



Geomagnetic Excursions are Aborted Reversals

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Geomagnetic excursions have been either considered as events of large amplitude secular variation or as aborted attempts of reversals. Recent sedimentary records of excursions during the Brunhes and Matuyama chron have recently been obtained with very high resolution and describe the field variations during these short periods. Similarly, some new detailed volcanic records have also been published. The compilation of the present database shows that in all excursions that have been properly documented a few virtual geomagnetic poles reach the opposite polarity. A simple model involving a decaying dipole superimposed to a time-varying non-dipole field shows that the VGPs never systematically reach the opposite polarity in the absence of a reversed dipole field with a size reaching at least 15-20% of the pre-transitional value. Using the same model we are also able to reproduce the dominant features of the VGP paths of the paleomagnetic records, in particular the existence of large loops of opposite sense which have been reported for the Laschamp and the Icelandic event. This leads us to conclude that i- all excursions documented so far with good precision are actually aborted field reversals and ii- that the excursionsal field is governed by the non-dipole components. Another consequence is that a polarity reversal can only be successful if the new reversed dipole field is able to exceed a threshold value. In the absence of significant recovery the new polarity cannot be established.