Geophysical Research Abstracts
Vol. 21, EGU2019-8703, 2019
EGU General Assembly 2019

Paleomagnetic remanence tests: the essentials for investigations of the ancient geodynamo held by single crystals

Rory Cottrell (1), John Tarduno (1,2), Richard Bono (1,3), and Hirokuni Oda (4)

(1) University of Rochester, Earth & Environmental Sciences, Rochester, NY, United States (rory.cottrell@rochester.edu), (2) University of Rochester, Physics & Astronomy, Rochester, NY, United States, (3) Geomagnetism Laboratory, University of Liverpool, Liverpool, United Kingdom, (4) AIST, Geological Survey of Japan, Tsukuba, Ibaraki, Japan

Single crystal paleomagnetism has provided new insights into the long-term evolution of the geodynamo, from the Archean, through inner core growth, to variations between the non-reversing (superchron) and reversing state. An important part of this analysis is examining progressively smaller scales to determine the fidelity of natural remanent magnetization. In reference to evidence for the oldest Hadean geodynamo recorded by zircons now found in younger sedimentary units (Tarduno et al., 2015), microconglomerate tests are essential to exclude the influence of geological events after deposition. However, inverse microconglomerate tests are also extremely useful as they can provide direct information of the nature of overprint magnetizations which can be held by potential secondary magnetic minerals should they be present within zircons (Cottrell et al., 2016). Here we show how these grain-scale tests can be combined with nano-scale electron microscopy investigations, and discuss the accuracy of the latter in elucidating the origin of natural remanent magnetization carriers in ancient zircons (cf. Tang et al., 2018). Paleomagnetic consistency tests support the interpretation that single domain magnetite is primary in origin and bears a thermal remanence magnetization, whereas electron microscopic evidence reported to date arguing for secondary magnetite cannot unambiguously determine the time, temperature and mechanism of formation, nor its contribution to natural remanent magnetizations. Now that the presence of high-unblocking temperature magnetizations first reported by the paleomagnetic analyses of zircons (Tarduno et al., 2015) has been replicated in other labs, the challenge becomes the characterization of the dominant natural remanence carriers in zircons.