Geophysical Research Abstracts
Vol. 14, EGU2012-12523, 2012
EGU General Assembly 2012
© Author(s) 2012

Probing the Oldest Geodynamo

R. D. Cottrell (1), J. A. Tarduno (1,2), and R. K. Bono (1)

(1) University of Rochester, Earth and Environmental Sciences, Rochester, New York, United States (john@earth.rochester.edu), (2) University of Rochester, Earth and Environmental Sciences, Rochester, New York, United States

The evolution of Earth during the Hadean and Archean, and its relationship to the development of life, remains a frontier research area where the most advanced field and analytical techniques must be harnessed to glean details from the ancient geologic record. During this time, the early geomagnetic field shielded Earth from intense solar winds from the rapidly rotating young Sun. Therefore, the onset and strength of the earliest field are of prime interest for understanding evolution of the planet. However, there are considerable obstacles preventing the easy retrieval of primary paleomagnetic information from the most ancient rocks. Even the best-preserved Paleoarchean rocks have seen low-grade metamorphism. The thermal and chemical effects render many, if not most, whole rocks unsuitable for analysis. Our approach to these challenges is to focus on the study of single silicate crystals hosting minute magnetic inclusions [1]. Recent investigations of Archean single silicate crystals from the Kaapvaal craton, using highly sensitive SQUID magnetometers and CO_2 laser demagnetization, have allowed definition of geomagnetic field intensities at 3.2 Ga [2], 3.4 Ga and 3.45 Ga [3]. In our current work, we extend this time line to 3.47 Ga through the study of single silicate crystals from granitic rocks that are subvolcanic feeders to the Duffer Formation of the Pilbara craton [4]. Preliminary paleointensity data suggest that a protective magnetic field was present. Some of the first physical evidence for life has been reported in similarly aged rocks. However, the new measured field intensities are only $\sim$25% of the modern value.

Extending the field to the Hadean necessitates study of ancient minerals held in younger conglomerate units. We discuss new paleomagnetic data from the Jack Hills conglomerate [e.g. 5] that host Hadean-age zircons. Data from whole rocks pass a preliminary conglomerate test suggesting some clasts could retain a primary magnetization. We will outline an approach (currently underway) using single silicate crystal analysis toward definition of these potential Hadean-age magnetizations.

[1] Tarduno J. A. et al. (2006) *Rev. Geophys.*, 44, RG1002. [2] Tarduno J. A. et al. (2007) *Nature*, 446, 657-660. [3] Tarduno J.A. et al. (2010) *Science*, 327, 1238-1240. [4] Van Kranendonk et al. (2002) *Economic Geol.*, 97, 695-732. [5] Valley, J.W. (2009) *Elements*, 2, 201-204.