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Impact of climate change and industrialization on remote Lake Bolshoe Toko, Siberia

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To test if recent climate change and pollution affected remote lake ecosystems without direct human influence, we used paleolimnological methods on lake sediments from a large, pristine, and deep lake in Yakutia, Russia. We compared diatoms and sediment-geochemistry from before and after the onset of industrialization in the mid-nineteenth century, at water depths between 12.1 and 68.3 m in Lake Bolshoe Toko. We analyzed diatom species changes and geochemical changes including mercury concentrations. Chronologies were established using ²¹⁰Pb and ¹³⁷Cs revealing sedimentation rates between 0.018 and 0.033 cm y⁻¹ at shallow- and deep-water sites, respectively. Increase in light planktonic diatoms (*Cyclotella*) and decrease in heavily silicified euplanktonic *Aulacoseira* through time at deep-water sites can be related to warming air temperatures and shorter periods of lake-ice cover, causing pronounced thermal stratification. Diatom beta diversity changed only significantly in shallow-water communities which can be related to the development of new habitats with macrophyte growth. Mercury concentrations increased by a factor of 1.6 as a result of atmospheric fallout. Increases in the chrysophyte *Mallomonas* indicates a trend towards acidification. We conclude that also remote boreal lakes are susceptible to human-induced long-distance pollution and recent climate change.