Holocene paleomagentic secular variation recorded in sediments from Lake Tazawa in Akita Prefecure, Northeast Japan

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We conducted a paleomagnetic study of three piston-core samples from Lake Tazawa in Akita Prefecture, aiming at reconstruction of the paleomagnetic secular variation in Northeast Japan. An age-depth model based on radiocarbon dating shows that the core samples cover the last 7500 cal year BP in the Holocene. Measurements of natural remanent magnetization (NRM) and anhysterresis remanent magnetization (ARM) were carried out on U-channel samples by a pass-through method with a 2G-Enterprises superconducting rock magnetometer. Then, we made deconvolution of the pass-through data by using the software UDECON (Xuan and Oda, 2015), which searches the optimum result in the ABIC-minimizing single smoothness-parameter scheme assuming smoothness in variation of the sediment magnetization. Low-field magnetic susceptibility of the U-channel samples was also measured by a pass-through method and deconvolved using the software, which we developed in two schemes, first assuming a single smoothness parameter for the entire sample (mono-decon) and then introducing an additional parameter for a specific interval (dual-decon). The program “dual-decon” enables us to assign the second hyper-parameter for the interval with a sharp susceptibility peak such as a tephra layer and an event layer. Experiments using a simulated continuous sample made by connecting discrete cubic samples (“cube-train”), which contains the B-Tm tephra layer, showed that the dual-decon produces the better result which is consistent with the discrete measurements rather than the mono-decon. It is suggested that the noise originated from a sharp increase could be reduced by introducing the second smoothness-parameter in the deconvolution process. Principal component analysis of the alternating-field demagnetization data after the deconvolution by UDECON revealed existence of characteristic magnetic components, which can be regarded representing the past geomagnetic field. In particular, the declination after 3,000 cal yr BP shows consistent variations between the cores. This variation also shows a good similarity with a global archaeomagnetic secular variation model, ARCH3k.1, and the paleomagnetic record from Lake Biwa (BIWA SV-3), implying importance for reconstruction of the paleosecular variation in Northeast Japan. On the other hand, estimation of relative paleointensity was difficult, mainly due to ununiformity of concentration and grain-size of magnetic minerals, suggested by variation of the ARM, the low-field susceptibility and the ARM susceptibility/susceptibility ratio.

Keywords: paleomagnetic secular variation, Holocene, deconvolution

