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**Automatic Interpretation of Potential Field Data  
Applied to the Study of Overburden Thickness  
and Deep Crustal Structures, South Australia**

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# Contents

<b>Abstract</b>	<b>xiv</b>
<b>Statement</b>	<b>xv</b>
<b>Acknowledgements</b>	<b>xvi</b>
<b>I Background</b>	<b>1</b>
<b>1 Introduction</b>	<b>2</b>
1.1 Aim and scope of the thesis . . . . .	2
1.1.1 Aim of the research . . . . .	2
1.1.2 Scope of research . . . . .	3
1.2 The geological problem . . . . .	3
1.3 The geophysical problem . . . . .	4
1.4 The geophysical program . . . . .	5
1.5 Organisation of the thesis . . . . .	5
1.6 The appendices . . . . .	6
<b>2 Review of interpretation methods</b>	<b>8</b>
2.1 Computer technology and interpretation methods . . . . .	8
2.2 Overview of interpretation methods . . . . .	9
2.3 Graphical and characteristic point methods . . . . .	10
2.4 Forward modelling . . . . .	11
2.5 Inversion method . . . . .	12
2.6 Spectral analysis . . . . .	13
2.6.1 Simple model spectral analysis . . . . .	13
2.6.2 Spectral analysis of a statistical model . . . . .	16
2.6.3 Downward continuation approach . . . . .	20
2.6.4 Depth relief modelling . . . . .	20
2.6.5 Advantages and disadvantages of spectral analysis . . . . .	20
2.7 Automatic depth estimation methods . . . . .	21
2.7.1 Introduction . . . . .	21
2.7.2 Euler deconvolution . . . . .	22
2.7.3 Werner deconvolution . . . . .	23
2.7.4 The Naudy technique . . . . .	25
2.8 Summary of interpretation methods . . . . .	30

<b>II</b>	<b>Techniques for data interpretation</b>	<b>32</b>
<b>3</b>	<b>Improved Naudy Technique for profile data</b>	<b>33</b>
3.1	Problems in the original technique . . . . .	33
3.2	The accurate location of the centre of the anomaly . . . . .	35
3.2.1	Effective magnetic field . . . . .	35
3.2.2	Characteristics of the similarity coefficients . . . . .	36
3.2.3	A solution: using horizontal and vertical components . . . . .	37
3.3	Extension to vertical magnetic gradient anomalies . . . . .	38
3.4	Determination of source parameters other than depth . . . . .	40
3.4.1	Determinations of dip and susceptibility for a dyke model . . . . .	42
3.4.2	Analysis of estimated dip and susceptibility from a finite extent dyke . . . . .	46
3.4.3	Determinations of dip and susceptibility for the edge model . . . . .	50
3.4.4	Determinations of dip and susceptibility for a plate model . . . . .	54
3.5	Summary of the Improved Naudy Technique (AUTOMAG) . . . . .	55
<b>4</b>	<b>Testing of AUTOMAG, using synthetic data</b>	<b>56</b>
4.1	Introduction . . . . .	56
4.2	Dyke with infinite depth extent . . . . .	57
4.3	Dyke with finite depth extent . . . . .	59
4.3.1	New standard dyke model . . . . .	59
4.3.2	Error analysis for varying depth extent . . . . .	61
4.3.3	Error analysis for varying width . . . . .	62
4.3.4	Error analysis for varying dip . . . . .	62
4.3.5	Summary of dyke model . . . . .	64
4.4	Edge model of infinite depth extent . . . . .	64
4.5	Edge model with finite depth extent . . . . .	66
4.5.1	New standard edge model . . . . .	66
4.5.2	Error analysis for using new edge model . . . . .	67
4.6	Thin plate model . . . . .	68
4.6.1	Expanded thin plate . . . . .	69
4.6.2	Error analysis for thin plate and slab models . . . . .	71
4.7	Summary of simple model test . . . . .	75
4.8	Complex model tests . . . . .	75
4.8.1	Multiple dykes with varying dip . . . . .	75
4.8.2	Multiple bodies with varied width . . . . .	76
4.8.3	Bodies with different depth extent . . . . .	78
4.8.4	Combination models . . . . .	79
4.9	Error effect from random noise . . . . .	80
4.10	Summary . . . . .	80
<b>5</b>	<b>Spectral analysis &amp; frequency filtering for grid data</b>	<b>83</b>
5.1	Separation filtering techniques . . . . .	84
5.2	The "compensation smoothing filter" . . . . .	86
5.3	Model experiment for comparisons of different separation filters . . . . .	87

