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A 30,000 year climate archive from Lake Karakul, Pamir, Tajikistan

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The goal of this study is to deepen the understanding of past changes in the Pamir, a climate sensitive region located at the boundary of large scale atmospheric circulation systems, of which no pre-Holocene records exist so far. A ca. 10 m sediment core with a basal age of ca. 30 ka BP was drilled at Lake Karakul (Tajikistan), a large closed brackish lake situated in a tectonic basin at an altitude of 3,928 m. The lake catchment may be classified as alpine steppe to alpine desert with mean annual temperature and precipitation of ca. -3.9 °C and 82 mm, respectively. We applied a multi-proxy approach which combines inorganic and organic geochemical parameters. Total organic carbon contents and organic biomarker concentrations are low during the glacial and rapidly increase to Holocene levels between ca. 14 and 11 ka BP. Biomarker fingerprints of aliphatic compounds are mostly dominated by mid-chain n-alkanes with δ13C values up to -14‰ which suggest a primarily aquatic origin. Terrestrial long-chain n-alkanes are mainly abundant during the late glacial to Holocene transition, possibly introduced by enhanced meltwater input during deglaciation. δ13C and δ18O values of authigenic carbonates show synchronous trends throughout the whole record. In contrast non-synchronous downcore trends between δ18O on carbonates and δD values measured on aquatic leaf wax-biomarkers (nC23) were observed despite similar water sources (lake water). The hydrogen isotopic variability of nC23 is ca. 50‰ with gradual depletion from 19 to 10 ka BP and episodes of strong enrichment at ca. 29-30, 24-25 and 15-16 ka BP. This indicates shifts in atmospheric circulation dynamics, origin of water vapour as well as source water for lipid synthesis (i.e. meltwater vs. precipitation) at the late glacial to Holocene transition and possibly during Heinrich events. Thus we infer a close coupling between Northern Hemispheric and Central Asian climate dynamics throughout the last 30 ka.