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A multi-proxy approach to reconstruct hydrological changes and Holocene climate development of Nam Co, Central Tibet

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In order to assess the impact of human activities on climate dynamics in Monsoon Asia it is essential to initially understand and evaluate the natural variability of the hydrological cycle being mainly controlled by monsoonal precipitation, meltwater production and the balance between precipitation and evapotranspiration. Thus, Holocene lake level fluctuations and related Asian Monsoon strength variations were reconstructed from a 2.7 m lacustrine sequence of a long sediment core from Nam Co, Central Tibet, China dating back more than 7.2 cal. ka BP.

The variations of environmental proxies including grain size, major elements, biomarker stable isotopes and minerals in the core suggest a climate evolution in at least five depositional units and subunits. Sediments in *Unit I* ($\sim$7.2 to $\sim$5.8 cal ka BP) are assumed to be deposited at highest lake levels with regards to the analyzed sediment sequence. Increased amount of allogenic minerals and allochthonous organic matter suggest high precipitation and melt water input and imply a positive water balance. Continuous increasing aquatic productivity points to favorable environmental conditions. *Unit II* ($\sim$5.8 to $\sim$4.2 cal ka BP) is the transition between these favorable and stable hydrological conditions and the onset of lake level decrease. Within this unit two remarkably drier periods with increased evaporation occurred around 5.75 cal ka

BP and around 4.75 cal ka BP that lead to significant enrichment of lake water δD values. Significant lower lake levels as consequence of a dryer climate with less monsoonal precipitation, higher evaporation rates and increased moisture recycling in the catchment are reflected in the sediments of *Unit III* ($\sim$4.2 to $\sim$1.75 cal ka BP). Most pronounced dry periods are recorded around 3.75 cal ka BP and 2 cal ka BP again leading to deuterium enrichment of aquatic n-alkanes. The proceeding lake shrinkage and salinization was interrupted in the first section of *Unit IV* ($\sim$1.75 to $\sim$800 cal years BP to $\sim$400 cal years BP) where a continuous increase in precipitation and runoff led to an at least stable but still low lake level. Increased grazing and cultivation possibly resulted in a decrease of lake water pH. The most recent *Unit V* (since 400 cal years BP) is characterized by progressing lake shrinkage due to intensive evaporation. Intermittent monsoonal precipitation events are reflected by large fluctuations in the geochemical parameters referring to alternating humid and arid periods at Nam Co. Actual hydrological parameter indicate that lake level is rising most recently. Correlation with other lake records from the Tibetan Plateau suggests an overall agreement with the broader picture of Holocene environmental evolution. In addition, the timing of dry and wet climate conditions at various lakes across Tibet including the Nam Co record indicates the gradual decreasing influence of the southern monsoons during the Holocene along a NW to SE transect. Inconsistencies still exist concerning reliable chronologies. Thus, further research is needed to improve the spatiotemporal interpretation of hydrological variations in association with alternating monsoonal circulation across the Asian continent.