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Geomagnetic secular variation in the Cretaceous Normal Superchron and in the Jurassic

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It is now widely thought that geomagnetic polarity reversals occur spontaneously as a result of normal dynamo action rather than being externally triggered. If this is the case, then it may well be that periods of time in which the geomagnetic reversal frequency was dramatically different were characterised by different styles of secular variation. Two such periods were the Cretaceous Normal Superchron (CNS) when no reversals have been observed in a period exceeding 30 Myr and the Jurassic period (144-200 Ma) where reversals occurred at an average rate of 4.7 Myrˆ-1. Here we analyse a database of new and published palaeomagnetic directions from lavas emplaced during these periods in order to obtain first-order descriptions of the palaeosecular variation (PSV) during these times. We then compare these records with one another and with that produced for the period 0-5 Ma (with average reversal frequency 4.0 Myrˆ-1). Our results are more equivocal than those obtained in a previous similar study (McFadden et al., 1991, Reversals of the Earths Magnetic-Field and Temporal Variations of the Dynamo Families. J. Geophys. Res. 96, 3923-3933). However, we demonstrate that this is probably a result of the previous study being affected by an artefact introduced by the analytical procedure they used. The usefulness of our Jurassic record is severely limited by the restricted palaeolatitudinal span of the available data. However, our record for the CNS does is sufficient to allow us to conclude that it was likely that secular variation was different then than in the 0-5 Ma period at least. This supports the hypothesis of a link between PSV and reversal frequency and therefore endorses PSV analysis as a first-order tool for determining geomagnetic stability

in the past.