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Strength of the Archean geomagnetic field, the paleomagnetosphere, and magnetic shielding against the young active Sun

J A Tarduno (1,2), R D Cottrell (1), M K Watkeys (3), A Hofmann (3)

(1) Department of Earth & Environmental Science, University of Rochester, Rochester, NY 14627, United States [john@earth.rochester.edu], (2) Department of Physics & Astronomy, University of Rochester, Rochester, NY 14627, United States, (3) School of Geological Sciences, University of KwaZulu-Natal, Durban 4041, South Africa

The nature of Earth's early magnetic field is of key importance for atmospheric evolution and the development of life as it provided shielding from the young active Sun. The strength of Earth's geomagnetic field 3.2 billion years ago was within 50% of the modern value (Tarduno et al., 2007), but for even earlier times it is unknown. Two scenarios have been offered: (1) The dynamo started shortly after core formation, and the subsequent field strength has been within a factor of 2-3 of the modern value since its initiation; (2) the field was at null values at 3.9-3.8 Ga and commenced between 3.8 and 3.2 Ga. The latter scenario relies on a hypothesis to explain the amount and isotopic composition of nitrogen found in lunar soils. These may have been derived from Earth's atmosphere via the solar wind (Ozima et al., 2005) in the absence of geomagnetic field that would otherwise shield atmospheric erosion. The available Archean rock record offers several opportunities to address the presence/absence of the magnetic field between 3.2 and 3.9 Ga, as well as its potential strength and morphology; on-going efforts will be discussed. The history of radiation and particle flux based on solar-analog stars with respect to the available constraints on magnetic shielding will also be reviewed. (References: Tarduno, J.A. et al., Geomagnetic field strength 3.2 billion years ago recorded by single silicate crystals, Nature, 446, 657-660, 2007; Ozima, M., et al., Terrestrial nitrogen and noble gases in lunar soils, Nature, 436, 655-659, 2005).