白亜紀中期入遠野花崗岩から分離した鉱物単結晶の古地磁気学的研究
Paleomagnetic studies on single crystals separated from the middle Cretaceous Iritono granite

*加藤 千恵[1]、佐藤 雅彦[2]、山本 裕二[3]、綱川 秀夫[1]、Kirschvink Joseph[4,5]
*Chie Kato[1], Masahiko Sato[2], Yuhji Yamamoto[3], Hideo Tsunakawa[1], Joseph L. Kirschvink[4,5]

1. 東京工業大学大学院理工学研究科地球惑星科学専攻、2. 産業技術総合研究所地質調査総合センター、3. 高知大学海洋コア総合研究センター、4. カリフォルニア工科大学、5. 東京工業大学地球生命研究所
1. Department of Earth and Planetary Sciences, Tokyo Institute of Technology, 2. Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology, 3. Center for Advanced Marine Core Research, Kochi University, 4. California Institute of Technology, 5. Earth-Life Science Institute, Tokyo Institute of Technology

To study the evolution of the geomagnetic field and its relationship to the thermal evolution of the Earth and mantle convection, the long-term behavior of the geomagnetic field should be emphasized. Granitic rocks could be good candidates to investigate the long-term evolution of the geomagnetic paleointensity because their long cooling times can average out relatively short-term fluctuations of the geomagnetic field. However, paleomagnetic measurements of granitic rocks are often disturbed by alteration like weathering and lightning, and the effects of multi-domain state magnetite. Recently, several research groups have investigated paleointensities from single crystals of primary minerals such as plagioclase, pyroxene, zircon and quartz for their potential to avoid difficulties that frequently plague whole-rock measurements (e.g. Tarduno et al., 2007; Usui et al., 2015; Sato et al., 2015). To provide solid ground for single silicate crystal paleomagnetism, paleointensity and rock-magnetic properties of single crystals should be systematically studied and compared to those of the host granitic rock.
We separated zircons, quartz and plagioclases from a Cretaceous granite sample whose whole-rock paleointensity and rock-magnetic properties were studied previously, and found to be particularly stable and reproducible (100 Ma, Wakabayashi et al., 2006; Tsunakawa et al., 2009). Superconducting quantum interference device (SQUID) magnetometer and magnetic property measurement system (MPMS) were used to measure natural remanent magnetization (NRM), isothermal remanent magnetization (IRM), thermal remanent magnetization (TRM), anhysteretic remanent magnetization (ARM) and low temperature magnetic properties of the single crystals.
Zircons with grain size of >100 μm were selected for measurements. Less than 1% of them had NRM intensity larger than 10 pAm^2. Low temperature magnetic properties and stepwise thermal demagnetization suggested that the major magnetic carrier of these zircons were pyrrhotite, and thus, the zircons are inappropriate for the paleointensity study. Quartz showed similar NRM intensity distribution with zircons. However, some quartz grains showed similar blocking temperature profiles with the host-rock, and primary magnetization components were detected on the orthogonal projections, indicating that these quartz could be suitable for paleointensity study. 44% of plagioclases had NRM intensity greater than 10 pAm^2. Their NRM/IRM ratio and low-temperature magnetic properties suggested the existence of tiny magnetite inclusions possibly exsolved from plagioclase. We performed paleointensity measurements by the Tsunakawa-Shaw method (Yamamoto et al., 2003) to four plagioclase crystals. The obtained paleointensities (46-77 μT) were consistent with the reported whole-rock paleointensity.

キーワード：古地磁気強度、花崗岩、単結晶
Keywords: paleointensity, granite, single crystals