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*佐藤 雅彦[1]、山本 伸次[2]、山本 裕二[3]、Du Wei[4]、大野 正夫[5]、綱川 秀夫[6]、丸山 茂徳[6]
*Masahiko Sato[1], Shinji Yamamoto[2], Yuhji Yamamoto[3], Wei Du[4], Masao Ohno[5], Hideo Tsunakawa[6], Shigenori Maruyama[6]

1.産業技術総合研究所、2.横浜国立大学、3.高知大学、4.東京大学、5.九州大学、6.東京工業大学
1.National Institute of Advanced Industrial Science and Technology, 2.Yokohama National University, 3.Kochi University, 4.The University of Tokyo, 5.Kyushu University, 6.Tokyo Institute of Technology

Geomagnetic field paleointensity data provide critical information about the thermal evolution of the Earth, and the state of the geomagnetic field is closely related to the surface environment. While it is pivotal to understand the variations in geomagnetic field intensity throughout the history of the Earth, data are still too scarce to resolve billion-year-scale geomagnetic field variation. This is primary because of the lack of geological samples for older eras, which often result in unsuccessful paleointensity experiments.

We focus on a paleointensity experiment using single zircon crystal. Zircon crystals play an important role in paleomagnetic studies because they have several mineralogical advantages: (1) they commonly occur in crustal rocks, (2) precise age determinations with U–Th–Pb and (U–Th)/He analyses are possible, and (3) they have highly resilient responses to alterations and metamorphism.

Recently Sato et al. (2015) reported the rock-magnetic properties of the single zircon crystals sampled from the Nakagawa River, which crosses the Tanzawa tonalitic pluton in central Japan. They demonstrated that the various rock-magnetic properties such as natural remanent magnetization (NRM), isothermal remanent magnetization (IRM), hysteresis parameters, and transition temperature could be measured using the standard magnetometers (SQUID magnetometer, MPMS, and AGM). Combining these rock-magnetic parameters, they proposed the sample selection criteria for paleointensity experiments using single zircon crystals.

In this study, we conducted rock-magnetic measurements for single zircon crystals sampled from the Yangtze River. NRM intensity (M_{NRM}) was first measured for the 1034 grains of zircon crystals. Then, low-temperature demagnetization (LTD) treatment was further conducted for 85 grains with M_{NRM} values larger than 5 $\times 10^{-12}$ Am^2, and the memory (NRM intensity after LTD treatment; $M_{NRM-LTD}$) was measured. For the 85 samples, we also carried out alternating field demagnetization (AFD) treatment at 10 mT, and the memory (NRM intensity after AFD treatment; $M_{NRM-AFD}$) was measured. After the NRM measurements, IRM was imparted with a field of 1 T using pulse magnetizer for the 1034 crystals, and the resultant IRM intensity was measured (M_{IRM}). Subsequently, IRM intensity after LTD treatment ($M_{IRM-LTD}$) and AFD treatment ($M_{IRM-AFD}$) were measured for the sample with M_{NRM} values larger than 5 $\times 10^{-12}$ Am^2.

M_{NRM} values of the single zircon crystals varied from 10^{-13} to 10^{-10} Am^2, and 101 crystals (9.8%) had M_{NRM} larger than 4 $\times 10^{-12}$ Am^2. M_{IRM} values of the single zircon crystals also varied by five orders of magnitude, and 402 crystals (38.9 %) showed M_{IRM} larger than 4 $\times 10^{-12}$ Am^2. The ratios of M_{NRM}/M_{IRM}, $M_{NRM-LTD}/M_{IRM-LTD}$, and $M_{NRM-AFD}/M_{IRM-AFD}$ varied 0.003–2.0, 0.005–2.4, and 0.005–2.4. There were several samples with the $M_{NRM-AFD}/M_{IRM-AFD}$ less than 0.1, which could be suitable for paleointensity experiment. Combining the rock-magnetic parameters, we will discuss the feasibility of the paleointensity experiment using single zircon crystals from the Yangtze River.

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