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## Glacial meltwater-produced high lake levels on the Tibetan Plateau during the late Quaternary period, using Be-10

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High lake levels across the Tibetan Plateau (TP) have attracted much attention, but the mechanisms driving the lake level rises are still debated. Dramatic lake expansions over the past decades are mainly ascribed to the additional water supply from accelerated glacial melting and precipitation increasing. Throughout the late Quaternary higher lake levels have been attributed primarily to enhanced monsoonal precipitation with glacial meltwater being a lesser contributor. We use absolute dating of the shorelines and glacial moraines, combined with modeled ice volumes, to examine the synchronicity of high lake levels and glaciations in the Nam Co's catchment in the western side of the Nyainqentanglha Mountains, and Linggo Co and Duoge Co North around the Puruogangri ice field on the TP. We find that lake water levels during Pleistocene are much higher than those during Holocene. The conspicuously exposed paleo-shoreline at 20-27 m above the current level of Nam Co in the southern TP formed during multiple short-lived periods at similar water levels that likely were initiated during Marine Isotope Stage (MIS) 6. This shoreline was subsequently re-sculpted in MIS 3. The second highest shoreline (14-18 m) was formed during the deglaciation associated with MIS 4 and reshaped during the last deglaciation. Four shorelines of Linggo Co in the innermost TP were formed during MIS 6 (25 - 29 m), MIS 4 (82-89 m), MIS 3 (94 m) and the Last Glaciation Maximum (LGM) (66 m). The shoreline associated with MIS 6 is lower in altitude than late-formed shorelines associated with MIS 4, MIS 3 and the LGM. The earlier shorelines are well-preserved and their ages are not significantly underestimated by later higher water-level processes, suggesting that the high lake levels were short-lived. The periods during which these two clearly discernible shorelines of Nam Co and four shorelines of Linggo Co were at their widest extent appear consistent with the timings of the extensive local glacial advances, suggesting that high lake levels were correlated with these glaciations. High water levels of glacier-fed lakes also appear synchronous with the local glaciations during the last glacial period across the semi-arid areas on the TP and its surrounding mountains. The climate conditions during MIS 6, MIS 4, MIS 3, the LGM, and the last deglaciation were generally colder and drier, but the lake levels during these periods were higher than those of the Holocene, suggesting that the increasing precipitation was not a major factor for these high lake levels. The reconstructed ice volume losses during LGM, MIS 3 and MIS 4 in the Nam Co's catchment are equivalent to a rise of 66-75 m in the Nam Co's water levels. We suggest that paleoglaciers would have contributed substantial meltwater to maintain high water levels for shore time for glacier-fed lakes during late Quaternary on the TP, and it implies that the increase of the water levels for present-day glacial meltwater-fed lakes would not last for a long time.

### Student Submission

No

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