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Research Advances

The Low Lake-Level Record according to the Selin Co Stratigraphical Basis and Multi-Proxies during the Last Glacial Maximum in the Central Tibetan Plateau

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Objective

The lake levels in the eastern and southern Asia are regarded as low lake-level owing to precipitation decreasing based on the records of lake-level fluctuation in the continental interior lakes since the last glacial maximum (LGM) (^{14}C 18±1 kaBP, since 20 kaBP) in the Central Asia. Higher lake-level appeared in the transition belt between western Kunlun Mountain and the central Tibetan Plateau. Furthermore, the highest lake-level was recorded in the belt of western Asia to Lake Balkhash (Shi Yafeng et al., 1997). But till now, no direct geological proofs can confirmed this viewpoint. A complete lake terrace strata since the Last Glacial Maximum near the Selin Co in the central Tibetan Plateau, the lowest lake-level was understood during the LGM based on the description of sediments and analyses of geochemical environmental proxies.

Methods

Sediment grain size, aragonite, element, Fe^{2+} ion concentration, and carbon and oxygen isotope of carbonates have been analyzed from a 242 cm second lake terrace sediment section in the southeastern edge. Seven AMS ^{14}C data from BETA and Lanzhou University radioactive Labs were used to establish the age model since ~19 cal ka BP after the carbon reservoir calibration (Appendix 1).

Results

After evaluating each environmental proxies in the Selin Co sediment section (Fig. 1), we obtained that the climate was cold and dry, and the lake level was low based on the gravel sediment layer as river or lake beach during LGM ~17.4–19 cal ka BP. From 17.4 to 15.5 cal ka BP, lake-level started to ascend with lots of fresh water filling but the lake remained shallow, and the paleoclimate was cool and wet. From 15.5 to 10.4 cal ka BP, a deep closed-lake formed stably a long period with bloomed vegetation, inferred a warm and humid climate background. From 10.4 to 5.2 cal ka BP, a shallow open lake during a warm period and high precipitation with vegetation blooming, but the effective precipitation was reduced. There were two significant cooling events during 9.7–9.4 cal ka BP and 8.75–8.5 cal ka BP. Lake became shallower, however, the effective precipitation was still high and the climate was cold and wet. From 5.2 to 1.2 cal ka BP, a shallow lake further with decreased temperature and precipitation vastly, inferred a cold and dry climate with deteriorative vegetation condition. However, during 4.3–4.0 cal ka BP, 3.3–3.0 cal ka BP and 2.4–1.75 cal ka BP, three short lake -level recovered events indicated a warm and dry climate. After 1.2 cal ka BP, the Lake Selin Co decreased quickly so that it had not got to the past lake-level altitude.

Conclusion

Based on the multi-proxies paleoenvironmental reconstruction to Selin Co sediment second terrace section in the central Tibetan Plateau, we confirm that the lake-level was lowest during the LGM and the lake area shrank greatly with thick river or lake beach sand and gravel sediments mainly. The climate was cold and dry. The Selin Co lake-level fluctuation had a significant relation with the solar radiation in the 30°N latitude without obvious phase difference since the last glacial maximum, which also indicates that the lake-level fluctuation was correlated with the India monsoon precipitation (Shi et al., 2017). The possibility of glaciers melting was low during the cold climate condition so that it cannot raise the lake-level. The effective precipitation determines the lake-level fluctuation, vegetation condition and weathering

