

Biological response of Lake Baikal to changing hydrological regimes on the last glacial-post glacial transition

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Lake Baikal, which is located in the south Siberian region, has exceptional taxonomic diversity, with more than 1300 species of fauna, ~60% of which are endemic. These characteristics suggest that the Lake Baikal ecosystem has sustained its biological activity through multiple glacial periods since its formation over 30 million years ago. To assess the ecosystem's response to hydrological changes, such as alterations in river input to the lake during the last glacial period, we analyzed geochemical (K/Ti inorganic element ratio, total organic carbon, and $\delta^{15}\text{N}$) and sedimentological (grain size) proxies from the Lake Baikal sediment core (VER99G12), using an updated age model for the past 31,000 years BP. This core was mainly composed of deposition materials from the Selenga River, which accounts for roughly 50% of the lake's total river input. Thus, the VER99G12 core reflects climate and environmental changes not only in the Lake Baikal water column but also in its watershed, including the extensive Siberian permafrost area. TOC, $\delta^{15}\text{N}$, K/Ti ratio, and grain size all exhibit short-term cyclic variations throughout the core, particularly from 31 to 21 ka BP. Furthermore, these variations are in harmony with the Chinese loess record, a proxy for the winter Asian monsoon. These findings indicate that hydrological fluctuations in the Lake Baikal watershed are governed by periodic factors during the last glacial period, and that the nutrients brought into the lake by these variations sustain the biological activity. Notably, during the last glacial period, precipitation brought into the watershed was not significant in the Siberian region. Thus, the link between river input and biological activity could be attributed to the melting of permafrost and nearby glaciers, which increase river water and nutrient input to the lake. This mechanism was critical in maintaining biological activity during the glacial period and contributed to the taxonomic diversity observed in the Lake Baikal ecosystem.