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Paleointensity of the 1.3 Ga Gardar basalts, southern Greenland-No evidence for onset of inner core growth

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The age of the inner core nucleation is a first-order problem in the thermal evolution of the Earth that can be addressed by paleomagnetism. We conducted a paleointensity study on the 1.3 Ga Gardar basalts from southern Greenland to investigate previously suggested high ancient field intensities. Biggin et al. (2015) used the earlier result to identify nucleation of Earth's solid inner core at 1.3 Ga. We collected 106 samples from 39 flows from the lavas of the Eriksfjord Formation, sampling 17 of the lower flows, 8 of the middle flows and 14 of the upper flows. Rock magnetic analyses, including magnetic hysteresis, first order reversal curves (FORCs), and magnetic susceptibility versus temperature measurements, suggest that the predominate magnetic mineral in the lower basalts is low Ti magnetite, whereas the middle and upper flows have varying amounts of hematite. The magnetic hysteresis data suggest magnetic grains range from multidomain to single domain in character, with an apparent dominance of pseudo-single behavior. Thellier-Thellier double heating experiments using the IZZI methodology yielded vector endpoint diagrams and Arai plots showing two components of magnetization, one up to approximately 450˚C and the higher temperature component typically from 450˚C up to 580˚C, but sometimes to as high as 680˚C. We attribute the lower temperature component, to partial overprinting by the nearby Ilimaussaq intrusion, and acquisition of viscous remanent magnetization. We assign standard selection criteria vetted by cumulative distribution plots that yields a paleointensity of 6.5 μT $\pm$ 5.9 μT and a nominal virtual dipole moment (VDM) of 1.72 x 10^{22} Am^2. However, we cannot exclude the possibility of bias in this value related to chemical remanent magnetization and multidomain effects. We isolate a conservative upper bound on paleointensity as the highest paleointensity result that is free of CRM effects. This yields a paleointensity of $\sim$18 μT, and a VDM of $\sim$4.5 x 10^{22} Am^2, which is a field strength similar to many other Proterozoic values. Thus, our analysis of the Gardar basalts suggests that there is no paleointensity signature of inner core growth 1.3 billion years ago.