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Random walk statistics provides a comprehensive view on geomagnetic polarity interval lengths and field intensity

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During the Earth's geological history, the geomagnetic field experienced hundreds of polarity reversals. The sequence of durations of the geomagnetic polarity intervals is usually described in terms of a non-homogenous Poisson process with time dependent reversal rate, reflecting the non-stationarity of the underlying geodynamo process. This view has recently been challenged, and here we show that the first-passage time statistics of random walks yields a much more consistent interpretation of the distribution of geomagnetic polarity intervals. The random-walk hypothesis indicates a link between mean and variance of the magnetic field intensity during polarity chrons, which coincides with available data. The model naturally includes the observed occurrences of very long superchrons, and it predicts that the probability for a geomagnetic field reversal within the next 30 ka is $< 5\%$ and the probability that we live in a chron longer than 2 Ma is about 30%.