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Magnetic Carriers in Metasediments of the Jack Hills (Western Australia): Constraints on Thermal History

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A b s t r a c t

Understanding Earth's earliest magnetic field is of critical interest in part because of the necessary protection provided by the field against solar wind erosion of the atmosphere, allowing for the preservation of liquid water on Earth's surface (Tarduno *et al.* 2014). Paleomagnetic studies document a geomagnetic field with strengths comparable to the modern field as early as the Hadean (Tarduno *et al.* 2015), on the basis of high unblocking temperature (~550 to 580 °C) components of magnetization carried by magnetic carriers within zircon grains. However, the oldest records are restricted to the Jack Hills, Western Australia, where the oldest terrestrial zircons (>4 Ga) have been recovered from the host metasediments. Therefore, it is necessary to understand the thermal history of the Jack Hills to determine whether these high unblocking temperature components, and their corresponding paleointensities, are primary in origin. Several independent lines of evidence, including an inter-laboratory comparison study, have been presented supporting both the primary origin of the high unblocking temperature component (Tarduno and Cottrell 2013, Tarduno *et al.* 2015, Dare *et al.* 2016) as well as the recognition of lower temperature (<500 °C) unblocking components acquired as overprint directions during metamorphic reheating events (Cottrell *et al.* 2016, Bono *et al.* 2018). Herein, we will discuss the recognition of coherent signals of overprinting events in otherwise highly scattered directional data using novel contouring/clustering analyses (Bono *et al.* 2018), the resulting thermal history model for the Jack Hills, and recent characterization of single/pseudo-single domain magnetic carriers likely responsible for the high unblocking temperature magnetization components in Jack Hills quartzite clasts.

Keywords: Archean, Hadean, paleomagnetism, Jack Hills, geodynamo.

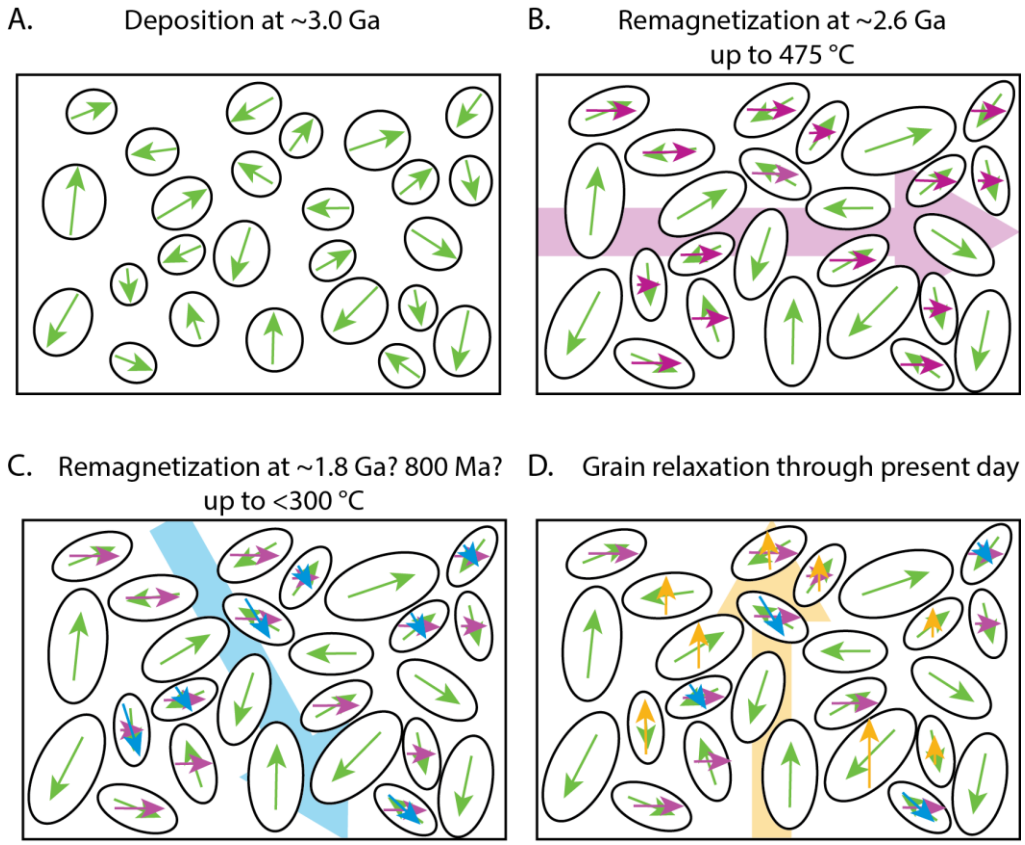

Fig. 1. Acquisition of low unblocking temperature magnetizations in Jack Hills quartzite cobble clasts. From Bono *et al.* 2018.

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