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High-resolution magnetostratigraphy of late quaternary sediments from Lake Baikal, Siberia: timing of intracontinental paleoclimatic responses

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Abstract

Sediment cores retrieved from 6 locations in Lake Baikal were subjected to a paleomagnetic study in order to establish detailed age models based on correlations of relative paleointensity records. Additional data were provided by calibrated accelerator mass spectrometry (AMS) ^{14}C dating, as well as by documentation of geomagnetic excursions like Laschamp at ~42 ka and Iceland Basin at ~185 ka. Few intervals were affected by diagenetic features like selective reductive dissolution of magnetite and greigite mineralization (Demory et al., 2005-this issue), and those that were left out of paleointensity records. These records were tuned to the well-dated paleomagnetic record from ODP Site 984 Channell [Channell, J.E.T., 1999. Geomagnetic paleointensity and directional secular variation at Ocean Drilling Program (ODP) site 984 (Bjorn Drift) since 500 ka: comparisons with ODP site 983 (Gardar drift). J. Geophys. Res., B: [Solid Earth], 104 (10):22, 937-22, 951]. The complex shape of the resulting depth/age curves highlights the need for a high-resolution age model. We focused on the climatic boundary between marine isotopic stage (MIS) 7 and 6 where the Iceland Basin paleomagnetic excursion is clearly documented in the North Atlantic Channell et al.[Channell, J.E.T., Hodell, D.A., Lehman, B., 1997. Relative geomagnetic paleointensity and d^{18}O at ODP Site 983 (Gardar Drift, North Atlantic) since 350 ka. Earth Planet. Sci. Lett., 153 (1–2), 103-118] and in Lake Baikal Oda et al. [Oda, H., Nakamura, K., Ikehara, K., Nakano, T., Nishimura, M., Khlystov, O., 2002. Paleomagnetic record from Academician Ridge, Lake Baikal: a reversal excursion at the base of marine oxygen isotope stage 6. Earth Planet. Sci. Lett., 202 (1), 117-132] ; present study). During this period, we provide evidence for a return to cold conditions in the Lake Baikal region simultaneous to the sea surface cooling, but earlier than the global ice volume change observed in North Atlantic planktonic and benthic $\delta^{18}O$ records, respectively. The classical strategy of age model reconstruction, based on direct correlation of the climatic record from Lake Baikal sediments with the marine $\delta^{18}O$ reference curves is shown here to be unreliable. Moreover, this strategy does not consider (i) the nonlinearity of the age model in Lake Baikal sediments and (ii) the time lags between the global ice volume change and sea surface cooling observed in $\delta^{18}O$ marine records. Finally, the "Baikal

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