5.4	Estimation of average depth from synthetic data . . . . .	90
5.4.1	The characteristics of energy spectra of Bouguer gravity data . . . . .	90
5.4.2	Average depth from block size of data . . . . .	95
5.5	Quantitative interpretation . . . . .	97
<b>III Applications and interpretation of real data</b>		<b>99</b>
<b>6</b>	<b>Eyre Peninsula: Regional gravity interpretation</b>	<b>100</b>
6.1	Original gravity data . . . . .	101
6.2	Application of anomaly separation and spectral analysis . . . . .	102
6.2.1	Anomaly separation . . . . .	102
6.2.2	Average depths for sub-division areas . . . . .	103
6.2.3	Average depth from block size of data . . . . .	106
6.3	Application of other methods . . . . .	107
6.4	Measurements of rock density and susceptibility . . . . .	107
6.5	Examples of application of spectral analysis . . . . .	108
6.5.1	The crustal depth and structure . . . . .	108
6.5.2	The Gawler Range volcanics . . . . .	112
6.6	Summary . . . . .	114
<b>7</b>	<b>Eyre Peninsula: Application of AUTOMAG</b>	<b>115</b>
7.1	Original aeromagnetic survey data . . . . .	116
7.2	Regional data processing and interpretation . . . . .	116
7.2.1	Linear transformations technique . . . . .	117
7.2.2	Shaded relief method . . . . .	119
7.2.3	Application of energy spectral analysis . . . . .	121
7.3	Application of AUTOMAG . . . . .	121
7.3.1	Geology and physical properties of overburden . . . . .	122
7.3.2	Procedures of applying AUTOMAG program . . . . .	122
7.3.3	Practical matters in the method . . . . .	124
7.3.4	Further use of the method . . . . .	126
7.3.5	Presentation of depth information . . . . .	126
7.3.6	Information of dip and other parameters . . . . .	127
7.4	Testing AUTOMAG using drilling information . . . . .	128
7.5	Discussion . . . . .	131
7.5.1	Speed of AUTOMAG and comparison with a manual processing . . . . .	131
7.5.2	Limitation and restriction of AUTOMAG . . . . .	133
<b>8</b>	<b>Conclusion</b>	<b>134</b>
8.1	AUTOMAG . . . . .	134
8.1.1	Summary . . . . .	134
8.1.2	Discussion . . . . .	135
8.2	Spectral analysis . . . . .	137
8.2.1	Summary . . . . .	137
8.2.2	Problems and further work . . . . .	138

8.3	The next stage for geophysical interpretation . . . . .	139
<b>IV</b>	<b>Appendices</b>	<b>140</b>
<b>A</b>	<b>Magnetic fields arising from various simple models</b>	<b>141</b>
A.1	Introduction . . . . .	141
A.2	Edge model . . . . .	145
A.3	Step model . . . . .	146
A.4	Dyke model with infinite depth extent . . . . .	147
A.5	Dyke model with finite depth extent . . . . .	148
A.6	Thin sheet model . . . . .	150
A.7	Horizontal thin sheet model . . . . .	151
A.8	Thin plate model . . . . .	152
A.9	Horizontal cylinder model . . . . .	153
<b>B</b>	<b>Derivation of the effective magnetic field</b>	<b>154</b>
<b>C</b>	<b>Summary of programs used in this thesis</b>	<b>157</b>
C.1	Introduction . . . . .	157
C.2	Software and hardware requirements . . . . .	157
C.3	List of major programs . . . . .	157
C.4	Summaries of program functionality . . . . .	159
C.4.1	Functions of commonly used programs . . . . .	159
C.4.2	Instruction of AUTOMAG . . . . .	161
<b>D</b>	<b>Relationship of magnetic fields of thin plate &amp; slab</b>	<b>163</b>
D.1	Comparison of even functions of TMI . . . . .	165
D.2	Comparison of odd functions of TMI . . . . .	167
D.3	Comparison of even functions of vertical gradient . . . . .	170
D.4	Comparison of odd functions of vertical gradient . . . . .	172
<b>E</b>	<b>Correction of 2-D body with oblique strike</b>	<b>175</b>
E.1	Introduction . . . . .	175
E.2	Parameter correction between true and interpreted body . . . . .	176
E.2.1	Presentation of the method . . . . .	176
E.2.2	Derivation . . . . .	177
E.3	Entire profile correction . . . . .	181
E.4	Conclusions . . . . .	182
<b>F</b>	<b>Tables of rock properties in Eyre Peninsula</b>	<b>184</b>
<b>G</b>	<b>A study of the shaded relief method</b>	<b>185</b>
G.1	Principle of the method . . . . .	185
G.2	Function of elevation angle . . . . .	186
G.3	Functions of azimuth . . . . .	187
G.4	Functions of scalar slope factor . . . . .	188



# Abstract

Determination of overburden thickness is important in geology and mineral exploration.

AUTOMAG, a computer program system which was developed by the author from the original Naudy technique and applied to high resolution magnetic data, provides an effective way of determining the thickness of overburden and the weathered zone in areas of metamorphic and igneous basement rocks. The method also can be applied to much greater depths, e.g. magnetic basement underlying sedimentary basin.

AUTOMAG which uses a SUN SPARC 2 workstation and VAX-780 computer is at least five to ten times as fast as several standard methods of depth estimation used by the exploration industry and it also yields width, dip and susceptibility of magnetic causative bodies. The results are presented as a series of sections showing magnetic profile, similarity coefficients and estimated depths.

AUTOMAG has been tested on simple and complex synthetic data, using a set of basic models (dyke and edge with finite depth extents, and an extended thin plate model) designed to be suitable for most geological situations. The results from airborne magnetic data have been compared with the information obtained from a ground magnetic survey and drill holes in the Eyre Peninsula, South Australia; this shows that AUTOMAG provides reliable information about the thickness of overburden.

Spectral analysis was used with gravity data provided by the South Australian Department of Mines and Energy in the Eyre Peninsula area ( $30^{\circ}S$  to  $35^{\circ}S$  and  $133^{\circ}E$  to  $139^{\circ}E$ ) to determine the density structure of the crust. Applying an anomaly separation filtering in the frequency domain and combining with the information from the energy spectra of the Bouguer gravity data, several depth slice maps in the study area have been constructed. Depth estimations determined from spectral analysis in the Eyre Peninsula area indicate a density boundary which is between 32 to 38 kilometres deep. This is consistent with previous seismic estimations of the depth of the Mohorovičić discontinuity in this area. Felsic Gawler Range Volcanics are underlain by dense rocks, which may be a large, zoned, mafic magma chamber of underplated mantle material.

Suggestion for further work to develop AUTOMAG and spectral analysis technique are made in Chapter 8.