

Rock-magnetic properties of single zircon crystals sampled from the Yangtze River and the Mississippi River

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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 primarily because of the lack of geological samples for older eras, which often result in unsuccessful paleointensity experiments. In this study, 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.

In order to evaluate the feasibility of the paleointensity experiment using single zircon crystals, we conducted systematic rock-magnetic measurements for single zircon crystals sampled from the Yangtze River and the Mississippi River. Remanent magnetizations of the single zircon crystals were measured using the superconducting quantum interference device magnetometer. Natural remanent magnetization (NRM) intensity was first measured. Then low-temperature demagnetization (LTD) treatment was further conducted, and the memory (NRM intensity after LTD treatment) was measured. We also carried out alternating field demagnetization (AFD) treatment, and the memory (NRM intensity after AFD treatment) was measured. After the NRM measurements, isothermal remanent magnetization (IRM) was imparted with a field of 1 T using pulse magnetizer, and the resultant IRM intensity was measured. Subsequently, IRM intensity after LTD treatment and AFD treatment were measured. For selected samples, hysteresis loop and low-temperature remanence curves were measured using the alternating gradient magnetometer and the magnetic property measurement system. We will discuss the rock-magnetic properties of single zircon crystal based on the experimental results.

Keywords: Zircon, Rock-magnetism, Yangtze river, Mississippi river