

Past Environmental Changes in Tsagaan Lake, Valley of The Gobi Lakes, Mongolia, revealed by Sediment Core Analyses and Satellite Observation

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The arid region of Mongolia is a sensitive region to climate change. Understanding climate variations in the past plays an important role to predict further climate changes. In this study, we aim to investigate the relationship between the climatic factor and sedimentation history in the short term. The sediment characteristics such as water, organic matter, carbonate, and silica concentrations and grain size and geochemical characteristics were applied for the 18TS1 (1.3 m depth) core from the Tsagaan lake in the Valley of the Gobi lakes, Mongolia. The sediment core mainly consists of clay and silt sediments relatively high in the carbonate, occasionally interrupted by the sand-dominated sediment. ²¹⁰Pb dating method was applied and three age models under the assumptions of Constant Rate of Supply (CRS), Constant Initial Concentration (CIC), and Constant Flux and Constant Sedimentation (CFCS), were investigated for the sediment chronology. In addition, a self-calibrating Palmer Drought Severity Index (scPDSI) was calculated for the study area using the Climate Research Unit (CRU) data. The CRS model of the ²¹⁰Pb method revealed that the upper 26 cm sediment spans the sedimentation history of the last 87 years, which is more reliable than the CIC and CFCS models. The drought period (negative value of PDSI) coincides with the organic matter, carbonate, and silica abundances with the coarser particles in the lake sediment. The significant correlations of Principal Component Analysis also evidence this result. Although the main section of the core was older than the limitation of ²¹⁰Pb dating age, the 18TS1 core might represent a more recent sedimentary record, the last millennium or hundred years based on the accumulation rate of the CRS model. Geochemically and in mineral composition, the sand-dominated units in the sediment core agreed with the sand sheets and sand dune in the catchment. According to the present results, the shallow lake condition and successive shrinkage of the lake occurred for the Tsagaan lake. After the shrinkage, aeolian sediments with divergent geochemical characteristics and coarser particle size could be deposited into the lake by the high-wind occurrence. Expanding the area of sand sheets was observed in the northern discipline of the lake by the aerial imagery, these sand-dominated sequences in the 18TS1 core may be a proxy of activated aeolian deposition during the lake shrinkage.

Keywords: Sediment, 210-lead dating, Drought, Aeolian sediment