



# Contents

<i>Preface</i>	ix
<b>1 The Earth's magnetic field</b>	1
1.1 Introduction	1
1.2 Spherical harmonic analysis of the Earth's magnetic field	11
1.3 Origin of the Earth's magnetic field	28
1.4 Mean-field electrodynamics	33
<b>2 The magnetization of rocks</b>	35
2.1 Introduction	35
2.2 Processes of magnetization in rocks	38
2.3 Self-reversal	46
2.4 Field reversal or self-reversal?	54
<b>3 The morphology of geomagnetic reversals</b>	59
3.1 Introduction	59
3.2 Field intensity during a polarity transition	66
3.3 Field direction during a polarity transition	73
3.4 Changes in the mean frequency of reversals	79
<b>4 Geomagnetic excursions</b>	87
4.1 Introduction	87
4.2 The Laschamp excursion	90
4.3 The Lake Mungo excursion	94
4.4 The Mono Lake excursion	96
4.5 The Gothenburg 'flip'	103
4.6 The Blake event	107
4.7 Lake Biwa events	110
4.8 Other excursions and short period events	112
4.9 Further comments	120

<b>5 Models for reversals</b>	<b>124</b>
5.1 Introduction	124
5.2 The models of Cox and Parker	126
5.3 The disc dynamo	131
5.4 The flooding model of Hoffman	145
5.5 Olson's model	149
5.6 Williams and Fuller's model	154
5.7 Dynamo families	158
5.8 McFadden's and Merrill's models	160
5.9 Gubbins' model	164
5.10 Statistical analyses	165
<b>6 Transition fields</b>	<b>179</b>
6.1 Introduction	179
6.2 The Matuyama–Brunhes transition	187
6.3 The Olduvai transition	192
6.4 The Cobb Mountain transition	198
6.5 Longitudinal confinement of transitional VGPs	202
6.6 Clustering of VGPs	211
6.7 The Steens Mountain reversal	216
6.8 Other rapid reversals	222
<b>7 Magnetostratigraphy</b>	<b>226</b>
7.1 Introduction	226
7.2 Magnetostratigraphic polarity units	228
7.3 The polarity time scale	235
7.4 Isotopic dating of magnetic anomalies	236
7.5 The Cenozoic–late Cretaceous timescale (0–83 Ma)	245
7.6 The late Jurassic and early Cretaceous timescale (83 ~ 160 Ma)	252
7.7 Magnetostratigraphy in the Jurassic and earlier	254
<b>8 The Earth's magnetic field and other geophysical phenomena</b>	<b>258</b>
8.1 Introduction	258
8.2 The orbital climatic theory of Milankovitch	258
8.3 The Earth's magnetic field, reversals and climate	266
8.4 Reversals, impacts and mass extinctions	271
8.5 Reversals, plumes and tectonics	278
8.6 Magnetic reversals and faunal extinctions	289
<i>References</i>	294
<i>Index</i>	341

