How long does it take for Earth's magnetic field to reverse polarity?

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The past several years have witnessed a proliferation of numercial models of the geodynamo that exhibit "earth-like" magnetic field behavior, most notably secular variation and polarity reversals. Each of these models, however, use parameters that are far from earth-like. Paleomagnetic records provide constraints on these models and may provide guidance in how to produce a more realistic geodynamo model. By far the most important constraint on geodynamo models was the discovery of polarity reversals.

Opdyke's pioneering work in deep-sea sediment records also provided some of the earliest estimates of the duration of polarity transitions. Theses estimates effectively ruled out the possibility that free decay and subsequent growth of the field could account for reversals. Instead, an active process is required for polarity reversal.

The durations of reversals and the rates at which the field changes, remains one of the most important contributions that paleomagnetism can provide to dynamo theory. In this paper I present an initial summary of the durations of polarity transitions from sediments that have been published to date. Each transition zone is defined as the stratigraphic interval that is bounded by the level at which the paleomagnetic directions exceed the circular standard deviation of the lower polarity chronozone and the level at which the directions fall within the circular standard deviation of the upper polarity chronozone. Estimates of the durations are then calculated using the best estimate of sedimentation rates for each section. Comparison of the durations with 1) reversal, 2)the site distribution, 3) sedimentation rates, and 4) full polarity secular variation in each record, provide insights into the remanence acquisition processes as well as providing an average estimate of polarity transition duration.

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