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The Paleoarchean geodynamo, solar wind and magnetopause

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The standoff of stellar winds by a planetary magnetic field prevents atmospheric erosion and water loss important for the evolution of a habitable planet. But little is known about early magnetic field strength and whether intense radiation from the young, rapidly rotating Sun modified Earth's atmosphere. New paleointensity results from single silicate crystals bearing magnetic inclusions indicate the presence of a geodynamo between 3.4 and 3.45 billion years ago. The field measured is $\sim$30-50% weaker than that of present-day and when combined with a greater solar wind pressure suggests steady-state Paleoarchean magnetopause standoff distances $\leq$ 5 Earth radii, similar to values observed during recent coronal mass ejection events. Aurora would have been at lower latitudes and polar cap area is predicted to have been up to 3 times greater than today. Heating, expansion and volatile loss from the exosphere is implied, affecting long-term atmospheric composition. Efforts to examine even older Paleoarchean-Hadean magnetic mineral carriers for geomagnetic paleointensity signatures will be discussed.