loose near-surface sediment was not recovered, so the top of the core is truncated at 1.36 ka BP. Geochemical composition was evaluated at 2-cm intervals using ICP-AES after fluxing of ignited samples with $LiBO_2$. The abundance of rare earth elements was determined for a subset of 16 samples using ICP-MS. Mineralogy was investigated at 2-cm intervals using XRD. Grain size distribution, organic matter content, and C:N ratio were determined at 1-cm intervals using laser scattering, loss-on-ignition, and an elemental analyzer, respectively. Results indicate that the flux and properties of dust arriving in the Uinta Mountains have varied over time, with the most significant variations occurring between 6.5 and 4.5 ka BP. During that time ratios of Zr/Al, Ti/Al and (Ca+Mg)/Fe rise to record-high values, and the abundance of Illite+Chlorite increases relative to feldspar. Prominent shifts occur in the abundances of some trace elements, such as Sc, along with changes in median grain size. The ratio La/Lu, as well as the magnitude of the Eu anomaly, also change. Collectively these fluctuations are consistent with a greater flux of dust to the Uinta Mountains, as well as a possible change in the composition of this dust, during the Middle Holocene. This result is notable because of evidence of drought at this time in other paleoclimate records from the region, including evidence of low water levels in Bear Lake and Lake Tahoe. Other shorter intervals of low water level during the late Holocene at Bear Lake also appear to correspond with proxies of increased dust delivery to the Uintas.