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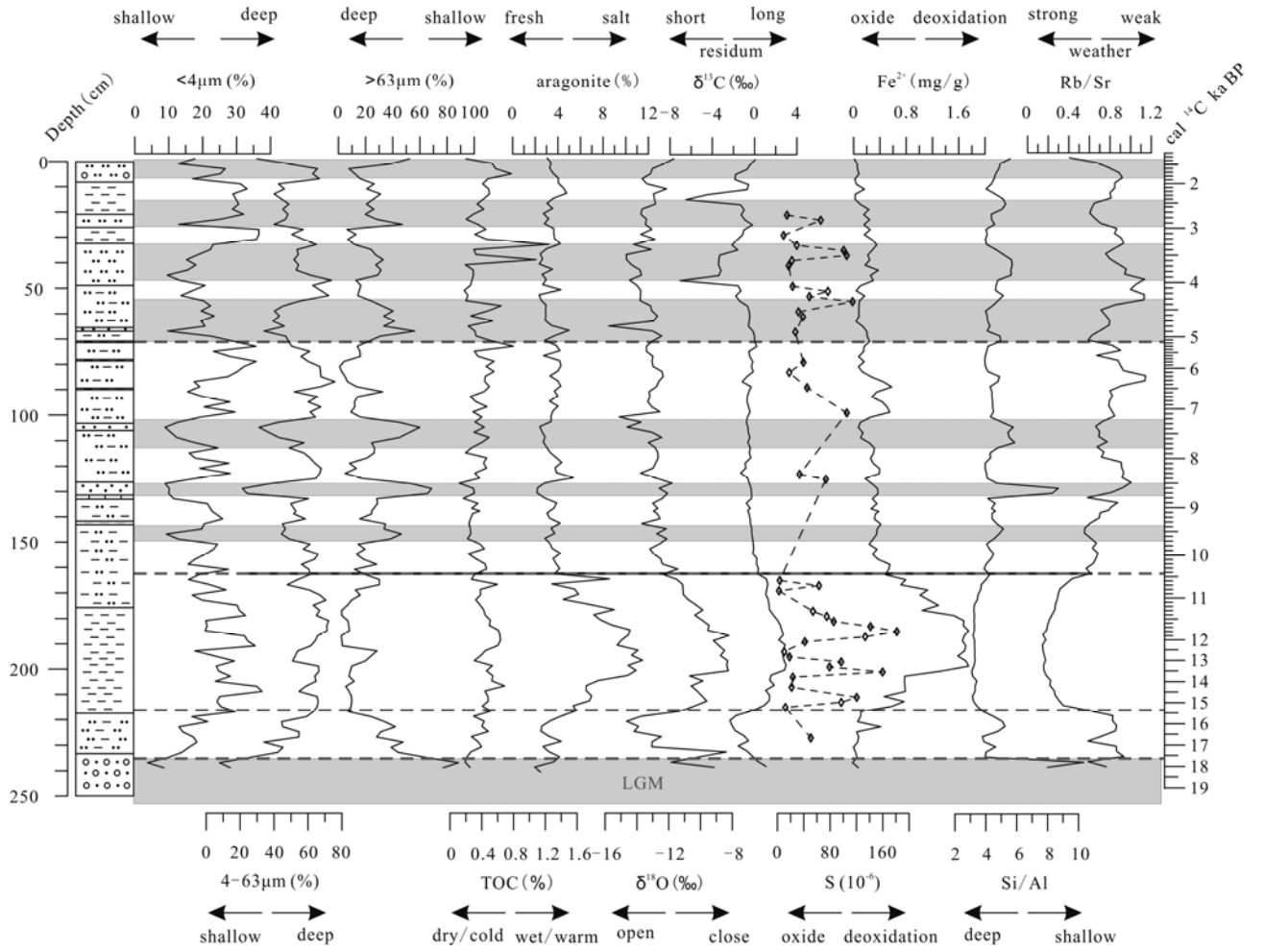

Fig. 1. Palaeoenvironmental reconstruction for Selin Co since the last glacial maximum based on the multi-proxies in the central Tibetan Plateau.

characteristics in the Tibetan Plateau.

Acknowledgments

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References

Shi Yafeng, Zheng Benxin, and Yao Tangdong, 1997. Glaciers and Environments during the Last Glacial Maximum (LGM) on the Tibetan Plateau. *Journal of Glaciology and Geocryology*, 19(2): 97–113 (in Chinese with English abstract).

Shi Xuhua, Kirby, E., Furlong, K.P., Meng Kai, Robinson R., Lu Haijian, and Wang Erchie, 2017. Rapid and punctuated Late Holocene recession of Siling Co, central Tibet. *Quaternary Science Reviews*, 172: 15–31.

Appendix 1 Radiocarbon dating results for section Selin Co determined in the BETA (USA) and Lanzhou University AMS Lab (China)

Lab ID	Sample No.	Depth (cm)	Material	$\delta^{13}C_{org}$ (‰)	$F^{14}C$*	^{14}C a BP	cal a B.P. (min.)	cal a B.P. (max.)
LZU16009	SL2015-4	6-8	TOC	-	0.7368±0.0028	2455±35	2435	2507
BETA-416754	SL2015-11	20-22	TOC	-22.8	-	3160±30	3345	3450
LZU16011	SL2015-38	74-76	TOC	-	0.6469±0.0037	5135±40	5888	5932
BETA-416755	SL2015-45	88-90	TOC	-23.5	-	6240±30	7155	7250
LZU16013	SL2015-78	154-156	TOC	-	0.1583±0.0023	9375±35	10560	10661
LZU16014	SL2015-96	190-192	TOC	-	0.0543±0.0012	10655±35	12702	12788
BETA-416757	SL2015-118	234-236	TOC	-22.0	-	14840±50	17980	18235

Note: *Fraction modern *sensu* Reimer et al. (2004).