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Holocene and Eemian clay records in Lake Baikal: weathering condition recovery during Interglacials

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A clay mineralogical record of a piston core recovered on an elevated plateau in the northern basin of Lake Baikal has been investigated at a centennial resolution for both the Holocene and the Eemian $s.s.$ (i.e., Kazantsevo in Siberian stratigraphy) interglacials. Clay mineralogical signature is determined by X-ray diffraction on oriented aggregates. Results are reported along a paleomagnetic-derived time scale. The sampling at a centimeter resolution allows for a centennial order reconstruction. We aim to test the application of sedimentary clay minerals as abiotic climate proxies. Assuming all clays are detrital, the evolution of clay assemblages preserve a fingerprint of the weathering conditions within the watershed, further related to the prevailing climate regime. In addition to the smectite/illite ratio (S/I), the mineralogical results are integrated by the calculation of a hydrolysis index (HI) that takes into account the abundance of all clay species and their sensitivity to chemical weathering. S/I underlines the pedogenetic transformation of illite into smectites, whereas HI integrates transformation processes of the two dominant herited minerals (illites and chlorites) into various secondary clays. Clay data are further compared with semi-quantitative diatom and pollen profiles, pollen-based quantitative reconstructions for the same core material and with other regional climate reconstructions. Our centennial clay record from northern Baikal (at Continent site, a northern extension of Academician Ridge) indicates highly variable weathering conditions through both the Kazantsevo and the Holocene interglacials, in contrast to the stable climate conditions inferred from pollen quantitative reconstructions. During the Kazantsevo Interglacial, the optimum chemical weathering inferred by clay changes lags the interglacial/glacial transition by at least 2 kyr. Such delay could reflect the time response for re-equilibration of weathering processes in soils due to new glacial conditions. For the Holocene interglacial, it is likely that the most intense chemical weathering conditions did not occur during the

Eurasian middle Atlantic climate optimum ($\sim$5.7 to 2.6 kyr BP) but occurred later during the Subboreal ($\sim$8 to 5.7 kyr BP). Synchronous with maximum diatom production in lake sediments, the highest clay proxy values lag the sharpest palynological-derived temperature change (*ca.* 7 kyr BP) by $\sim$1 to 2 kyr. This lag takes into account the time response for soil re-equilibrium, but also for the time lag between pedogenesis and sediment deposition. To conclude, Lake Baikal clay minerals trace the nature of the main weathering conditions within the watershed. We note any increase in physical weathering is rapidly recorded in sedimentary clay assemblages but the mineral imprint to chemical weathering changes is more gradual, lagging the climate conditions over the lake by a few kyr. This information is essential for validation of paleoclimate clay-derived reconstruction but requests confirmation by further investigations with constrained chronology on Siberian soils.