

Paleoenvironmental proxy records from Lake Hovsgol, Mongolia, and a synthesis of Holocene climate change in the Lake Baikal watershed

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Abstract

Here we discuss paleoenvironmental evolution in the Baikal region during the Holocene using new records of aquatic (diatom) and terrestrial vegetation changes from Hovsgol, Mongolia's largest and deepest lake. We reconcile previous contradictory Baikal timescales by constraining reservoir corrections of AMS dates on bulk sedimentary organic carbon. Synthesis of the Holocene records in the Baikal watershed reveals a northward progression in landscape/vegetation changes and an anti-phase behavior of diatom and biogenic silica proxies in neighboring rift lakes. In Lake Baikal, these proxies appear to be responsive to annual temperature increases after 6 ka, whereas in Lake Hovsgol they respond to higher precipitation/runoff from 11 to 7 ka. Unlike around Lake Baikal, warmer summers between 6 and 3.5 ka resulted in the decline, not expansion, of forest vegetation around Lake Hovsgol, apparently as a result of higher soil temperatures and lower moisture availability. The regional climatic proxy data are consistent with a series of 500-yr time slice Holocene GCM simulations for continental Eurasia. Our results allow reevaluation of the concepts of 'the Holocene optimum' and a 'maximum of the Asian summer monsoon', as applied to paleoclimate records from continental Asia. © 2007 University of Washington. All rights reserved.

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Introduction

Lake Hovsgol, Mongolia's largest and deepest lake, is located within the Lake Baikal catchment at 1645 m a.s.l. and currently has an outlet to Selenga River and eventually Lake Baikal (Fig. 1). A unique feature of the Hovsgol basin, making it a sensitive 'water gauge' in continental interior Asia, is the low ratio of the catchment area to the modern lake surface area, 1.7:1 as compared with the ratio of 17:1 for Baikal (Potemkina and Potemkin, 2002). Regional climate has sharp seasonal contrasts with annual temperature range of about 35 °C; average annual temperatures are negative. From October through

March, climate is dominated by the Siberian (Asiatic) High. Precipitation in November through March accounts for as little as 5–10% of the annual total of 300–600 mm; 60–70% occurs in June–August (Bogoyavlensky, 1989). Long paleoclimate proxy records from Lake Hovsgol have high potential for providing long needed data on changes of regional water budget and possibly seasonal precipitation patterns over several past interglacials. Despite a decade of research of longer records from Lake Baikal, this issue remains essentially unresolved.

Here we report new Holocene records from Lake Hovsgol, which were selected from the suite of 15 sedimentary sections sampled by Benthos™ gravity cores. We skip the discussion of lithologic composition and depositional environments in Lake Hovsgol, which were specifically addressed by Prokopenko et al. (2005). Instead, we discuss ways to resolve radiocarbon age

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