East Asian summer monsoon dynamics over the last interglacial-glacial cycle inferred from fluctuations of Lake Daihai in northern China

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Palaeolake archives, including both core sedimentary sequences and palaeoshorelines, from northern China have been extensively used to reconstruct the lake evolution and regional moisture history during the latest Pleistocene and Holocene. Such studies have played important roles in understanding the intensity variations of East Asian summer monsoon (EASM) and the underlying drivers on the sub-orbital timescales. However, the reconstructions of lake evolution in the time period beyond late glacial is substantially limited, and as a result, the picture and forcing of the EASM variations on the glacial-interglacial timescale have not been well revealed from lake archives yet.
In this study, we applied a combined quartz and K-feldspar luminescence dating to a fluvial-lacustrine sedimentary sequence (section DH17-1) from Lake Daihai in semiarid northern China to reconstruct its lake level fluctuation. The comprehensive investigations based on sedimentology, stratigraphy, and luminescence chronology demonstrate two highstands periods of Lake Daihai from ~130 ka to 110 ka and from ~90 ka to 70 ka, respectively, interrupted by a relatively low lake level period in between. Afterward, the lake level might have experienced a gradual decrease from ~70 ka to ~50 ka, suggested by less and less offshore components upward shown in grain-size end-member analysis of sediments. The reconstructed lake fluctuation history of Lake Dai infers a humid condition at the last interglacial owing to strengthened EASM intensity but deteriorated regional moisture condition through the last glacial. The overall correspondence of lake-level fluctuations to marine isotope record implies a dominant ice-volume forcing of the EASM variations on the glacial-interglacial timescale. It appears to be incompatible with the standpoint of the insolation regulation of monsoon intensity documented by the stalagmite oxygen isotope records on the orbital timescale.

Keywords: Lake level fluctuation, Glacial-interglacial, OSL dating, Humid condition, Monsoon

