Fractal Models in the Earth Sciences

G. Korvin

Department of Geology and Geophysics University of Adelaide P.O. Box 498, Adelaide, S.A. 5001, Australia





1992

ELSEVIER AMSTERDAM • LONDON • NEW YORK • TOKYO

Contents

Prefac Ackno	ce owledgements for reproductions of previously published material	VII XI
	What an anoth fractal?	1
11	The self similarity of rivers	1
1.1	Lies less in the Vietule river?	11
1.2	The period of testing investigation of testing conditiones	17
1.2 1	The paradox of fortuosity, permeability of kaoninite-bearing sandstones	17
1.3.1	The permeability of shary sanasiones	21
1.3.2	Basic concepts of percolation theory	20
1.3.3	Percolation models of rock permeability	24
1.4	The constitution of Duitain	24
1.4.1	The coastine of Britain	10
1.4.2	A fractal model of coastal erosion	40
1.4.5	The perimeter area rule of Mandelbrot	55
1.5 1	The perimeter-area rule of Mandelorot	55
1.5.1	Islands and lakes	55
1.5.2	The fractal snape of clouds	66
1.3.3	The suitistand analysis of fracture surfaces	72
AL	The function of cimilarity	73
AI.1		15
A1.2	Practal curves are not	01
	References	01
2	Fractals in Flatland: a romance of <2 dimensions	87
2.1	The paradox of sedimentation rate	87
2.1.1	Stratigraphic hiatuses and sedimentation rate	87
2.1.2	From the Cantor dust to the Devil's staircase	90
2.1.3	A fractal model for stratigraphic hiatuses	95
2.1.4	Sadler's model of unsteady sedimentation and its fractal generalisation	102
2.2	Fractal analysis along a line: slip lines and fractures	113
2.3	Strange attractors, aggregates and geophysical networks	118
2.3.1	Fractal characterisation of geophysical measuring networks	120
2.4	Fractals in the plane: fractures-earthquakes-volcanoes	127
2.4.1	Cellular structures	127
2.4.2	Fracture networks, faults and earthquakes	144
A2	Mathematical appendix	171
A2.1	Different kinds of fractal dimensions and their numerical determination	171
	References	180

XXVIII

FRACTAL MODELS IN THE EARTH SCIENCES

 3.1 The size-frequency relation for islands, lakes and caves	191 200 200
3.2 Fragmentation: from broken sea ice to the distribution of galaxies 2	200
	200
3.2.1 The fractal theory of fragmentation 2	210
3.2.2 The Renormalization Group (RNG) model of rock fragmentation 2	210
3.2.3 Maximum-entropy people and fractal people 2	215
References 2	226
The second s	121
4 Fractal surfaces 2	231
4.1 Fractal surfaces everywhere	231
4.2 Simple geometrical models of fractal surfaces 2	243
4.3 Analytical treatment of fractal surfaces 2	253
4.4 Wave scattering from fractal surfaces 2	265
4.5 Fractal models of porous rocks 2	284
4.5.1 Why are the pores fractal rather than smooth? 3	306
4.6 Multifractal measures — not for the squeamish 3	308
References	317
3 1 Structure condulnies a	707
5 Of time and change	120
5.1 Paradoxes of time	521
5.1.1 The puzzle called the Hurst phenomenon	328
5.1.2 Paradoxes of the 1/f noise	339
5.2 On growth and form	349
References 3	366
Author index	373
Subject index	383

Later, south a line shi gits that a post method in the