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Lake-levels, vegetation and climate in Central Asia during the Last Glacial Maximum

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Central Asian region is bounded in the east corner of the Greater Khingan Range and the Loess Plateau, and to the west – the Caspian Sea. This representation of region boundaries is based on classical works of A.Humboldt and V.Obruchev. Three typical features of Central Asia nature are: climate aridity, extensive inland drainage basins with numerous lakes and mountain systems with developed glaciation.

Nowadays the extensive data is accumulated about lake-levels during the Last Glacial Maximum (LGM) in Central Asia. Data compilation on 20 depressions, where lakes exist now or where they existed during LGM, shows that most of them had usually higher lake-level than at present time. This regularity could be mentioned for the biggest lakes (the Aral Sea, the Balkhash, the Ysyk-Kol etc.) and for small ones that located in the mountains (Tien Shan, Pamir and Tibet). All of these lake basins get the precipitation due to westerlies.

On the other hand lakes, which are located in region's east rimland (Lake Qinghai and lakes in Inner Mongolia) and get the precipitation due to summer East Asian monsoons, do not comply with the proposed regularity. During LGM these lake-levels were lower than nowadays. Another exception is Lake Manas, its lake-level was also lowered. Lake Manas is situated at the bottom of Junggar Basin. There are many small rivers, which come from the ranges and suffer the violent fluctuation in the position of its lower channel. It is possible to assume that some of its runoff did not get to Lake Manas during LGM.

Mentioned facts suggest that levels of the most Central Asian lakes were higher during LGM comparing to their current situation. However, at that period vegetation was more xerophytic than now. Pollen data confirm this information for Tibet, Pamir and Tien Shan. Climate aridization of Central Asia can be proved by data about the intensity of loess accumulation during LGM. This evidence received for the east part of region (the Loess Plateau) and for its west part (the piedmonts of Tien Shan and Pamir Mountains). So it confirms a synchronous aridization in different parts of Central Asia. It was the result of amplification of winter Siberian anticyclone, weakening westerlies and East Asian summer monsoons.

The observed discrepancy between vegetation conditions and lake-levels during LGM can be explained by lake-levels dependence on runoff as now from mountains, where snow and glaciers melt. Investigations in the area of Mongun Tayga (Tyva Republic in Russian Federation, Lake Hyargas Nuur basin) suggest that precipitation decreased by 30% during LGM, but at the same time snow accumulation increased due to lower temperature in mountains. Thus, special conditions were provided for climate cryoaridization, when vegetation was degraded due to lowering precipitation, but lake-levels grew due to higher runoff from mountain ranges.