Geomagnetic excursions observed in Lake Suigetsu varved sediments during the latest stage of the last glacial period

*Shota Tanabe[1], Masako Miki[1], Masayuki Hyodo[2], Takeshi Nakagawa[3], Ikuko Kitaba[3], Keitaro Yamada[3], Junko Kitagawa[4], Suigetsu 2014 Project Members[5]

1. Kobe University, 2. Research Center for Inland Seas, Kobe University, 3. Ritsumeikan University, 4. Fukui Prefectural Satoyama-Satoumi Research Institute, 5. www.suigetsu.org

A geomagnetic excursion is a brief event that the geomagnetic field direction deviates largely from a normal one, generally lasting for less than two thousand years. The relative paleointensity data stack Sint-800 revealed that the excursions during the Brunhes Chron occurred when the dipole magnetic field strength decreased below 50% of the present one. However, some previous studies report some geomagnetic excursions may be unrelated to weakening of the geomagnetic field. We conducted paleomagnetic analyses of the Lake Suigetsu varved sediments in order to detect unknown excursions during the past ca. 20 ka.

We analyzed the Fukui-SG14 core collected in 2014 from Lake Suigetsu. Paleomagnetic analyses were conducted on LL-channel sections of 1 m length with a cross section of 2 cm ×2 cm, with stepwise alternating field demagnetizations at depth intervals of 1 cm (about 14 years in time) over a composite-depth range from 900 cm - 2100 cm (correlation model version 08 May 2016). Principal component analysis was performed on the demagnetization data at 852 depth levels, and positions of virtual geomagnetic poles (VGPs) were calculated. As a result, we found three geomagnetic excursions including successive directions with VGPs lower than 45˚N, between 1700 cm and 2000 cm in depth. The three excursions are tentatively named A, B, and C in the descending order. The detailed chronology of the Fukui-SG14 based on the high-resolution correlation with the SG06 age model provides their mid-ages (durations) are about 15.3 $SG06_{2012}$ kyr BP (about 370 yr), 17.7 $SG06_{2012}$ kyr BP (about 130 yr), and 19.4 $SG06_{2012}$ kyr BP (about 380 yr), respectively. The intensities in the geomagnetic excursions we observed do not decrease.

We also conducted stepwise thermal demagnetizations with some samples from the excursion zones. The results confirmed presence of the excursions.

The thermomagnetic analyses and isothermal remanent magnetization (IRM) acquisition experiments show that the main magnetic carriers are magnetite and greigite.

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