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Geomagnetic Field Strength and Reversal Rate

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We performed a 2 million year long composite curve by stacking records of relative paleointensity from sedimentary sequences. Correlation between records was improved by adjusting the intensity minima corresponding to the reversals and other features such as those associated with excursions without violating the original depth-time correspondence.The stability of the signal was tested against different selections of data. The Sint-2000 composite curve obtained for our preferred selection represents the field evolution of the dipole field intensity for the past 2000 year. The curve was calibrated using the virtual dipole moments (VDMs) of the 2004 updated volcanic database of absolute paleointensity over 0.1 Myr long intervals. The value of the time-averaged VDM (7.46+/-1.16 x 10^{22} Am^2) for the past 0.8 Myr was used for calibration. The mean values of the successive 0.1 Myr intervals are in very good agreement with the relative paleointensity for the same periods. A striking characteristic of this Sint-2000 curve is the succession of periods with different mean values of paleointensity. During the Brunhes chron the dipole oscillated around a value of 7.51+/-1.66 x 10^{22} Am^2, which was significantly larger than during the previous 400 kyrs (5.3 +/- 1.5 x 10^{22} Am^2). To provide a more quantitative picture of field strength as a function of reversal frequency, we calculated successive running averages of the field intensity over 100 kyrs long intervals. The results confirm that the time-averaged field correlates with the number of reversals. We also observe that the amplitude of the short-term oscillations remained the same. Thus less intervals of very low intensity are expected during periods associated with a strong average dipole moment, whereas more excursions or other instabilities are produced during periods of weak field intensity. The relation between mean dipole strength and reversal frequency suggests also the existence of a large field during long periods without reversals, under the assumption that they would be governed by the same processes (which is not known). Prior to reversals, the axial dipole decays during 60 to 80 kyrs, but rebuilds itself in the opposite direction much more

rapidly, in a few thousand years at most. These time constants suggest that the decay phase is caused by diffusion while advection would dominate the dipole recovery.