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New evidence for important lake-level changes in Lake Baikal during the Last Glaciation

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In recent years, a number of estimates have been proposed of fluctuations of the Baikal lake level caused by climate changes. They were mainly based on the interpretation of reflection seismic data from the Selenga delta area (eastern coast of Lake Baikal). These estimates range between 2 m [Colman, 1998] and 600 m [Romashkin et al., 1997]. Better-constrained values of lake-level changes during the last 100 ky were presented by Urabe et al. [2004]. According to their reflection seismic data from the Selenga delta area, the level of Lake Baikal was significantly lower than the present-day level during the two last cold stages (i.e. -45 m during MIS2 and -73 m during MIS4). To precise and verify these values, we carried out an additional high-resolution reflection seismic study in the area of Olkhon Gate (western shore of Lake Baikal). The maximum water depth in this area does not exceed 40 m. The seismic data were collected using two different types of seismic sources: i) a multi-electrode CENTIPEDE sparker with a frequency range of 350-1400 Hz, and ii) the "Sonic-2" seismic system with a frequency range of 2-5 kHz. They allow investigation of the sedimentary record with a resolution of about 1 m (to 300 m depth) and 15-20 cm (to 30 m depth), respectively.

Interpretation of these new data allowed distinguishing several seismic units separated by unconformities (erosion surfaces) in the upper part of the seismic profiles. These unconformities could be traced across the entire study area. The uppermost two erosion surfaces are more sharply defined. In the deepest parts of the channel (at 37-40 m water depth) the uppermost unconformity occurs at 5-10 ms below the lake floor, and the second unconformity at 15-20 ms below the lake floor. Both unconformities are interpreted as subaerial erosion surfaces and thus mark a lowstand of the lake level during a prolonged time. For calculation of the thickness of these two units, we used

the acoustic logging data from the BDP-98 borehole [BDP Members, 2000]. According these data p-wave velocities vary from 1.6 to 1.8 km/s. The thickness of our upper two seismic units can thus be converted to 4-8 m and 12-16 m, respectively. This implies that the uppermost unconformity occurs at 41-48 m, and the second unconformity at 52-64 m below present-day lake level, which is approximately at the same depth as the two unconformities in the Selenga delta area that were studied by Urabe et al. [2004] and attributed with the MIS2 and MIS4 cold periods, respectively.

Our new data thus support the growing amount of evidence of a lowering of the Lake Baikal water level by 40-65 m during glacial/cold periods. The lowstands are probably caused by water redistribution in the Lake Baikal watershed due to climate changes (i.e. glaciation and atmospheric circulation). These data also allow making quantitative assessments of water balance and paleoclimate parameters in the past.

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